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Mass Transport and Shear Stress in the Carotid Artery Bifurcation RILEY GORDER, ALBERTO ALISEDA, University of Washington — The carotid artery bifurcation (CAB) is one of the leading sites for atherosclerosis, a major cause of death and disability in the developed world. The specific processes by which the complex flow found at the bifurcation and carotid sinus promotes plaque formation and growth are not fully understood. Shear stress, mass transport, and flow residence times are considered key factors. Although the governing equations closely link shear stress and mass transfer, the pulsatile, transitional, and detached flow found at the CAB can lead to differences between regions of WSS and mass transfer statistics. In this study, CAB geometries are reconstructed from patient specific 3D ultrasound medical imaging. Using ANSYS FLUENT, the fluid flow and scalar transport was solved using realistic flow conditions and various mass transfer boundary conditions. The spatial and temporal resolution was validated against the analytical solution of the Graetz-Nusselt problem with constant wall flux to ensure the scalar transport is resolved for a Peclet number up to 100,000. High residence time regions are investigated by determining the number of cardiac cycles required to flush out the carotid sinus. The correlations between regions of low WSS, high OSI, and scalar concentration are computed and interpreted in the context of atherosclerotic plaque origin and progression.

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