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Flow-mediated transport around a macroscopic arterial thrombus.[1] DEBANJAN MUKHERJEE, University of California, Berkeley, JOCELYN GARDUNO, Los Angeles Trade Technical College, SHAWN SHADDEN, University of California, Berkeley — Pathological blood clotting (thrombosis) is the acute cause of most major cardiovascular events including heart attack and stroke. Local blood and plasma transport in the neighborhood of a clot is thought to govern the thrombotic process (e.g. growth and consolidation), embolization, and the effectiveness of pharmacological treatments. To better understand the fluid mechanics near a clot it is necessary to resolve the dynamic interactions between a realistic thrombus with arbitrary shape and microstructure, and viscous, pulsatile flow. Here, we describe a computational technique to characterize flow-mediated transport phenomena in the vicinity of macro-scale arterial clots. The technique comprises (a) resolving unsteady flow around a thrombus model using a discrete particle fictitious domain finite element method; (b) identifying coherent transport features using finite time Lyapunov exponent fields, and (c) characterizing mixing using a particle-based approach. Numerical examples are discussed using realistic thrombus aggregates derived from experimental data, and pulsatile flow typical in human arteries. The results indicate the existence of local transport barriers and coherent regions in the vicinity of the clot with potential influence to local biochemical mechanics.

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