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Patient Specific Multiscale Simulations of Blood Flow in Coronary Artery Bypass Surgery ABHAY BANGALORE RAMACHANDRA, SETHURAMAN SANKARAN, Department of Mechanical and Aerospace Engineering, UCSD, ANDREW M. KAHN, Department of Medicine, UCSD, ALISON L. MARSDEN, Department of Mechanical and Aerospace Engineering, UCSD — Coronary artery bypass surgery is performed to revascularize blocked coronary arteries in roughly 400,000 patients per year in the US.While arterial grafts offer superior patency, vein grafts are used in more than 70% of procedures, as most patients require multiple grafts. Vein graft failure (approx. 50% within 10 years) remains a major clinical issue. Mounting evidence suggests that hemodynamics plays a key role as a mechano-biological stimulus contributing to graft failure. However, quantifying relevant hemodynamic quantities (e.g. wall shear stress) invivo is not possible directly using clinical imaging techniques. We numerically compute graft hemodynamics in a cohort of 3-D patient specific models using a stabilized finite element method. The 3D flow domain is coupled to a 0D lumped parameter circulatory model. Boundary conditions are tuned to match patient specific blood pressures, stroke volumes & heart rates. Results reproduce clinically observed coronary flow waveforms. We quantify differences in multiple hemodynamic quantities between arterial &venous grafts & discuss possible correlations between graft hemodynamics & clinically observed graft failure.Such correlations will provide further insight into mechanisms of graft failure and may lead to improved clinical outcomes.

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