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Predictive value of coronary artery calcium score for myocardial ischaemia in positron emission tomography

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Introduction: Coronary artery calcium score (CACS) is an excellent predictor of long-term adverse cardiac events. However, little is known about its value and thresholds for immediate prediction of myocardial ischaemia.

Purpose: We tested the ability of CACS to predict myocardial ischaemia in patients with positron emission tomography (PET). In particular, we assessed the negative predictive value (NPV) of low CACS and the positive predictive value (PPV) of high CACS for myocardial ischaemia.

Methods: All consecutive patients undergoing 82Rb PET myocardial perfusion imaging with CACS from October 2016 to January 2019 at our centre were enrolled. Patients with known coronary artery disease (CAD) were excluded. Ischaemia was defined as a summed difference score (SDS) =4 in PET, and severe ischaemia as SDS =8 or transient ischaemic dilation. CACS was measured from low-dose computed tomography (CT) scans using the Agatston method. Receiver operating characteristic (ROC) analysis was used to calculate areas under the curves (AUC, with 95% confidence interval) and to assess sensitivity, specificity, PPV and NPV of CACS for ischaemia at pre-specified cut-offs (0, 100, 400, and 1000 Agatston units [AU]). Multivariate logistic regression was used to assess the predictive ability of CACS with clinical and ECG data, using odds ratios (OR, with 95% confidence interval). Prediction models were generated with propensity scores for CACS and clinical data with ECG, and compared using AUC.

Results: Of 1833 patients, 927 were included, all with CACS and 82Rb PET, without known CAD. Mean age was 64.3 ±11.1 years and median CACS was 55 AU (interquartile range 359). In PET, 179 patients (19.3%) had ischaemia and 87 (9.4%) severe ischaemia. To predict ischaemia, CACS had an AUC of 0.82 (0.79-0.84) and was superior to the clinical and ECG data model (AUC 0.68 [0.65-0.71], P<0.0001 vs. CACS, Figure 1). For ischaemia, CACS 0 AU had 97% sensitivity and 98% NPV, and CACS 100 AU 81% sensitivity and 94% NPV. But CACS 1000 AU had 94% specificity and 60% PPV. Results were similar for severe ischaemia, with an AUC of 0.81 for CACS (0.79-0.84) and superiority over the clinical and ECG data model (AUC 0.74 [0.71-0.77], P=0.018 vs. CACS). For severe ischaemia, CACS 0 AU had 98% sensitivity and 99% NPV, and CACS 100 AU 85% sensitivity and 98% NPV. But CACS 1000 AU had 90% specificity and 30% PPV. In multivariate analysis, CACS was the strongest predictor of ischaemia (OR 1.14 [1.11-1.17] by 100 AU, P<0.0001) and made all clinical and ECG data nonsignificant.

Conclusion: CACS is a valuable predictor of myocardial ischaemia in PET. In particular, CACS =100 AU has an excellent NPV and CACS =1000 a good PPV for myocardial ischaemia. These findings can be useful to assess the need for additional cardiac testing after a chest CT showing coronary calcifications and to support the interpretation of borderline myocardial perfusion results.
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