Agatston-2.0: An AI-Based Coronary Artery Calcium Scoring System to Improve Risk Assessment in Individuals with Agatston Scores 1-99 - Part III

An AI-CVD Study within the Multi-Ethnic Study of Atherosclerosis and Framingham Heart Study

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Background

We previously introduced AI-enabled coronary artery calcium (AI-CAC) scoring using the Agatston-2.0 framework to address limitations of conventional Agatston scoring, including rigid attenuation and lesion-size thresholds and failure to characterize plaque distribution and density. These limitations are particularly relevant in CAC <100, which includes approximately 75% of CAC-assessed adults yet nearly 40% of coronary heart disease (CHD) events. Parts I and II found that Agatston-2.0 reclassified risk among individuals with CAC = 0. Part III examines CAC 1-99, a heterogeneous group accounting for 25% of CHD events but generally treated as a single guideline category.

Objective

To determine whether AI-CAC Agatston-2.0 improves CHD risk stratification beyond conventional CAC scoring.

Methods

We pooled 1,542 participants from the Multi-Ethnic Study of Atherosclerosis (MESA) and Framingham Heart Study (FHS) with CAC 1-99 below the standardized 75th percentile. AI-CAC quantified relative density, plaque distribution (number of plaques multiplied by affected vessels), and hyperdensity.

Results

Among 151 CHD events over a median follow-up of 12.5 years, the top tertile of plaque distribution (7 or more) identified 33.0% of participants, with 11.1% 10-year CHD incidence. Adding bottom-tertile hyperdensity (0) identified a 14.8% risk phenotype. Conversely, bottom-tertile distribution (2 or fewer) with top-tertile hyperdensity (at least 10.7%) identified a 2.2% risk phenotype. Top- and bottom-tertile distribution thresholds reclassified 73.6% of participants and yielded a 34.8% categorical net reclassification improvement.

Conclusions

Agatston-2.0 stratified CAC 1-99 into clinically distinct risk phenotypes, up-classifying one-third of participants who accounted for 52% of 10-year CHD events while down-classifying 41% to less than 5% 10-year CHD risk.

Keywords: coronary artery calcium; Agatston score; artificial intelligence; plaque distribution; plaque density; coronary heart disease; risk stratification

This standalone file contains the abstract only. The full submitted manuscript is not attached.