

Abstract Submitted
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Effect of varying heart rate on intra-ventricular filling fluid dynamics¹ ARVIND SANTHANAKRISHNAN, Oklahoma State University, IKECHUKWU OKAFOR, YAGNA ANGIRISH, AJIT YOGANATHAN, Georgia Institute of Technology & Emory University — Impaired exercise tolerance is used to delineate asymptomatic patients during the clinical diagnosis of diastolic left heart failure. Examining the effects of varying heart rate on intra-ventricular filling can provide a physical understanding of the specific flow characteristics that are impacted during exercise. In this study, diastolic filling was investigated with an anatomical left ventricle (LV) physical model under normal heart rate of 70 bpm, and varying exercise conditions of 100 bpm and 120 bpm. The LV model was incorporated into a flow loop and tuned for physiological inflow rates and outflow pressures. 2D PIV measurements were conducted along 3 parallel longitudinal planes. The systemic pressure was maintained the same across all test conditions. The E/A ratio was maintained within 1.0-1.2 across all heart rates. The strength of the mitral vortex ring formed during E-wave, as well as the peak incoming jet velocity, decreased with increasing heart rate. During peak flow of the A-wave, the vortex ring propagated farther into the LV for 120 bpm as compared to 70 bpm. The results point to the heightened role of the atrial kick for optimal LV filling during exercise conditions.

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