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Spatiotemporal characterization of pulmonary hypertension under pulsatile flow conditions[1] NARASIMHA RAO PILLALAMARRI, SENOL PISKIN, ENDER FINOL, Department of Mechanical Engineering, University of Texas at San Antonio — Pulmonary hypertension (PH) is a progressive disease characterized by elevated pressure and vascular resistance in pulmonary arteries. Nearly one quarter of a million hospitalizations occur annually in the U.S. with PH as the primary or secondary condition. A definitive diagnosis of PH requires right heart catheterization (RHC) in addition to a chest computed tomography, a walking test, and others. RHC is invasive has inherent risks and contraindications. This study aims to investigate non-invasive surrogates for RHC measures. Pulsatile hemodynamic simulations were conducted in 28 PH patient-specific geometries with a flow solver developed by customizing OpenFOAM libraries (v5.0, The OpenFOAM Foundation). Quasi patient-specific boundary conditions were implemented using a Womersley inlet velocity profile and resistance outflow conditions. Hemodynamic indices such as wall shear stress (WSS), time-averaged WSS, oscillatory shear index, and blood damage index were evaluated along with clinical metrics such as pulmonary vascular resistance and compliance to assess possible spatiotemporal correlations. The results are promising in the context of a long-term goal of identifying computational biomarkers that can serve as surrogates for invasive diagnostic protocols of PH.

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