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Vascular Dynamics of a SMP Foam Aneurysm Treatment Technique JASON ORTEGA, DUNCAN MAITLAND, Lawrence Livermore National Laboratory, WILLIAM TSAI, ÖMER SAVAŞ, U.C.Berkeley, DAVID SALONER, U.C. San Francisco — An aneurysm treatment technique currently under development at LLNL is modeled with CFD simulations. This treatment technique involves the catheter delivery of a piece of shape memory polymer (SMP) foam to an aneurysm. When the foam is heated by laser radiation from a fiber-optic cable embedded within the catheter, the foam expands, filling the aneurysm volume. To determine the effects of the foam upon the arterial walls, the coupled Navier-Stokes and thermal energy equations are solved for steady flow through a generic basilar aneurysm for pre-, during-, and post-treatment stages. Two steady flowrates are applied to the basilar artery corresponding to the mean and peak flowrates over a cardiac cycle. For the mean flowrate boundary condition, the flow through the aneurysm and bifurcation is steady for all treatment stages. However, at the peak systole, the shear layers from the confined jet entering the untreated aneurysm become unstable and roll up into pairs of counter- rotating vortex hoops. The pressure within the aneurysm becomes unsteady as series of these hoop pairs advect into the aneurysm dome. For the post-treatment stage in which the aneurysm is completely filled, the foam eliminates all flow unsteadiness. This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48. UCRL-ABS-213657.

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