Nitrite-Induced Changes Of Endothelium Functional State And Cognitive Brain Functions In Rats

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Introduction

It is common knowledge that the cerebrovascular insufficiency and hypoxia result in the encephalopathy. Several studies have explored that the intraperitoneal injections of aqueous solution of sodium nitrite to pregnant female rats from the 10th to the 19th day of pregnancy caused hemic hypoxia and disturbance of the cognitive function of the brain in the offspring of rats (Sosedova L., Vokina V., 2012). However, the possibility of the encephalopathy developing of male rats with a background of chronic administration of aqueous solution of sodium nitrite has been poorly investigated.

Aim of the study

The study was designed to determine the nitrite-induced changes of the endothelium functional state and cognitive functions of the brain in adult rats.

Methods

The experiment was performed on 24 male WAG rats aged 5-6 months weighing 180-230 g, which were divided into 4 groups (6 rats in each group). Groups 1 and 2 received 0.1% and 0.2% aqueous solution of sodium nitrite respectively instead of drinking water (in free access) for 6 weeks. Rats of group 3 were injected 50 mg / kg of body mass the aqueous solution of sodium nitrite intraperitoneally during 2 weeks. Group 4 was control. The endothelial growth factor (VEGF-A, pg / ml) was determined by the immuno-enzymatic method, the von Willebrand factor (vWF, %) was identified by photometric method, the 2, 3 diphosphoglycerate (2, 3-DFG, μmol / ml) was measured by spectrophotometric method. Cognitive functions were evaluated using passive avoidance test and extrapolational disposal test.

Results

The level of VEGF-A was found increased in rats of the group 1 by 1.8 times (52.5 ± 0.5), group 2 - by 4,4 times (131,3 ± 1,8), group 3 – by 21 times (622,1 ± 6,6) compared to control group (29,7 ± 0,7). Quantitative analysis of von Willebrand factor and 2, 3 diphosphoglycerate showed the highest levels in the third group, which indicated a significant endothelial damage and led to rising of oxygen transfer to tissues. Rats of the group 3 did not pass extrapolational disposal test and the conditional reflex was not formed in passive avoidance test. It proved that the cognitive functions of brains in the group 3 were noticeably reduced. In contrast, the control group rats completed both tests successfully. There were no significant changes in rats of first and second groups.

Conclusions

The data demonstrates that the long-term administration of aqueous solution of sodium nitrite leads to development of endothelial dysfunction and cognitive impairment of the brain in rats.