

## Construction of a Dynamic Cerebral Blood Circulation Model

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### ABSTRACT

An automatic control system of physiological brain condition, including cerebral blood flow, intracranial pressure, brain temperature, and cerebral metabolism, is effective for advanced brain resuscitation. However, a physiological brain condition model used in simulation tests is required for developing such system because basic performance experiments is not allowed ethically. Therefore, as a first step, a dynamic cerebral blood circulation model was constructed as an electrically analogous circuit model. The constructed model represents the anatomical structure and the physiological characteristics, such as the formation of cerebral arterial circles; the branching of anterior, middle, and posterior cerebral arteries into gray matters and white matters; blood viscosity; vascular elasticity; and the vascular conductance that is auto regulated by regional cerebral perfusion pressure and intracranial pressure. This model was analyzed using Runge-Kutta method under the condition of healthy adults. As a result, the analyzed cerebral blood flow and blood storage amount converged within the physiological normal range. Thus, the constructed model can reasonably represent the cerebral blood flow and the cerebral blood volume of normal adults as least. The next step is the construction of a whole physiological condition model, by integrating this model and the already constructed each model of fluid migration, heat transfer, and metabolism in cerebral tissue.

**Keywords:** brain resuscitation; automatic control system; cerebral blood flow; electrical circuit model; physiological condition model