Ierssel S., Conraads V., Craenenbroeck E., Liu Y., Maas A., Parizel P., Hoymans V., Vrints C., Jorens P. 2015. Endotheliai dysfunction in acute brain injury and the development of cerebral ischemia. J Neurosci. Res. V. 93. P. 866.

Kalogeris T., Baines C., Krenz M., Korthuis R. 2016. Ischemia/Reperfusion. 2017. Compr. Physiol. V. 7. P. 113.

Liu K., Guo L., Zhou Z., Pan M., Yan C. 2019. Mesenchymal stem cells transfer mitochondria into cerebral microvasculature and promote recovery from ischemic stroke. Microvasc. Res. V. 123. P. 74.

Mahmood A., Lu D., Chopp M. 2004. Intravenous administration of marrow stromal cells (MSCs) increases the expression of growth factors in rat brain after traumatic brain injury. J. Neurotrauma. V. 21. P. 33.

Newman R., Yoo D., LeRoux M. 2009. Treatment of inflammatory diseases with mesenchymal stem cells. Inflammation and Allergy. V. 8. P. 110.

Penfornis P., Pochampally R. 2011. Isolation and expansion of mesenchymal stem cells/multipotential stromal cells from human bone marrow. Methods Mol. Biol. V. 698. P. 11.

Pu C., Liu C., Liang C., YenY.-H., Chen S.-H., Jiang-Shieh Y.-F., Chien C.-L., Chen Y.-C., Chen Y.-L. 2016. Adipose-derived stem cells protect skin flaps against ischemia/reperfusion injury via IL-6 expression. J. Investig. Dermatol. V. 137. P. 1353.

Correction of Post-Ischemic Microcirculation Disturbances in the Rat Brain Cortex by Application of Mesenchymal Stem Cells

I. B. Sokolova[a], *, O. P. Gorshkova[a], and N. N. Pavlichenko[b]

[a] *Pavlov Institute of Physiology, Russian Academy of Sciences, St. Petersburg, 199034 Russia*

[b] *Trans-Technologies, Ltd, St. Petersburg, 192148 Russia*

**e-mail: SokolovaIB@infran.ru*

The aim of the work was to examine the effect of intravenous transplantation of human mesenchymal stem cells (hMSC) carried out on the day of ischemia/reperfusion on the density of the microvascular network, reactivity of arterial vessels, and tissue perfusion in the cerebral cortex of rats on 7, 14 and 21 day after ischemia. Using an apparatus for studying microcirculation, the density of the entire microvascular network and the density of arterial vessels in the pial membrane of the sensorimotor cortex of the brain of rats after ischemia/reperfusion (I/R) and intravenous transplantation of hMSCs. The same device was used to study the reactivity of the pial arteries after axposure to the acetylcholine (ACh). In parallel, the perfusion (P) in the sensorimotor cortex was measured with a LAKK-M laser doppler. The most significant decrease in the density of the entire microvascular network and the density of arterial vessels compared to sham-operated rats were detected during the first 7 days after I/R; by an average of 1.6 and 1.4 times, respectively. Fourteen days after ischemia, these parameters were decreased by 1.4 and 1.2 times, and after 21 days – by 1.2 an 1.3 times, respectively. The reactivity of the pial arteries to ACh in animals after I/R significantly reduced. Seven days after I/R, the number of dilated arteries decreased by 1.4–1.7 times, 14 days after ischemia – by 1.6–1.9 times and after 21 days – by 1.2–1.7 times. The perfusion (P) decreased by an average of 1.6 times 21 days after ischemia. Intravenous administration of hMSC restored the density of the pial membrane microvascular network (at the level of control animals) in rats after ischemia. Reactivity of the arteries in the cell therapy group also did not differ from the control values. Twenty-one day after I/R P level was 1.2 times lower than in sham-operated group but statistically significantly higher than in rats after I/R that did not receive cell therapy. Conclusion: intravenous hMSCs transplantation prevented degradation of the microvascular bed in the cerebral cortex of rats after I/R and preserved the reactivity of pial arteries at the level of control animals.

Keywords: ischemia/reperfusion, brain, intravenous transplantation, mesenchymal stem cells, microvascular density, reactivity, perfusion