Cell-Cell Interaction Effect in Mural Thrombosis; a Dissipative Particle Dynamic Approach

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Mural thrombosis, due to its highly complex physiological process and its pathological significance, has gained great attention through mathematical modeling with different methods and different models. One of crucial aspect of this phenomenon is the effect of cell-cell interaction (CCI) in development of mural clot, which is inherited from complexity of blood via different suspended cells. In this work, we have implemented dissipative particle dynamics, to model flow of plasma, biconcave RBCs, and platelets in proximity of a $24r_c$ mural lesion in middle of a 2D micro-channel of ($150r_c \times 80r_c$) with a parabolic inlet. The CCI is mainly gained through grouping of DPD particles within each cell which interact with the fluid particles and other cells in addition to the use of elastic collision theory [1,2]. To emphasis the CCI effect we have compared two models of thrombosis: one including only platelets flow, and in the other RBCs and platelets are both included. In this comparison, the effect of RBC-platelet interaction is vivid in both increasing the rate of aggregation and the proximal fraction of the aggregated platelets along the lesion which agree well with the previous in-vitro and numerical studies [3,4]. As a concluding remark, the explicit modeling of suspended cells in blood flow helps in gaining better view on the clot formation process.

References

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