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cFos Protein Synthesis in Medulla Oblongata after Intraperitoneal Injection of Staphylococcus Enterotoxin B (SEB) on the Background of Selective Subdiaphragmatic Vagotomy

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ABSTRACT

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Introduction

The vagus nerve carries out parasympathetic innervation of the pulmonal and peritoneal organs. Sensory information from these organs reaches the brain through vagus nerve. Vagus sensory neurons express a wide range of receptors, including receptors for neuromodulators, cytokines, and growth factors [1,2]. In this regard, vagus nerve is a key pathway of information transmission from the immune system of the peritoneal and pleural cavities to the CNS [3]. The aim of this work was to determine the degree of activation of the cells in vagus nuclei NTX and DMX after administration of staphylococcus enterotoxin B (SEB) with and without selective subdiaphragmatic vagotomy (SSV).

Material and Methods

The work was performed on 20 Wistar males (200-250 g), divided into the following experimental groups: SSV with the saline administration (control), SSV with the SEB administration; sham-operated animals with the SEB administration. SSV was produced by ligating the right branch of the vagus nerve below the diaphragm. SEB was administered intraperitoneally on the fifth day after SSV at a dose of 500 μg/kg. Sham-operated animals and animals with SSV were divided into two subgroups, which were withdrawn from the experiment 2 and 4 hours respectively after the SEB administration. Removal from the experiment was carried out by transcardial perfusion and subsequent fixation of the brain. The medulla oblongata was isolated, cryostat sections were prepared, and immunohistochemical analysis was performed to identify cFos-positive neurons [4]. Differences between the number of cFos-positive neurons in different groups were determined using the Mann-Whitney U test.

Results

The number of cFos-positive neurons in the nuclei of the medulla oblongata in animals after SSV followed by the SEB administration and removal from the experiment after 2 and 4 hours, as well as in sham-operated animals in the corresponding groups, was 3-4 times higher than in the control. There were no significant differences in the number of cFos-positive neurons between animals with and without SSV after SEB administration. The number of cFos-positive neurons in the NTS and DMX vagus nuclei at 2 and 4 hours after SEB administration did not differ.

Conclusion

Thus, intraperitoneal SEB administration causes activation of the NTS and DMX nuclei in the medulla oblongata, which is leads to a 3-4 times increase in the number of cFos-positive neurons both 2 and 4 hours after antigen administration. The absence of differences between the activation of the NTS and DMX nuclei in animals with

SSV and sham-operated animals can probably be explained by the uneven distribution of parasympathetic, sensory, and motor fibers between the anterior and posterior trunks of the vagus nerve, as a result of which the signal of antigen entry into the peritoneal cavity reaches the studied brain structures through fibers, the vagotomy of which has not been performed.

An analysis of the complex data concerning the issue of information exchange pathways between the immune and nervous systems made it possible to propose a hypothesis about the fundamental mechanisms of information transmission along the nervous pathways [3]. The meaning of the hypothesis is that antigen action leads to producing a complex of cytokines by the cells of the immune system. The receptors for cytokines are present at the endings of nerve fibers and peripheral neurons, in particular, parasympathetic. Perceiving the action of cytokines, peripheral neurons change electrical activity and the corresponding information by the nerve fibers reaches the brain. Confirmation of this hypothesis requires additional research, which is currently being carried out.

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