Role of the Motor Cortex Stimulation on Neurotransmitter Concentration in the Periaqueductal Gray Area (PAG)

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Introduction

Subthreshold stimulation of the motor cortex is a relative new technique that has been used for the treatment of patients with chronic neuropathic pain syndromes that are resistant to conventional pharmacological treatment. The motor cortex may be the most rostral structure in the neuroaxis responsible for pain modulation, and recent results obtained by our group demonstrated that motor cortex stimulation (MCS) increase the neuronal activation of periaqueductal gray (PAG) in animals models of peripheral neuropathies. The PAG is one of the main subcortical centers of the descending pain suppressor system, and receives inputs from several brain areas.

Methods

Experiments were carried out on Winstar male rats, subdivided into three surgical groups. In the first group, the right sciatic nerve was tied, producing a chronic constriction injury (CCI), the second group was the sham-operated animals; and the third group was the control non-operated animals (naïve). All the rats underwent implantation of unilateral transdural electrodes on the motor area corresponding to the right hind paw. The animals were evaluated for mechanical

Results

Animals subjected to chronic constriction injury of the sciatic nerve showed reversal of mechanical hyperalgesia after motor cortex stimulation. Motor cortex stimulation induced a significant increase in glycine levels during MCS (153 % increase) and after MCS (134%). The GABA concentration increases 145 % during transdural stimulation. Glutamate levels showed no change in PAG microdialysate after MCS.

Conclusions

Our results suggest that the neurotransmitters glycine and GABA, released in PAG during MCS, contribute to descending antinociceptive actions.

The results of this project will contribute for the elucidation of the mechanisms of the antinociceptive effect of MCS, a phenomenon that has not been fully understood currently.

Learning Objectives

This study investigate the effects of motor cortex stimulation on neurotransmitters release in the PAG in naive rats and in neuropathic pain models, in order to investigate the possible neurochemical mechanisms involved in this effect.

References