



Calcium scoring: a personalized probability assessment predicts the need for additional or alternative testing to coronary CT angiography

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Abstract

Objective To assess whether anthropometrics, clinical risk factors, and coronary artery calcium score (CACS) can predict the need of further testing after coronary CT angiography (CTA) due to non-diagnostic image quality and/or the presence of significant stenosis.

Methods Consecutive patients who underwent coronary CTA due to suspected coronary artery disease (CAD) were included in our retrospective analysis. We used multivariate logistic regression and receiver operating characteristics analysis containing anthropometric factors: body mass index, heart rate, and rhythm irregularity (model 1); and parameters used for pre-test likelihood estimation: age, sex, and type of angina (model 2); and also added total calcium score (model 3) to predict downstream testing.

Results We analyzed 4120 (45.7% female, 57.9 ± 12.1 years) patients. Model 3 significantly outperformed models 1 and 2 (area under the curve, 0.84 [95% CI 0.83–0.86] vs. 0.56 [95% CI 0.54–0.58] and 0.72 [95% CI 0.70–0.74], $p < 0.001$). For patients with sinus rhythm of 50 bpm, in case of non-specific angina, CACS above 435, 756, and 944; in atypical angina CACS above 381, 702, and 890; and in typical angina CACS above 316, 636, and 824 correspond to 50%, 80%, and 90% probability of further testing, respectively. However, higher heart rates and arrhythmias significantly decrease these cutoffs ($p < 0.001$).

Conclusion CACS significantly increases the ability to identify patients in whom deferral from coronary CTA may be advised as CTA does not lead to a final decision regarding CAD management. Our results provide individualized cutoff values for given probabilities of the need of additional testing, which may facilitate personalized decision-making to perform or defer coronary CTA.

Key Points

- Anthropometric parameters on their own are insufficient predictors of downstream testing. Adding parameters of the Diamond and Forrester pre-test likelihood test significantly increases the power of prediction.
- Total CACS is the most important independent predictor to identify patients in whom coronary CTA may not be recommended as CTA does not lead to a final decision regarding CAD management.
- We determined specific CACS cutoff values based on the probability of downstream testing by angina-, arrhythmia-, and heart rate-based groups of patients to help individualize patient management.

Keywords Coronary artery calcium score · Coronary CT angiography · Downstream testing · Image quality · Cardiovascular risk

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Abbreviations

AUC	Area under the curve
BMI	Body mass index
CACS	Coronary calcium score
CAD	Coronary artery disease
CI	Confidence interval
CTA	Computed tomography angiography
HR	Heart rate
IQ	Image quality