Abstract Submitted
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Nonlinear Dynamic Theory of Acute Cell Injuries and Brain Ischemia[1] DOAA TAHA, Department of Physics and Astronomy, Wayne State University, FIKA ANGGRAINI, DONALD DEGRACIA, Department of Physiology, School of Medicine, Wayne State University, ZHI-FENG HUANG, Department of Physics and Astronomy, Wayne State University — Cerebral ischemia in the form of stroke and cardiac arrest brain damage affect over 1 million people per year in the USA alone. In spite of close to 200 clinical trials and decades of research, there are no treatments to stop post-ischemic neuron death. We have argued that a major weakness of current brain ischemia research is lack of a deductive theoretical framework of acute cell injury to guide empirical studies. A previously published autonomous model based on the concept of nonlinear dynamic network was shown to capture important facets of cell injury, linking the concept of therapeutic to bistable dynamics. Here we present an improved, non-autonomous formulation of the nonlinear dynamic model of cell injury that allows multiple acute injuries over time, thereby allowing simulations of both therapeutic treatment and preconditioning. Our results are connected to the experimental data of gene expression and proteomics of neuron cells. Importantly, this new model may be construed as a novel approach to pharmacodynamics of acute cell injury. The model makes explicit that any pro-survival therapy is always a form of sub-lethal injury. This insight is expected to widely influence treatment of acute injury conditions that have defied successful treatment to date.

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