Carotid artery longitudinal wall motion: regulatory factors and implications for arterial health

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Abstract: The carotid artery wall moves longitudinally along the length of the vessel, although little is known about what causes this motion, or what health information it represents. The overarching purpose of this dissertation was to investigate the regulation of carotid artery longitudinal wall motion (CALM) in humans, as well as how CALM can be used to infer information about arterial health. Through observational and experimental designs, we tested evidence for a structural ventricular-vascular coupling effect, which postulates that systolic anterograde CALM is influenced by the forward blood shear rate while systolic retrograde CALM is influenced by left ventricular rotation, although the data suggest a moderate influence of left ventricular rotation, and minimal influence of shear rate. In cross-sectional analyses, we demonstrated that diastolic CALM variables are better related to age and health status compared with systolic CALM displacement and that this relationship was independent of traditional measures of arterial stiffness. These experimental and observational results directed the use of diastolic CALM as a potential indicator of arterial health in subsequent studies, owing to the relative independence from systolic events. While there was no effect of 12 weeks of exercise training in healthy men on diastolic CALM variables, we observed increased systolic retrograde CALM and diastolic CALM acceleration in men with a history of resistance exercise training compared with sedentary men, suggesting an effect of habitual exercise training. Our novel findings suggest that CALM is regulated by a complex system, in part related to both arterial wall structure and ventricular-vascular coupling, and may have clinical value in complimenting measures of traditional arterial stiffness in humans. Future studies should examine whether local changes to arterial wall structure or indirect changes in regulatory control dictate differences in CALM with aging and with chronic exercise training, before integrating CALM into routine measurement of arterial health.

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