

Research and Clinical Applications of Biomechanical Analysis in Optimization of Coronary Interventions

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Abstract: Coronary artery disease (CAD) is the leading cause of mortality and morbidity worldwide. It is the disease of the blood vessels supplying the heart muscle. The fatty plaques built within the walls of the coronary arteries might rupture, creating a thrombus, thereby blocking the entire flow through the vessel, which is followed by a heart attack. Patients who suffer from CAD with documented ischemia are predominately sent to the catheterization laboratory for an invasive procedure (PCI, or percutaneous coronary intervention) to open the vessel by the placement of a “stent” as a scaffolding device to release from ischemia. Identifying the culprit lesions that cause the actual ischemia is crucial for PCI optimization. It has been shown in many clinical trials that the integration of coronary imaging and physiology is better in guiding PCI compared to imaging alone. Over the past years, we have developed approaches to derive coronary physiological data using image reconstruction and biomechanical analysis, thus realizing seamless co-registration between imaging and physiology without using extra invasive devices to measure coronary physiology. Some of these approaches are being transferred into clinical applications that have potential to increase the utility of physiological assessment in patients with CAD. In this talk, I will present these activities and our efforts in developing practical solutions for tailored treatment strategies.

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Dr. Shengxian Tu is a Professor at the School of Biomedical Engineering, Shanghai Jiao Tong University. He received his master degree in Biomedical Engineering from Shanghai Jiao Tong University in 2008. After that, he joined the Medis Applied Research group as a scientific researcher, while at the same time pursuing a PhD degree at the Division of Image Processing (LKEB), Department of Radiology, Leiden University Medical Center, the Netherlands. He graduated cum laude in February 2012. He joined Shanghai Jiao Tong University as a Faculty in 2014. He is the inventor of several patents including the methods for computation of fractional flow reserve from imaging data (FFR_{QCA} or QFR, OFR). He is also the founder of three quantitative analysis systems (AngioPlus, OctPlus, and QAngio XA 3D), which are being used for clinical decisions or studies by a number of hospitals in Europe, Asia, and America. Over the past few years he has published several articles in the leading cardiovascular journals such as Journal of the American College of Cardiology, JACC-Cardiovascular Interventions, and Circulation-Cardiovascular Interventions. In 2014 he was accepted as a Fellow of European Society of Cardiology (FESC) and in 2017 he was accepted as a Fellow of American College of Cardiology (FACC). Currently, he serves as an associate editor of the International Journal of Cardiovascular Imaging and a member of the Editorial Board of Cardiology Journal, Journal of Geriatric Cardiology, and Cardiovascular Diagnosis and Therapy.