

Standardised quantification of coronary inflammation using cardiac computed tomography: The Fat Attenuation Index Score (FAI-Score)

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Introduction: Non-invasive detection of coronary inflammation has the potential to improve targeting of cardiovascular prevention strategies. Coronary computed tomography angiography (CCTA)-based fat attenuation indexing (FAI) is a novel, validated measure of coronary inflammation that captures spatial changes in perivascular fat composition induced by coronary inflammation. However, to ensure accuracy, FAI values must be carefully standardized for technical, anatomical and biological factors before they are introduced for risk stratification in clinical practice.

Purpose: To validate the prognostic value of FAI-Score, the output of a new, artificial intelligence (AI)-powered algorithm, that harmonizes the FAI values of each coronary artery to generate a standardized metric of coronary inflammation for clinical use.

Methods: The study included 3912 individuals from the CRISP-CT study (2040 from the United States and 1872 from Europe) with a mean age of 55.7 (\pm standard deviation 13.7 years), 1608 (41.1%) of whom were women; all underwent clinically indicated CCTA. FAI-Score was measured at baseline in the proximal right coronary (RCA), left anterior descending (LAD) and left circumflex arteries (LCX) using the CaRI-Heart V1.1 platform (panel A). Percentile curves were created for the FAI-score of the RCA, LAD and LCX across different age and sex strata. Their prognostic value was further assessed in Cox models adjusted for hypertension, hyperlipidemia, diabetes mellitus, smoking, high-risk plaque features and the modified Duke prognostic coronary artery disease index.

Results: Over a median follow-up period of 5.6 years there were a total of 74 cardiac deaths. FAI-Score percentile curves were created to provide a population reference map for FAI-Score phenotyping of the three main coronary territories; LAD (panels B, C), RCA and LCX.

There was a stepwise association between higher FAI-Score percentiles and the prospective risk of cardiac mortality across all three vessels analysed. When compared to individuals below the 50th percentile, those in the 90th percentile or higher had a 3.5-fold (LAD, panel D), 5.5-fold (RCA, panel E) and 2-fold (LCX, panel F) higher adjusted risk of cardiac mortality.

Conclusion: Coronary FAI-Score percentile curves provide a reference map for coronary inflammatory burden and enable standardized interpretation of perivascular FAI mapping on CCTA. Individuals in the top percentile curves have an increased cardiovascular risk independent of traditional risk factors and existing atherosclerotic changes.

Abstract Figure.

