Higher Aortic Stiffness and Carotid Systolic and Pulse Pressure are Selectively Associated with Lower White Matter Integrity in the Genu and Frontal Cortex in Older Healthy Adults

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Introduction: Previous studies have demonstrated an association between higher aortic stiffness and central pulse pressure (PP) with lower brain white matter structural integrity (WMI) and neuropsychological functioning in older adults. However, it is unknown if aortic stiffness and central PP are associated with lower WMI in select brain regions or if they relate to cognitive abilities that decline with age such as processing speed.

Objectives: We hypothesized that greater aortic stiffness and carotid PP would be associated with lower regional WMI and slower processing speed.

Methods and Results: In younger (n=12, age 23.2 ± 2.3 yrs) and older (n=7, 67.7 ± 2.7 yrs) healthy adults, aortic stiffness (carotid-femoral pulse wave velocity, cfPWV) and carotid blood pressure (BP) were determined non-invasively using applanation tonometry and brachial cuff BP (Cardiovascular Engineering, Inc.). Fractional anisotropy (FA) (3T MRI, Siemens) assessed from diffusion imaging measured WMI. The association between vascular variables and FA was determined using voxel-wise and region-of-interest (ROI) analyses. Letter and pattern comparison assessed processing speed.

Results: In the entire cohort, cfPWV (adjusted for age, mean BP) and carotid and brachial PP (adjusted for age) were not correlated with WMI in any brain regions using voxel-wise or ROI. Among older adults using ROI, cfPWV (adjusted for mean BP) was correlated with genu corpus callosum ($r=-0.90$, $p<0.05$) and frontal ($r= -0.77$, $p<0.05$) FA values and corroborated in voxel-wise analyses. Carotid, but not brachial systolic BP or PP, was negatively correlated with genu and superior frontal gyrus and medial prefrontal cortex FA values ($p<0.05$) using voxel-wise analysis. cfPWV, but not FA in the genu or frontal ROIs, was correlated with processing speed ($p<0.05$) in older adults.

Conclusion: Preliminary results suggest that greater aortic stiffness is selectively associated with lower WMI in the genu and frontal cortex, and slower processing speed in older adults.