Influence of orexin-A on synaptic facilitations in CA1/CA3 fields of the hippocampus in the control and kainite model of epilepsy

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According to the World Health Organization's (WHO) report for 2017 year, approximately 50 million people worldwide have epilepsy, making it one of the most common neurological diseases globally. Epileptic seizures result from abnormal synchronous firing of neuronal population [1]. Nowadays, kainic acid - an excitatory neurotoxin - is widely used for KA-induced seizure model of epilepsy (KA-SE) [2]. The CA3 region of the hippocampus has been suggested to be crucial for kainic acid-induced seizure, because of its strong expression of kainate glutamate receptors [3]. Although the hippocampus has the lowest threshold of seizure initiation within a brain.

Orexinergic neurons, the expression of which is marked in the lateral hypothalamus, gives extensive projections throughout the brain and play an important role in both physiological and pathophysiological processes in the brain. The role of orexinergic system in the regulation of synaptic plasticity in the hippocampus is well documented [4,5], but there is controversy regarding the involvement of this system in pathophysiology of epilepsy [6,7].

The aim of the present work was to investigate the effects of intraventricular administration of orexins on the baseline neuronal activity and paired pulse facilitations in CA1/CA3 fields, induced by intrahippocampal electric stimulation in the control and KA-SE groups of laboratory rats.

Our results demonstrate that the amplitude of single evoked responses was increased in CA1 and decreased in CA3 after OX-A injection. OX-B was ineffective, indicating involvement of OX1 receptors in the effects of OX-A. OX-A induces potentiation of paired pulse facilitation in CA1. The effects of Orexin were different in control and kainite model of epilepsy. Paired pulse facilitation test demonstrates that changes caused by kainic acid have postsynaptic localization. We suggest that different character of influence of OX-A in normal condition and pathophysiology of epilepsy depends on changes in neurotransmitter systems' activity caused by epilepsy itself.

Reference:

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