Cerebral blood flow dynamics

- Quantification of the cerebral pressure-flow relationship directional sensitivity: Reliability of shorter repeated squat-stand durations
- Diagnostic dynamic contrast-enhanced magnetic resonance imaging blood-brain barrier assessment combined with plasma biomarkers for mild cognitive impairment
- Revealing neurovascular coupling at a high spatial and temporal resolution in the living human retina
- Histological Analysis of Intracranial Cerebral Arteries for Elastin Thickness, Wall Thickness, and Vessel Diameters: An Atlas for Computational Modeling and a Proposed Predictive Multivariable Model of Elastin Thickness
- Brain perfusion and blood-brain barrier permeability in systemic lupus erythematosus patients: Associations with disease activity, cognitive dysfunction, fatigue and pain
- Translational Insights Into Pericyte-Mediated Regulation of Cerebral Blood Flow: Implications for Ischemic Stroke
- Brain water dynamics across sleep stages measured by near-infrared spectroscopy: Implications for glymphatic function
- Capillaries susceptible to frequent stall dynamics revealed by comparing OCT and bessel-2PM measurements

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A monoexponential model characterizing cerebral blood flow velocity dynamics at the onset of exercise may mask dynamic responses by the cerebrovasculature countering large fluctuations of middle cerebral artery blood velocity (MCAv) and cerebral perfusion pressure (CPP) oscillations. Therefore, the purpose of this study was to determine whether the use of a monoexponential model attributes initial fluctuations of MCAv at the start of exercise as a time delay (TD). Twenty-three adults (10 women, 23.9 ± 3.3 yrs; 23.7 ± 2.4 kg/m2) completed 2 min of rest followed by 3 mins of recumbent cycling at 50 W. MCAv, CPP, and Cerebrovascular Conductance index (CVCi), calculated as CVCi = MCAv/MAP × 100 mmHg, were collected, a lowpass filter (0.2 Hz) was applied, and averaged into 3-second bins. MCAv data were then fit to a monoexponential model [ΔMCAv(t) = Amp(1 - e-(t-TD)/τ)]. TD, tau (τ), and mean response time (MRT = TD + τ) were obtained from the model. Subjects exhibited a TD of 20.2 ± 18.1 s. TD was directly correlated with MCAv nadir (MCAvN), r = -0.560, p = 0.007, which occurred at similar times (16.5 ± 15.3 vs. 20.2 ± 18.1 s, p = 0.967). Regressions indicated CPP as the strongest predictor of MCAvN (R2a = 0.36). Fluctuations in MCAv were masked using a monoexponential model. To adequately understand cerebrovascular mechanisms during the transition from rest to exercise, CPP and CVCi must also be analyzed. A concurrent drop in cerebral perfusion pressure and middle cerebral artery blood velocity at the start of exercise forces the cerebrovasculature to respond to maintain cerebral blood flow. The use of a monoexponential model characterizes this initial phase as a time delay and masks this large important response [1].

[1]
Ashley J, Shelley J, Song J, Sun J, Larson RD, Larson DJ, Berkowitz A, Yabluchanskiy A, Kellawan JM. Cerebral blood flow dynamics: Is there more to the story at exercise onset? Physiol Rep. 2023 Jun;11(11):e15735. doi: 10.14814/phy2.15735. PMID: 37287070.