Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Computational fluid dynamics comparisons of wall shear stress in patient-specific coronary artery bifurcation using coronary angiography and optical coherence tomography.[1] ERIC POON, VIKAS THONDAPU, CHENG CHIN, CEDRIC SCHEERLINCK, TONY ZAHTILA, CHRIS MAMON, WILSON NGUYEN, ANDREW OOI, Univ of Melbourne, PETER BARLIS, Northern Health, Australia — Blood flow dynamics directly influence biology of the arterial wall, and are closely linked with the development of coronary artery disease. Computational fluid dynamics (CFD) solvers may be employed to analyze the hemodynamic environment in patient-specific reconstructions of coronary arteries. Although coronary X-ray angiography (CA) is the most common medical imaging modality for 3D arterial reconstruction, models reconstructed from CA assume a circular or elliptical cross-sectional area. This limitation can be overcome with a reconstruction technique fusing CA with intravascular optical coherence tomography (OCT). OCT scans the interior of an artery using near-infrared light, achieving a 10-micron resolution and providing unprecedented detail of vessel geometry. We compared 3D coronary artery bifurcation models generated using CA alone versus OCT-angiography fusion. The model reconstructed from CA alone is unable to identify the detailed geometrical variations of diseased arteries, and also under-estimates the cross-sectional vessel area compared to OCT-angiography fusion. CFD was performed in both models under pulsatile flow in order to identify and compare regions of low wall shear stress, a hemodynamic parameter directly linked with progression of atherosclerosis.

[1]Supported by ARC LP150100233 and VLSCI VR0210

Eric Poon
Univ of Melbourne

Date submitted: 01 Aug 2016 Electronic form version 1.4