Combined Quantitative Assessment of Calcified and Noncalcified Coronary Plaques on CT for Improved Prediction of Clinical Events

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Theme: Tissue structure/fluid transport

Background: Coronary plaques already develop in adolescence and form the basis for important clinical events such as myocardial infarction. Calcified and noncalcified coronary artery plaques can be detected by computed tomography (CT) and CT angiography (CTA) (**Fig. 1**-**2**) and were of high clinical predictive value for events in the SCOT-HEART (SCOT-HEART Investigators *NEJM* 2018) and DISCHARGE trial (DISCHARGE Trial Group *NEJM* 2022, https://www.nejm.org/doi/full/10.1056/NEJMoa2200963). The interplay between the two types of coronary plaques (calcified and noncalcified) and the additional predictive value of combined quantitative assessment of calcified and noncalcified coronary artery plaques has yet to be investigated further for improved prediction of clinical events.
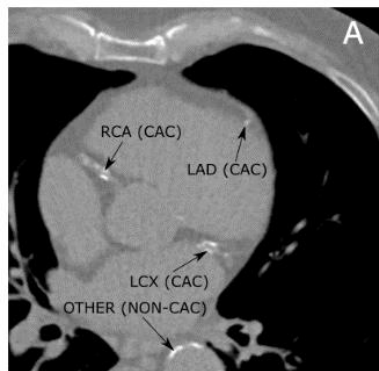

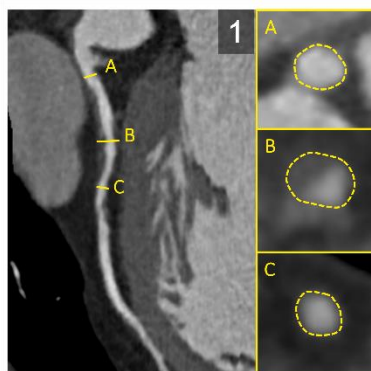**Figure 1** *Calcified coronary plaques on noncontrast CT identified by arrows.*

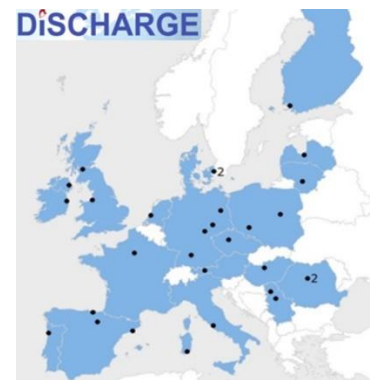**Figure 2** *Noncalcified coronary plaques on CTA on a curved multiplanar reformation and cross-sections.*

Figure 3 *Location of the DISCHARGE trial centers coordinated by Charité. From NEJM 2022.*

Hypothesis: Combined quantitative assessment of calcified and noncalcified coronary artery plaques on CT and CTA from the DISCHARGE trial (**Fig. 3**) is feasible and has high predictive value for clinical events such as cardiovascular death, myocardial infarction, or stroke and quality of life.

Tandem team: Following the successful tandem team of a PhD and an MD/PhD student in the 2nd BIOQIC cohort, we envision the same strategy for the 3rd BIOQIC cohort. The appointed MD/PhD student will work closely together with the PhD student (Project 12 'Developing Multitask and Multimodality Deep Learning Methods for Automated and Quantitative Image Assessmentof Coronary Artery Plaques').

Methods:

1) Combined quantitative assessment of calcified and noncalcified coronary plaques from patients with suspected coronary artery disease based on stable chest pain will be conducted using existing and novel segmentations of CT and CTA image data.

2) The clinical predictive value of combined quantitative assessment of calcified and noncalcified coronary artery plaques will be evaluated using existing clinical events and quality of life data after 3.5 years of follow-up in the DISCHARGE trial dataset.

Relevance: This project covers the important translational research field of quantitative and combined assessment of calcified and non-calcified coronary artery plaques in relation to clinical events, which has potential to be used to individually target medical treatment to patients at greatest risk of events.

Impact: The methodological approaches described above will each have their own impact being: 1) Enabling combined assessment and 2) Understanding the accuracy in clinical prediction.

Please contact for any questions Prof Dewey at marc.dewey@charite.de or +4930450527296 and review www.dischargetrial.eu or https://www.nejm.org/doi/full/10.1056/NEJMoa2200963 for additional information about the DISCHARGE trial. You may also contact Federico Biavati (MD/PhD in the 2nd BIOQIC cohort) at federico.biavati@charite.de or +4930450627309.