



4.2 Biological and Vascular Contributors to Cerebral Pulsatility and Pulsatile Damping

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ABSTRACT

Cerebral pulsatility is an emerging contributor to brain health that reflects the balance between the transmission and damping (i.e. attenuation) of pulsatility through extracranial vessels into the cerebrovasculature. Identifying biological (age, sex) and vascular contributors to pulsatile balance may provide insight into sex differences in brain aging.

Purpose: Explore biological and vascular contributors to cerebral pulsatility and pulsatile damping.

Methods: 282 Adults (53% female) 18–85 yrs underwent measurements of cerebral (middle cerebral artery) pulsatility, pulsatile damping (cerebral:carotid pulsatility), large artery stiffening (aortic:carotid pulse wave velocity (PWV)), and carotid wave transmission/reflection dynamics using wave-intensity analysis. Multiple regression was used to examine the contributions of 1) age, sex, BMI, aortic:carotid PWV, carotid diameter, pulse pressure, and forward-wave energy to cerebral pulsatility; and 2) age, sex, BMI, aortic:carotid PWV, carotid diameter, wave reflection index, and suction-wave energy to pulsatile damping.

Results: Age and female sex were predictors of greater cerebral pulsatility and reduced pulsatile damping. Beyond the effects of age and sex, greater large artery stiffening ($\beta = 0.21$), pulse pressure ($\beta = 0.28$), and forward wave energy ($\beta = 0.26$, model $R^2 = 0.42$, $p < 0.05$) predicted greater cerebral pulsatility, while greater carotid wave reflection index ($\beta = 0.23$, model $R^2 = 0.49$, $p < 0.05$) predicted greater pulsatile damping.

Conclusion: Our data confirms literature linking age and extracranial artery stiffening and hemodynamics to cerebral pulsatility. Our findings suggest age and female sex are associated with reduced damping of pulsatile hemodynamics, while carotid wave reflections enhance pulsatile damping. Lower pulsatile damping among females may contribute to greater cerebral pulsatile burden compared to males.

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