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Clot Permeability, Agonist Transport, and Platelet Binding Kinetics in Arterial Thrombosis[1] JIAN DU, Florida Institute of Technology, DONGJUNE KIM, Georgia Institute of Technology, GHADAH ALHAWAEL, Florida Institute of Technology, DAVID KU, Georgia Institute of Technology, AARON FOGELSON, University of Utah — During the process of arterial thrombosis, the formation of stable wall-adherent platelet aggregates requires the rapid formation of large number of interplatelet bonds to sustain the drag force exerted on the thrombus by the background fluid. The magnitude of this force is strongly influenced by the thrombus permeability. We investigate platelet aggregation in coronary-sized arteries using both computational simulations and in vitro experiments. The computational model tracks the formation and breaking of bonds between platelets and treats the thrombus as an evolving porous, viscoelastic material, which moves differently than the background fluid. Fluid and thrombus interact through a Kozeny-Carman drag term, parameterized based on our experimental permeability-porosity measurements. We found that 1) Using physiological parameter values, a stable thrombus growth is possible only if the clot permeability is within the range of our experimental measurement. 2) Under high shear flow, soluble agonist released by platelets is limited to the thrombus and a boundary layer downstream. This limits the thrombus growth into the vessel lumen. 3) Adding to the model binding and activation of unactivated platelets through vWF-mediated processes allows greater thrombus growth.

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