

Computational modeling of blood rheology in cerebral aneurysm flow dynamics

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Abstract

Cerebral aneurysms are pathological dilations of intracranial arteries that present serious health risks due to potential rupture and subarachnoid hemorrhage. Despite advances in imaging and treatment, the mechanisms driving aneurysm development and rupture remain unclear. Image-based simulations are valuable tools in this research, but often oversimplify blood rheology. While many models treat blood as a Newtonian fluid, it exhibits shear-thinning non-Newtonian behavior that can significantly influence flow predictions, especially in low-shear regions like aneurysm domes.

This talk explores how blood rheology affects CFD outcomes in image-based aneurysm models. Comparing Newtonian and non-Newtonian approaches, we find significant differences in wall shear stress, oscillatory shear index, and flow structures. These results highlight the need for realistic blood modeling to enhance the accuracy and clinical utility of simulations.

Keywords: image-based cerebral aneurysms, non-Newtonian shear-thinning models, hemodynamics.