RESEARCH TOPIC DASMEN8

Multimodality imaging and artificial intelligence for vulnerable plaque characterization

Curriculum DASMEN Standard

Laboratory name and address
Cardio Center, IRCCS Istituto Clinico Humanitas

Barts Heart Centre and Queen Mary University of London

Datascience Supervisor
Christos Bourantas
cbourantas@gmail.com

Research Supervisor
Giulio Stefanini
Giulio.stefanini@hunimed.eu

Andreas Baumbach
a.baumbach@qmul.ac.uk

Abstract

Despite the impressive technological and pharmaceutical advances in the field of cardiovascular medicine, coronary artery disease remains the principal cause of mortality worldwide with a substantial societal and economic impact.

Understanding the mechanisms of coronary artery disease progression with the potential identification of subjects with a higher risk of ischemic events represents a key objective of cardiovascular research.

Today it is well-known that cardiovascular events can be caused by lesions that are not flow-limiting and thus are left untreated.

Over the past 30 years, major advances have been achieved in the understanding of plaque pathogenesis and pathophysiology and the term “vulnerable plaque” has been introduced to define coronary plaques that are particularly unstable and prone to cause major adverse events.

Identification of plaque characteristics associated with increased vulnerability is therefore of outmost importance as prompt detection of vulnerable plaques may change current practice justifying their pharmacological or interventional therapy.

A number of imaging tools, the use of which is currently increasing in clinical practice, may play a role to facilitate the identification of vulnerable plaques. Indeed, imaging technologies allow an accurate characterization of atherosclerotic plaques morphology and activity, and their modifications over time.

The aim of the project will be to integrate invasive and non-invasive coronary imaging data to identify surrogate endpoints of plaque vulnerability. Based on these endpoints, we will develop a computational model aimed at predicting plaque vulnerability.
The project will be the basis for a scientific collaboration between Humanitas University and Barts Heart Centre (London, UK)

Main technical approaches

- Non-invasive imaging by cardiac computed tomography angiography.
- Invasive imaging by intravascular ultrasound and optical coherence tomography.
- 3D computational fluid dynamics modelling for wall shear stress estimation.
- Machine-learning.

Scientific references

- Chiarito M,… and Stefanini G. Monotherapy with a P2Y 12 inhibitor or aspirin for secondary prevention in patients with established atherosclerosis: a systematic review and meta-analysis Lancet. 2020;395(10235):1487-1495.
- Stefanini G et al. Early detection of elevated cardiac biomarkers to optimise risk stratification in patients with COVID-19. Heart. 2020;106(19):1512-1518.
- Tufaro V,… and Bourantas C. Wall shear stress estimated by 3D-QCA can predict cardiovascular events in lesions with borderline negative fractional flow reserve. Atherosclerosis 2021 Feb 24;322:24-30.

Type of contract

Place without scholarship.

Posizione senza borsa.

Humanitas University
Via Rita Levi Montalcini 4
20090 Pieve Emanuele (Milano) Italy
Tel +39.02.8224.1 - Fax +39.02.8224.2394
info@hunimed.eu
Website: www.hunimed.eu
C.F. 97692990159