

Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

The Effect of Aortic Compliance on Left Ventricular Power Requirement NIEMA PAHLEVAN, MORTEZA GHARIB, California Institute of Technology — Aortic compliance depends on both geometry and mechanical properties of the aorta. Reduction in arterial compliance has been associated with aging, smoking, and multiple cardiovascular diseases. Increased stiffness of the aorta affects the wave dynamics in the aorta by increasing both pulse pressure amplitude and wave speed. We hypothesized that decreased aortic compliance leads to an increased left ventricular power requirement for a fixed cardiac output due to altered pulse pressure and pulse wave velocity. We used a computational approach using the finite element method for solid and fluid domains coupled to each other by using the direct coupling method. A nonlinear material model was used for the solid wall. The fluid flow model was considered to be Newtonian, incompressible, and laminar. The simulation was performed for a heart rate of 75 beats per minute for six different compliances while keeping the cardiac output and the peripheral resistance constant. The results show a trend towards increased left ventricular energy expenditure per cycle with decreased compliance. The relevance of these findings to clinical observations will be discussed.

Niema Pahlevan
California Institute of Technology

Date submitted: 03 Aug 2009

Electronic form version 1.4