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Numerical simulations of cell interactions under shear flows in complex geometries GAOZHU PENG, Laboratory for Visiometrics and Modeling, Rutgers University, NORMAN ZABUSKY, PROSENJIT BAGCHI — The receptor-mediated leukocyte adhesion and rolling on endothelium under shear flows are of crucial importance in governing a range of cell functions: inflammatory response, lymphocyte homing, and sickle cell vascular occlusion. In vivo, an endothelium-lined blood vessel lumen has a non-flat irregular complex geometry presented to blood flows, and adherent leukocytes can lead to further geometry complexity. This geometry factor can have a prominent impact on the mechanics and hemodynamics of cell interactions and adhesions in high endothelial venules, non-uniform capillaries and post-capillary expansions to name a few. In this work, a ghost-cell immerse boundary/front tracking method is presented to examine the physiological role of the blood vessel geometry in microcirculation. Motions of deformable blood cells are computed via a multiphase front tracking method. Boundary conditions for arbitrary geometries are enforced through a high-order ghost cell immersed boundary method. The current method is validated and used to explore the potential roles of vessel geometry in modulating hemodynamics and kinetics of 2d/3d cell interactions, in particular leukocyte adhesion and accumulation.

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