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A numerical investigation of blood damage in the hinge area of bileaflet mechanical heart valves MIN YUN, JINGSHU WU, HELENE SIMON, Georgia Institute of Technology, FOTIS SOTIROPOULOS, University of Minnesota, CYRUS AIDUN, AJIT YOGANATHAN, Georgia Institute of Technology — Studies have shown that high shear stress and large recirculation regions have a strong impact on thromboembolic complications in Bileaflet mechanical heart valves (BMHV). This study quantitatively compares the hinge flow field and blood damage of the 23mm St. Jude Medical (SJM) regent with different hinge gap widths and the 23mm CarboMedics (CM) valves. The lattice-Boltzmann method with external boundary force (LBM-EBF) [Wu and Aidun, *Int. J Num. Methods Fluids*, **62**, 7, 2009] was implemented to simulate the flow and capture the dynamics and the surface shear stress of the platelets with realistic geometry. The velocity boundary conditions for the small-scale hinge flow are obtained from previous 3D large-scale computational fluid dynamics (CFD) simulations [Simon et al, *Annals of Biomedical Engineering*, **38**, 3, 2009]. The flow patterns of three hinges that were studied were similar during diastole. However, velocity magnitudes and shear stresses at the hinge gap were different, which may explain the higher blood damage index (BDI) value for the CM valve and lower BDI value for the SJM valve with a larger gap width. The multiscale computational method used to quantitatively measure the BDI during a full cardiac cycle will be discussed.

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