Relations Between Aortic Stiffness And Left Ventricular Mechanical Function

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Objectives: Left ventricular contraction produces longitudinal strain in the proximal aorta. As a result, aortic stiffening may impair optimal mechanical ventricular-vascular coupling and left ventricular (LV) systolic function, particularly in the long axis. LV global longitudinal strain (GLS) has recently emerged as a sensitive measure of early cardiac dysfunction. In this study, we investigated the relation between aortic stiffness and GLS in a large community-based sample.

Methods: In 2516 participants (age 39-90 years, 57% women) of the Framingham Offspring and Omni cohorts, free of cardiovascular disease, we performed tonometry to measure aortic stiffness and echocardiography to assess cardiac function. Aortic stiffness was evaluated as carotid-femoral pulse wave velocity (CFPWV) and as characteristic impedance (Zc), and GLS was calculated using speckle tracking-based measurements.

Results: In multivariable analyses adjusting for age, sex, height, systolic blood pressure, augmentation index, LV structure, and additional cardiovascular disease risk factors, increased CFPWV (β±SE: 0.122±0.030 SD strain per SD CFPWV, P<0.0001) and Zc (0.091±0.029 SD/SD, P=0.002) were both associated with worse (less negative) GLS. We observed effect modification by sex of the relation between Zc and GLS (P=0.004); in sex-stratified multivariable analyses, the relation between greater Zc and worse GLS persisted in women (0.145±0.040, P=0.0003) but not in men (P=0.73).

Conclusion: Higher aortic stiffness was associated with worse GLS after adjusting for hemodynamic variables. Parallel reductions in LV long axis shortening and proximal aortic longitudinal strain in individuals with a stiffened proximal aorta may represent a manifestation of abnormal direct mechanical ventricular-vascular coupling.

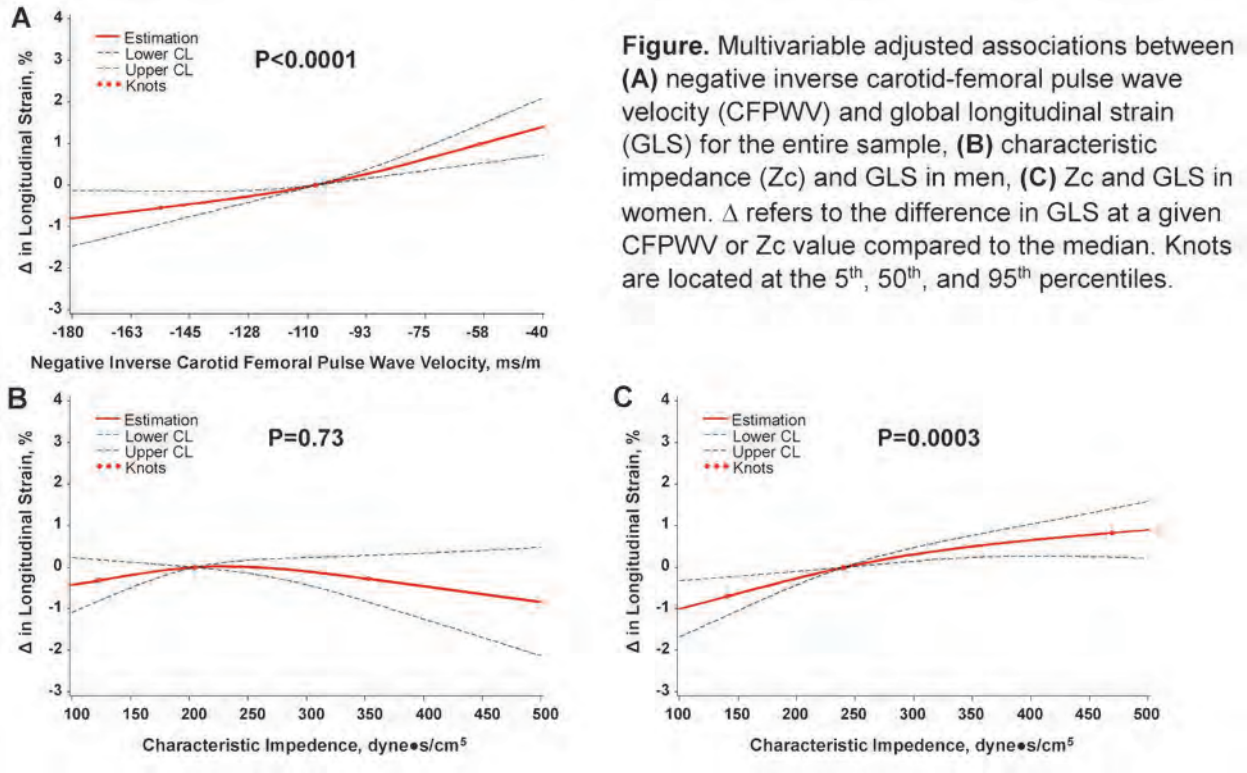

Figure. Multivariable adjusted associations between **(A)** negative inverse carotid-femoral pulse wave velocity (CFPWV) and global longitudinal strain (GLS) for the entire sample, **(B)** characteristic impedance (Zc) and GLS in men, **(C)** Zc and GLS in women. Δ refers to the difference in GLS at a given CFPWV or Zc value compared to the median. Knots are located at the 5th, 50th, and 95th percentiles.