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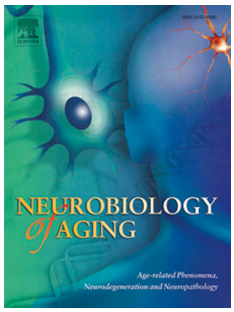


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# Aging-associated changes in cerebral vasculature and blood flow as determined by quantitative optical coherence tomography angiography

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**ABSTRACT**

Normal aging is associated with significant alterations in brain's vascular structure and function, which can lead to compromised cerebral circulation and increased risk of neurodegeneration. The *in vivo* examination of cerebral blood flow (CBF), including capillary beds, in aging brains with sufficient spatial detail remains challenging with current imaging modalities. In the present study, we use three-dimensional (3-D) quantitative optical coherence tomography angiography (OCTA) to examine characteristic differences of the cerebral vasculatures and hemodynamics at the somatosensory cortex (S1) between old (16-month-old) and young mice (2-month-old) *in vivo*. The quantitative metrics include cortical vascular morphology, CBF, and capillary flow velocity. We show that compared to young mice, the pial arterial tortuosity increases by 14%, the capillary vessel density decreases by 15%, and the CBF reduces by 33% in the old mice. Most importantly, changes in capillary velocity and heterogeneity with aging are quantified for the first time with sufficiently high statistical power between young and old populations, with a 21% ($p<0.05$) increase in capillary mean velocity and 19% ($p\leq0.05$) increase in velocity heterogeneity in the latter. Our findings through non-invasive imaging are in line with previous studies of vascular structure modification with aging, with additional quantitative assessment in capillary velocity enabled by advanced OCTA algorithms on a single imaging platform. The results offer OCTA as a promising neuroimaging tool to study vascular aging, which may shed new light on the investigations of vascular factors contributing to the pathophysiology of age-related neurodegenerative disorders.

*Keyword: optical coherence tomography angiography, capillary imaging, aging, neurodegeneration, Alzheimer's disease, tortuous blood vessel, capillary loss, cerebral blood flow, capillary transit time heterogeneity*