Abstract Submitted
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Computational fluid dynamics evaluation of incomplete stent apposition in a tapered artery[1] ERIC POON, VIKAS THONDAPU, ANDREW OOI, University of Melbourne, Australia, UMAIR HAYAT, PETER BARLIS, Northern Health, Australia, STEPHEN MOORE, IBM Research, Australia — Coronary stents are deployed to prop open blocked arteries and restore normal blood flow, however in-stent restenosis (ISR) and stent thrombosis (ST) remain possibly catastrophic complications. Computational fluid dynamics (CFD) analyses can elucidate the pathological impact of alterations in coronary hemodynamics and correlate wall shear stress (WSS) with atherosclerotic processes. The natural tapering of a coronary artery often leads to proximal incomplete stent apposition (ISA) where stent struts are not in contact with the vessel wall. By employing state-of-the-art computer-aided design (CAD) software, generic open-cell and closed-cell coronary stent designs were virtually deployed in an idealised tapered coronary artery. Pulsatile blood flow (80 mL/min at 75 beats/min) was carried out numerically on these CAD models using a finite volume solver. CFD results reveal significant fluctuations in proximal WSS and large recirculation regions in the setting of proximal ISA, resulting in regions of high wall shear stress gradient (WSSG) that have been previously linked to poor endothelial cell coverage and vascular injury. The clinical significance of these proximal high WSSG regions will be correlated with findings from high-resolution in-vivo imaging.

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Eric Poon
University of Melbourne, Australia

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