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Image based numerical simulation of hemodynamics in a intracranial aneurysm TRUNG LE, LIANG GE, FOTIS SOTIROPOULOS, University of Minnesota, DAVID KALLMES, HARRY CLOFT, DEBRA LEWIS, DAYING DAI, YONGHONG DING, RAMANATHAN KADIRVEL, Mayo Clinic — Image-based numerical simulations of hemodynamics in a intracranial aneurysm are carried out. The numerical solver based on CURVIB (curvilinear grid/immersed boundary method) approach developed in Ge and Sotiropoulos, JCP 2007 is used to simulate the blood flow. A curvilinear grid system that gradually follows the curved geometry of artery wall and consists of approximately 5M grid nodes is constructed as the background grid system and the boundaries of the investigated artery and aneurysm are treated as immersed boundaries. The surface geometry of aneurysm wall is reconstructed from an angiography study of an aneurysm formed on the common carotid artery (CCA) of a rabbit and discretized with triangular meshes. At the inlet a physiological flow waveform is specified and direct numerical simulations are used to simulate the blood flow. Very rich vortical dynamics is observed within the aneurysm area, with a ring like vortex sheds from the proximal side of aneurysm, develops and impinge onto the distal side of the aneurysm as flow develops, and destructs into smaller vortices during later cardiac cycle. This work was supported in part by the University of Minnesota Supercomputing Institute.

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