Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Virtual Treatment of Basilar Aneurysms Using Shape Memory Polymer Foam J.M. ORTEGA, Lawrence Livermore National Laboratory, J. HARTMAN, Kaiser Permanente, J.N. RODRIGUEZ, D.J. MAITLAND, Texas A&M University — Numerical simulations are performed on patient-specific basilar aneurysms that are treated with shape memory polymer (SMP) foam. In order to assess the post-treatment hemodynamics, two modeling approaches are employed. In the first, the foam geometry is obtained from a micro-CT scan and the pulsatile blood flow within the foam is simulated for both Newtonian and non-Newtonian viscosity models. In the second, the foam is represented as a porous media continuum, which has permeability properties that are determined by computing the pressure gradient through the foam geometry over a range of flow speeds comparable to those of in vivo conditions. Virtual angiography and additional post-processing demonstrate that the SMP foam significantly reduces the blood flow speed within the treated aneurysms, while eliminating the high-frequency velocity fluctuations that are present prior to treatment. A prediction of the initial locations of thrombus formation throughout the SMP foam is obtained by means of a low fidelity thrombosis model that is based upon the residence time and shear rate of blood. The two modeling approaches capture similar qualitative trends for the initial locations of thrombus within the SMP foam.

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Date submitted: 27 Jul 2012 Electronic form version 1.4