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Numerical Modeling of Thrombus Transport to the Cerebral Vasculature in the Presence of a Left Ventricular Assist Device ANGELA STRACCIA, VENKAT KESHAV CHIVUKULA, FANETTE CHASSAGNE, JENNIFER BECKMAN, CLAUDIUS MAHR, ALBERTO ALISEDA, University of Washington — Left ventricular assist devices (LVAD) represent an increasingly available treatment for end-stage heart failure. Despite improvements in LVAD design that have greatly reduced the incidence of in-pump thrombosis, thromboembolic events, such as stroke, remain the main cause of mortality and morbidity. This study aims to identify the relationship between the source of thrombi – LVAD outflow graft or aortic valve – and their destination in the cerebral vasculature. The hemodynamics, from the aortic arch and LVAD outflow graft to the Circle of Willis, are investigated using 3D time-resolved computational fluid dynamics (CFD) in patient-specific models obtained from segmented medical imaging. Thrombi of different sizes are seeded in the blood flow and followed throughout their trajectories via Lagrangian particle tracking, accounting for inertial effects. We achieve a statistical description of the likelihood of thrombi being transported towards different regions of the cerebral circulation by studying a wide distribution of thrombi properties and seeding locations. Patient-specific stroke risk, and its origins, is quantified, along with the altered hemodynamics in the cerebral vasculature in the presence of stroke.

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