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Aortic Wave Dynamics and Its Influence on Left Ventricular Workload NIEMA PAHLEVAN, MORTEZA GHARIB, California Institute of Technology — Clinical and epidemiologic studies have shown that hypertension plays a key role in development of left ventricular (LV) hypertrophy and ultimately heart failure mostly due to increased LV workload. Therefore, it is crucial to diagnose and treat abnormal high LV workload at early stages. The pumping mechanism of the heart is pulsatile, thus it sends pressure and flow wave into the compliant aorta. The wave dynamics in the aorta is dominated by interplay of heart rate (HR), aortic rigidity, and location of reflection sites. We hypothesized that for a fixed cardiac output (CO) and peripheral resistance (PR), interplay of HR and aortic compliance can create conditions that minimize LV power requirement. We used a computational approach to test our hypothesis. Finite element method with direct coupling method of fluid-structure interaction (FSI) was used. Blood was assumed to be incompressible Newtonian fluid and aortic wall was considered elastic isotropic. Simulations were performed for various heart rates and aortic rigidities while inflow wave, CO, and PR were kept constant. For any aortic compliance, LV power requirement becomes minimal at a specific heart rate. The minimum shifts to higher heart rates as aortic rigidity increases.

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