Functional state of the brain endothelium and energy metabolism in rats with dementia of the Alzheimer’s type induced by different ways

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Introduction. The role of brain endothelial dysfunction and energy metabolism in development of dementia of the Alzheimer’s type induced by completely different triggers is poorly known. Effect of stem cells on conditions of scopolamine and sodium nitrite - induced dementia models was not investigated.

Aim of study. To determine the role of state of brain vascular endothelial and energy metabolism in rats with experimental models of dementia of the Alzheimer’s type induced by scopolamine and sodium nitrite before and after stem cell correction.

Material and methods. The experiment was performed on 72 male WAG rats weighing 180-250 g, which were divided into 9 groups. 1-4 groups were injected intraperitoneally by an aqueous solution of sodium nitrite (50 mg/kg of body mass) during 14 (groups 1-2) and 28 days (3-4). Groups 5-6, 7-8 were injected intraperitoneally by scopolamine (1 mg/kg of body mass) during the same periods. Groups 2, 4, 6, 8 were received intravenously mesenchymal stem cells transformed by GFP at a dose of 500000 cells per rat. Group 9 was control. Endothelin-1 (ET-1), endothelial Nitric Oxide Synthase (eNOS) were determined in a blood serum by the immuno-enzymatic method. Spectrophotometric analysis was used for determination of ATP concentration in brain homogenate. Cardiolipin was identified in mitochondria of brain cells by thin layer chromatography.

Results. Animals of 1–8 groups showed increasing of the ET-1/eNOS ratio 2 times at group 1 and 4 times at groups 3, 7. The endothelial dysfunction with a predominance of vasoconstriction was observed in groups 3, 7. After stem cells correction all indicators of endothelial function of rats from groups 4, 8 almost reached the control level. The level of cardiolipin of group 3 is 2.4 times lower compared to control group and 1.2 times lower than at the group 7. The brain cell energy metabolism after stem cells correction was more recovered at groups 4, 8.

Conclusion. The vessel injury plays important role in damage of nervous tissue for various triggers of dementia of the Alzheimer’s type development. More effective regeneration of vascular function and energy metabolism of brain after stem cells correction was observed in groups after 28 days injections.

Key words: dementia of the Alzheimer’s type, scopolamine, sodium nitrite.