Neuroprotective role of galantamine with/without physical exercise in experimental autoimmune encephalomyelitis in rats

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Abstract

Aims: The fact that physical activity besides central cholinergic enhancement contributes in improving neuronal function and spastic plasticity, recommends the use of the anticholinesterase and cholinergic drug galantamine with/without exercise in the management of the experimental autoimmune encephalomyelitis (EAE) model of multiple sclerosis (MS).
Materials and methods: Sedentary and 14 days exercised male Sprague Dawley rats were subjected to EAE. Hereafter, exercised rats continued on rotarod for 30 min for 17 consecutive days. At the onset of symptoms (day 13), EAE sedentary/exercised groups were subdivided into untreated and post-treated with galantamine. The disease progression was assessed by EAE score, motor performance, and biochemically using cerebrospinal fluid (CSF). Cerebellum and brain stem samples were used for histopathology and immunohistochemistry analysis.
Key findings: Galantamine decreased EAE score of sedentary/exercised rats and enhanced their motor performance. Galantamine with/without exercise inhibited CSF levels of tumor necrosis factor (TNF)-Ŭ, interleukin (IL)-6), and Bcl-2-associated X protein (Bax), besides caspase-3 and forkhead box P3 (Foxp3) expression in the brain stem. Contrariwise, it has elevated CSF levels of brain derived neurotrophic factor (BDNF) and B-cell lymphoma (Bcl-2) and enhanced remyelination of cerebral neurons. Noteworthy, exercise boosted the drug effect on Bcl-2 and Bax.
Significance: The neuroprotective effect of galantamine against EAE was associated with anti-inflammatory and anti-apoptotic potentials, along with increasing BDNF and remyelination. It also normalized regulatory T-cells levels in the brain stem. The impact of the add-on of exercise was markedly manifested in reducing neuronal apoptosis.

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