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Pulsatile pressure-induced myogenic response is impaired by aging in mouse cerebral arteries

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Background: Aging is associated with increased incidence of cerebrovascular disorders, but the age-dependent changes in local vasomotor mechanisms are not completely understood. Myogenic autoregulation of cerebral vessels in response to static changes in perfusion pressure protects the microcirculation from high pressure and volume. However, it was recently shown that aging impairs static myogenic regulation of cerebral blood flow, responses of cerebral vessels to pulsatile pressure, especially in aging are not known. Thus, we tested the hypotheses that aging impairs myogenic responses of cerebral arteries to pulsatile pressure.

Methods and Results: Isolated and cannulated middle cerebral arteries (MCA) were isolated from young (3 mo) and aged (24 mo) C57BL/6 mice. Both young and aged MCAs developed similar myogenic tone in response to stepwise, steady-state increases in intraluminal P. Also, young MCAs exhibited significant myogenic adaptation to sinusoidal pulsatile P (amplitude: 40 mmHg, frequency: 450/min). While in myogenic-inactive MCAs each P pulse elicited a ≈7% distension in synchrony with the pulsatile P, in young myogenic-active MCAs the amplitude of the diameter changes induced by the P pulses in the autoregulated P range was significantly attenuated (≏2%). The mean P-myogenic tone curve was similar in young MCAs exposed to constant and pulsatile P. In aged MCAs the cyclic changes in diameter induced by the P pulses were increased (≏4%) and development of myogenic tone in response to pulsatile P was impaired.

Conclusion: Collectively, aging impairs myogenic adaptation of cerebral arteries to pulsatile P, which likely promotes the development of cerebromicrovascular injury, such as cerebral microbleeds and blood brain barrier disruption by allowing high P to penetrate the distal portion of the cerebral microcirculation.