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MEASURES OF PULSATILE ARTERIAL LOAD ARE ASSOCIATED WITH MYOCARDIAL WALL STRESS DURING SYSTOLE

Moderated Poster Contributions
Hall C
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Background: Pulsatile arterial load increases with age and may increase systolic myocardial wall (fiber) stress (σf) in older individuals. We investigated the association of measures of pulsatile load with σf in older adults.

Methods: We performed arterial tonometry and echocardiography with speckle tracking in 309 adults from the community (age 66±9 years, 57% women, 76% hypertensive, and mean LV ejection fraction 63±7%). Components of arterial load were derived from central pressure and flow analyses; σf at peak flow, peak pressure, and end-systole was computed using Arts formula (Table).

Results: The mean time to peak flow and peak pressure corresponded to 38±5% and 71±6% of systole respectively. After adjustment for age, sex, body-size, cardiovascular risk factors and systolic BP, higher aortic characteristic impedance (Zc) was associated with higher σf at peak flow and peak pressure but not at end systole. In contrast, higher augmentation index (AI) and lower total arterial compliance (TAC) were each associated with higher σf at end-systole (all P≤.003, Table).

Conclusions: In older adults, increased proximal aortic stiffness (Zc) was associated with higher σf during the first two-thirds of systole while greater wave reflection (AI) and lower TAC were associated with higher σf at end-systole. Proximal aortic stiffness is a major determinant of systolic myocardial wall stress.

Table. Association of measures of pulsatile load with myocardial wall stress

	σf at peak flow	σf at peak pressure	σf at end-systole
Log Zc	41.6±9.0 (P<.001)	43.1±8.8 (P<.001)	P=0.5
Log-TAC	P=0.05	P=0.3	-19.3±6.2 (P=.002)
AI	0.18±0.23 (P=0.4)	0.38±0.23 (P=0.1)	0.47±0.15 (P=.003)

Abbreviations: Zc=aortic characteristic impedance, TAC=total arterial compliance, AI=augmentation index. σf=myocardial fiber stress

We performed stepwise analysis to assess the association of components of 3-element Windkessel model (Zc, TAC and systemic vascular resistance) with σf after adjusting for age and sex. AI was not included in the model to the multicollinearity detected by high VIF. After this step, multivariable regression analysis was performed to assess the association of Zc, TAC or AI with σf after adjusting for age, sex, body-size, heat rate, hypertension, diabetes, smoking, coronary heart disease, LV ejection fraction, systemic vascular resistance and systolic BP. The association is expressed as regression coefficient±stardard error (P-value).

σf =Pi(LV) x (1+3Vi(chamber)/Vi(wall)), i=time at peak flow, peak pressure and end-systole; P=LV pressure estimated by carotid pressure calibrated by brachial BP; V=volume, calculated by area-length method.