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Computational Simulations of Inferior Vena Cava (IVC) Filter Placement and Hemodynamics in Patient-Specific Geometries KENNETH AYCOCK, Penn State University, SHANKAR SASTRY, University of Utah, JIBUM KIM, Penn State University, SUZANNE SHONTZ, Mississippi State University, ROBERT CAMPBELL, KEEFE MANNING, Penn State University, FRANK LYNCH, Penn State Hershey Medical Center, BRENT CRAVEN, Penn State University — A computational methodology for simulating inferior vena cava (IVC) filter placement and IVC hemodynamics was developed and tested on two patient-specific IVC geometries: a left-sided IVC, and an IVC with a retroaortic left renal vein. Virtual IVC filter placement was performed with finite element analysis (FEA) using non-linear material models and contact modeling, yielding maximum vein displacements of approximately 10% of the IVC diameters. Blood flow was then simulated using computational fluid dynamics (CFD) with four cases for each patient IVC: 1) an IVC only, 2) an IVC with a placed filter, 3) an IVC with a placed filter and a model embolus, all at resting flow conditions, and 4) an IVC with a placed filter and a model embolus at exercise flow conditions. Significant hemodynamic differences were observed between the two patient IVCs, with the development of a right-sided jet (all cases) and a larger stagnation region (cases 3-4) in the left-sided IVC. These results support further investigation of the effects of IVC filter placement on a patient-specific basis.

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