Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Computational simulation of aortic dissection with a comparison with 4D flow MRI PAN DU, University of Notre Dame, NICHOLAS BURRIS, Department of Radiology, University of Michigan, Ann Arbor, MI, USA, JULIO SOTELO, Universidad de Valparaso, Valparaso, Chile General Cruz N 222, Valparaso. 236 2905, JIANXUN WANG, University of Notre Dame — Aortic dissection, typically characterized by an intimal flap separating the aortic flow into two channels referred to as true lumen (TL) and false lumen (FL), is a leading cause of death in cardiovascular diseases. 4-dimensional flow magnetic resonance imaging (4D flow MRI) can provide time-resolved volumetric blood-flow information non-invasively, and hereby shows great potential to improve the diagnosis of aortic dissection. However, the inherent imperfection of the 4D flow MRI measurement (e.g., noise, artifacts, and low temporal-special resolution) limits its precision in quantifying the blood flow. Alternatively, computational fluid dynamic (CFD) simulation can produce high-resolution results based on physical models, whilst suffers from model inadequacy caused by unrealistic assumptions such as uniform viscosity or rigid wall. In this paper, we propose a novel data assimilation method that reconstructs the vascular flow field by leveraging both the physiologic authenticity of clinical 4D flow MRI data and the high resolution of the CFD simulation results. Typical biomarkers regarding aortic dissection such as velocity vector field, pressure distribution, and time-averaged wall shear stress are assessed to evaluate the feasibility and effectiveness of the proposed method.

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Date submitted: 22 Nov 2020 Electronic form version 1.4