

Supporting Information

Paper title: Assessment of cerebral autoregulation indices – a modelling perspective

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Running title: assessment of cerebral autoregulation

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S1 Tiecks' ARI Model ¹

The cerebral blood flow velocities in response to different levels of cerebral autoregulation, was evaluated by a second-order linear differential equation (Supplementary equation 1-4)¹, where C is a constant value, denoting the initial value of ABP. ABP(n) represents mean ABP at time (sample) n and f stands for the sampling frequency of ABP. Tiecks' model separated CA into 10 levels through a set of parameters, which are the value of time constant (tau), damping factor (D), and the autoregulatory dynamic gain (K) (Supplementary Table 1). x_1 and x_2 are intermediate, state variables, which are set to zero at the start of the simulation process.

$$P(n) = ABP(n) - c \quad (1)$$

$$x_1(n) = x_1(n - 1) + \frac{P(n) - x_2(n-1)}{f\tau} \quad (2)$$

$$x_2(n) = x_2(n - 1) + \frac{x_1(n) - 2D \cdot x_2(n-1)}{f\tau} \quad (3)$$

$$V(n) = P(n) - K \cdot x_2(n) \quad (4)$$

Supplementary Table 1. Parameters used in Tiecks' model related to different levels of cerebral autoregulation

tau [s]	D	K	ARI	dROR,%/s
...	0.00	0	0	0, Absent autoregulation
2.00	1.60	0.20	1	2.5
2.00	1.50	0.40	2	5.0
2.00	1.15	0.60	3	10.0
2.00	0.90	0.80	4	15.0
1.90	0.75	0.90	5	20.0, Normal autoregulation
1.60	0.65	0.94	6	30.0
1.20	0.55	0.96	7	40.0
0.87	0.52	0.97	8	60.0
0.65	0.50	0.98	9	80.0 Overly active autoregulation

tau is time constant, D is damping factor, K is autoregulatory dynamic gain, ARI is autoregulation index, dROR is dynamic rate of regulation according to Aaslid et al

References

1. Tiecks, F. P., Lam, A. M., Aaslid, R. & Newell, D. W. Comparison of Static and Dynamic Cerebral Autoregulation Measurements. *Stroke* **26**, 1014–1019 (1995).