Centre for Biosystems Science and Engineering

Seminar

Towards a fluid-structure-growth and remodelling framework to simulate Vein graft failure post Coronary Artery bypass surgery

on

2nd January 2017,
4:00 PM, MRDG Seminar Hall, 1st Floor, Biological Sciences Building

by

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Coronary artery bypass graft surgery (CABG) is performed to revascularize ischemic myocardium, and is widely accepted as an effective treatment for multi vessel coronary artery disease. Venous grafts are used in approximately 70% of these cases and have failure rates as high as 50% within 10 years post-surgery. Mechanics is known to play a key role as a stimulus contributing towards vein graft failure and comprehending its role is key towards understanding disease progression and clinically observed differences between arterial and venous grafts following CABG. The talk will showcase how a two pronged approach is being used to understand vein graft failure from a mechanobiological perspective.

The first approach involves quantifying biologically relevant mechanical stimuli, not available from standard imaging, in patient-specific simulations incorporating non-invasive clinical data. Then computational fluid dynamics is used with closed loop circulatory physiology models to quantify biologically relevant indices, including wall shear, oscillatory shear, and wall strain. The speaker will explain the significant differences in mechanical stimuli acting on venous vs. arterial grafts, that show up in simulations, in line with clinically observed graft failure rates.

The second approach is to understand how mechanics affects vein graft 'mal'adaptation by extending an existing continuum mechanics based constrained mixture model of arterial growth and remodelling to a vein to identify plausible mechanisms of adaptation versus maladaptation. The talk will entail a discussion on how enhanced mass production, rapid evolution of vasomotor tone and a gradual change in load mitigate maladaptation.

About the speaker

Abhay Ramachandra is currently pursuing a PhD with Prof. Allison Marsden in Engineering Sciences (Mechanical Engineering) with a subspecialty in Multiscale Biology at the University of California San Diego, La Jolla, and has a temporary affiliation as a PhD student at Stanford University. He obtained his Bachelors of Technology in Mechanical Engineering from National Institute of Technology, Surathkal and Masters in Mechanical Engineering from Carnegie Mellon University, Pittsburgh. His primary interest is in vascular biomechanics and he is trying to develop computational models to understand vein graft failure in coronary artery bypass graft surgeries.