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Fluid-Structure Interaction Modeling of Intracranial Aneurysm Hemodynamics: Effects of Different Assumptions[1] HAMIDREZA RAJABZADEH OGHAZ, ROBERT DAMIANO , HUI MENG, University at Buffalo, State University of New York — Intracranial aneurysms (IAs) are pathological outpouchings of cerebral vessels, the progression of which are mediated by complex interactions between the blood flow and vasculature. Image-based computational fluid dynamics (CFD) has been used for decades to investigate IA hemodynamics. However, the commonly adopted simplifying assumptions in CFD (e.g. rigid wall) compromise the simulation accuracy and mask the complex physics involved in IA progression and eventual rupture. Several groups have considered the wall compliance by using fluid-structure interaction (FSI) modeling. However, FSI simulation is highly sensitive to numerical assumptions (e.g. linear-elastic wall material, Newtonian fluid, initial vessel configuration, and constant pressure outlet), the effects of which are poorly understood. In this study, a comprehensive investigation of the sensitivity of FSI simulations in patient-specific IAs is investigated using a multi-stage approach with a varying level of complexity. We start with simulations incorporating several common simplifications: rigid wall, Newtonian fluid, and constant pressure at the outlets, and then we stepwise remove these simplifications until the most comprehensive FSI simulations. Hemodynamic parameters such as wall shear stress and oscillatory shear index are assessed and compared at each stage to better understand the sensitivity of in FSI simulations for IA to model assumptions.

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