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Intraventricular filling under increasing left ventricular wall stiffness and heart rates¹ MILAD SAMAE, HONG KUAN LAI, JOSEPH SCHOVANEC, ARVIND SANTHANAKRISHNAN, Oklahoma State University, SHERIF NAGUEH, Houston Methodist Hospital — Heart failure with normal ejection fraction (HFNEF) is a clinical syndrome that is prevalent in over 50% of heart failure patients. HFNEF patients show increased left ventricle (LV) wall stiffness and clinical diagnosis is difficult using ejection fraction (EF) measurements. We hypothesized that filling vortex circulation strength would decrease with increasing LV stiffness irrespective of heart rate (HR). 2D PIV and hemodynamic measurements were acquired on LV physical models of varying wall stiffness under resting and exercise HRs. The LV models were comparatively tested in an in vitro flow circuit consisting of a two-element Windkessel model driven by a piston pump. The stiffer LV models were tested in comparison with the least stiff baseline model without changing pump amplitude, circuit compliance and resistance. Increasing stiffness at resting HR resulted in diminishing cardiac output without lowering EF below 50% as in HFNEF. Increasing HR to 110 bpm in addition to stiffness resulted in lowering EF to less than 50%. The circulation strength of the intraventricular filling vortex diminished with increasing stiffness and HR. The results suggest that filling vortex circulation strength could be potentially used as a surrogate measure of LV stiffness.

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