Neuroprotection in Stroke

Poljaković, Zdravka

Journal of Integrative Neuroscience

J. Integr. Neurosci. **2022**; 21(5): 137
https://doi.org/10.31083/j.jin2105137

Editorial

Neuroprotection in Stroke

Zdravka Poljakovic[1,*]

[1]Medical School in Zagreb, Departement of Neurology, University Hospital Zagreb, 10000 Zagreb, Croatia
*Correspondence: zdravka.po@gmail.com (Zdravka Poljakovic)

Academic Editor: Rafael Franco
Submitted: 20 June 2022 Revised: 26 June 2022 Accepted: 30 June 2022 Published: 26 July 2022

The high medical and socio-economic importance of stroke is a well-known fact. As stroke is still second cause of death and disability in the world, in spite of the clear improvement of treatment modalities, additional treatment strategies for this condition remain challenging [1]. Neuroprotection as an add-on therapy in stroke is a promising idea, and the number of studies investigating possible neuroprotective agents or methods is rising [2]. Due to variety of the neuronal death mechanisms following the disruption of the blood supply, the possible therapeutic approaches should vary as well. Most important mechanisms of brain tissue damage are neuronal excitotoxicity, peri-infarct depolarizations, local and distant inflammation, cellular apoptosis, and oxidative stress [2–5]. Furthermore, it is proven that free radical oxygen species (ROS) as well as calcium play an important role in increasing the inflammatory response by raising the levels of inflammatory cytokines and endothelial cell-adhesion molecules [2,3,6,7]. Development of cerebral edema, a reaction to brain tissue damage, should not be forgotten as an additional factor influencing the final extension of neuronal cell loss as well [8].

Recanalization strategies opened a new era in stroke treatment. However, as a well-known fact in clinical settings, even complete recanalization in due time does not guarantee reperfusion. Futile recanalization is a disappointing clinical condition leading to extensive brain tissue damage despite opened blood vessels. Furthermore, a complication known as reperfusion injury clearly affects the outcome in some patients [9]. Neuroprotection might be a possible treatment modality that can influence the damage to distant brain tissue in stroke. As certain types of reperfusion injury include neuroinflammation and brain edema, agents that can affect those mechanism could be of clinical benefit as well. Combining recanalization techniques with neuroprotection remains an attractive idea. Over 1000 neuroprotective agents and methods have been tested in preclinical studies, showing promising results [2,10]. Unfortunately, more than 200 studies involving clinical trials did not provide the same results so far, and only a few have showed some clinical success [2,4,10].

Despite this, neuroprotective agents and non-pharmacological neuroprotective strategies (like hypothermia or transcranial direct-current stimulation) should be encouraged as a comprehensive approach to stroke treatment. Ongoing and future research focusing especially on the "add-on" approach of neuroprotection after recanalization treatment modalities may add some new insights and prove the efficacy of neuroprotection in stroke. The goals of neuroprotective agents in current studies are to reduce infarct volume and to reduce the rate of haemorrhagic transformation in ishemic stroke. An interesting approach is also to affect stroke risk, like the changing of plaque characteristics in carotid artery disease. Improving the functional outcome in stroke survivors using add-on therapy with preclinicaly proven neuroprotective potential is a final goal of all ongoing trials. In order to support this approach, the aim of this special issue of the Journal of Integrative Neuroscience is to reflect some of the newest results in the scientific field of neuroprotection in stroke.

Author Contributions

All work was conceived and completed by ZP.

Ethics Approval and Consent to Participate

Not applicable.

Acknowledgment

Not applicable.

Funding

This research received no external funding.

Conflict of Interest

The author declares no conflict of interest.

References

[1] Saini V, Guada L, Yavagal DR. Global Epidemiology of Stroke and Access to Acute Ischemic Stroke Interventions. Neurology. 2021; 97: S6–S16.

[2] Ghozy S, Reda A, Varney J, Elhawary AS, Shah J, Murry K, *et al*. Neuroprotection in Acute Ischemic Stroke: A Battle Against the Biology of Nature. Frontiers in Neurology. 2022; 13: 870141.

[3] Dirnagl U, Iadecola C, Moskowitz MA. Pathobiology of ischaemic stroke: an integrated view. Trends in Neurosciences. 1999; 22: 391–397.

[4] Ginsberg MD. Neuroprotection for ischemic stroke: Past, present and future. Neuropharmacology. 2008; 55: 363–389.

[5] Benveniste H, Drejer J, Schousboe A, Diemer NH. Elevation of the Extracellular Concentrations of Glutamate and Aspartate in Rat Hippocampus during Transient Cerebral Ischemia Monitored by Intracerebral Microdialysis. Journal of Neurochemistry. 1984; 43: 1369–1374.

[6] Willmot M, Gray L, Gibson C, Murphy S, Bath PMW. A systematic review of nitric oxide donors and l-arginine in experimental stroke; effects on infarct size and cerebral blood flow. Nitric Oxide. 2005; 12: 141–149.

[7] Ishida K, Berger M, Nadler J, Warner DS. Anesthetic neuroprotection: antecedents and an appraisal of preclinical and clinical data quality. Current Pharmaceutical Design. 2014; 20: 5751–5765.

[8] Stokum JA, Gerzanich V, Simard JM. Molecular pathophysiology of cerebral edema. Journal of Cerebral Blood Flow & Metabolism. 2016; 36: 513–538.

[9] Vos EM, Geraedts VJ, van der Lugt A, Dippel DWJ, Wermer MJH, Hofmeijer J, *et al*. Combining Neuroprotection with Reperfusion in Acute Ischemic Stroke. Frontiers in Neurology. 2022; 13: 840892.

[10] O'Collins VE, Macleod MR, Donnan GA, Horky LL, van der Worp BH, Howells DW. Experimental treatments in acute stroke. Annals of Neurology. 2006; 59: 467–477.