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A patient-specific CFD-based study of embolic particle transport for stroke[1] DEBANJAN MUKHERJEE, SHAWN C. SHADDEN, Univ of California - Berkeley — Roughly 1/3 of all strokes are caused by an embolus traveling to a cerebral artery and blocking blood flow in the brain. A detailed understanding of the dynamics of embolic particles within arteries is the basis for this study. Blood flow velocities and emboli trajectories are resolved using a coupled Euler-Lagrange approach. Computer model of the major arteries is extracted from patient image data. Blood is modeled as a Newtonian fluid, discretized using the Finite Volume method, with physiologically appropriate inflow and outflow boundary conditions. The embolus trajectory is modeled using Lagrangian particle equations accounting for embolus interaction with blood as well as vessel wall. Both one and two way fluid-particle coupling are considered, the latter being implemented using momentum sources augmented to the discretized flow equations. The study determines individual embolus path up to arteries supplying the brain, and compares the size-dependent distribution of emboli amongst vessels superior to the aortic-arch, and the role of fully coupled blood-embolus interactions in modifying both trajectory and distribution when compared with one-way coupling. Specifically for intermediate particle sizes the model developed will better characterize the risks for embolic stroke.

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