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Pulsatile pressure-induced myogenic response of mouse cerebral arteries is impaired by aging
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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. Recently it was shown that aging impairs static myogenic regulation of cerebral vessels, however effects of aging on responses of cerebral arteries to pulsatile pressure are not known. Thus, we tested the hypothesis that aging impairs myogenic responses of cerebral arteries to increases in pulsatile pressure.

Methods and Results: Middle cerebral arteries (MCA) were isolated from young (3 mo) and aged (24 mo) C57BL/6-mice and then cannulated. Young and aged MCAs developed similar myogenic tone in response to stepwise, steady-state increases in intraluminal P. Young MCAs exhibited significant myogenic adaptation to sinusoidal pulsatile pressure (PP, amplitude: 40 mmHg, frequency: 450/min). While in myogenic-inactive MCAs each PP elicited a ~7% distension in synchrony with the PP, in young myogenic-active MCAs the amplitude of the diameter changes induced by the PP was significantly attenuated (~2%) in the range of autoregulation. The myogenic tone curves of young MCAs were similar to steady and pulsatile pressures. In aged MCAs, the cyclic changes in diameter induced by the PP were increased, but the development of myogenic tone in response to PP was impaired.

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