

Abstract:

On vessel wall injury the complex process of blood coagulation is set off. It is composed of vasoconstriction, primary hemostasis, secondary hemostasis and fibrinolysis. This work enriches current model of primary hemostasis of Storti. The previous model used ALE formalism for tracing of development of platelet plug. The phase field method is used for tracing of the development of interface blood-thrombus. Storti's primary hemostasis was extended to capture the fact, that the platelets can be activated in the blood flow in the area of reactive surface not only by influence of chemical agents like thromboxane, ADP and thrombin but also by their exposure to elevated values of shear stress. In our first approach we deal the emerging thrombus as a fluid with very high viscosity. In the second approach it was assumed, that platelet plug develops as a viscoelastic material according to constitutive equations of clot introduced by Kempen. In this manner platelet clot matures into blood clot. In both approaches the blood is represented as a non-Newtonian fluid. The framework of the phase field method was applied also to the model of high shear rate thrombosis of Weller. Weller's original model of Weller took advantage of the cylindrical symmetry of computational domains for its computations, hence the computations were actually two dimensional. Computations in three dimensions were performed using the finite element library deal.ii. It was used its ability to distribute computations across large number of cores/nodes using the MPI interface. A scalability study was done for the model Weller. The results of the final model, where the clot was taken as a viscoelastic material, are compared with the in vivo experiment of Falati.