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CORONARY BLOOD FLOW MODELLING FOR FRACTIONAL FLOW RESERVE PREDICTION

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MINI-SYMPOSIUM PROPOSAL

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Ischemic heart disease is the leading cause of death globally [1], and its relevance will increase as the global population ages. Stable Coronary Artery Disease (CAD) is, in addition to acute myocardial infarction, the main symptomatic manifestation of coronary artery disease. In this context, Fractional Flow Reserve (FFR) has demonstrated to be a reliable tool to determine the functional significance of coronary artery stenosis and guide the course of clinical treatment by assisting in the decision whether percutaneous coronary intervention or optimal medical treatment is the best choice. Further, FFR-guided revascularization has improved event-free survival and lowered healthcare costs in randomized studies [2, 3, 4].

Over the last decade many attempts have been made to predict FFR non-invasively by the use of mathematical models [5]. Although such models make use of patient-specific information, a number of modelling hypotheses have to be made. For the problem under consideration, one needs to specify:

1. a computational domain (coronary artery geometry),
2. equations that govern blood flow (and eventually its interaction with vessel walls),
3. a complete set of boundary conditions (in the form of prescribed values of the sought solution or additional models and their related parameters).

This mini-symposium is not intended to be about showing *the best model-based FFR method*. Although invasive FFR remains the preferred metric when discussing how a method or modelling choice performs, the goal of this mini-symposium is to promote an open and constructive discussion about the above mentioned aspects in order to improve our understanding about this problem. The systematic description of modeling methodologies to allow for reproducible results is a simple but fundamental aspect in modeling and simulation, and in science in general, but is currently lacking in many studies addressing model-based FFR prediction.

Keeping these thoughts in mind, and thus aiming for clear and complete descriptions of problems under investigation, we welcome contributions covering the following topics:

- How do different models for blood flow (3D, 3D-FSI, 1D/0D, 0D, transient or steady state models) perform in the context of FFR estimation?;

- How to assess the sensitivity of FFR with respect to image processing?
- Estimation of coronary flow at rest, its distribution among coronary vessels and hyperemic state simulation. Sensitivity of FFR to related parameters;
- Proposal of novel methods or validation of published methods for the determination of any of the above mentioned aspects;
- Uncertainty quantification in models for FFR prediction;
- Methods for non-invasive prediction of Instantaneous Wave-Free Ratio (iFR);
- Other contributions related to the above mentioned topics.

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