Effects of Trpv1 on the Hippocampal Synaptic Plasticity in the Epileptic Rat Brain

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ABSTRACT Temporal lobe epilepsy is often presented by medically intractable recurrent seizures due to dysfunction of temporal lobe structures, mostly the temporomesial structures. The role of transient receptor potential vaniloid 1 (TRPV1) activity on synaptic plasticity of the epileptic brain tissues was investigated. We studied hippocampal TRPV1 protein content and distribution in the hippocampus of epileptic rats. Furthermore, the effects of pharmacologic modulation of TRPV1 receptors on field excitatory postsynaptic potentials have been analyzed after induction of long term potentiation (LTP) in the hippocampal CA1 and CA3 areas after 1 day (acute phase) and 3 months (chronic phase) of pilocarpine-induced status epilepticus. A higher expression of TRPV1 protein in the hippocampus as well as a higher distribution of this channel in CA1 and CA3 areas in both acute and chronic phases of pilocarpine-induced SE was observed. Activation of TRPV1 using capsaicin (1 μM) enhanced LTP induction in CA1 region in non-epileptic rats. Inhibition of TRPV1 by capsazepine (10 μM) did not affect LTP induction in non-epileptic rats. In acute phase of SE, activation of TRPV1 enhanced LTP in both CA1 and CA3 areas but TRPV1 inhibition did not affect LTP. In chronic phase of SE, application of TRPV1 antagonist enhanced LTP induction in CA1 and CA3 regions but TRPV1 activation had no effect on LTP. These findings indicate that a higher expression of TRPV1 in epileptic conditions is accompanied by a functional impact on the synaptic plasticity in the hippocampus. This suggests TRPV1 as a potential target in treatment of seizure attacks. Synapse 00:000–000, 2015. © 2015 Wiley Periodicals, Inc.

INTRODUCTION Temporal lobe epilepsy (TLE) is a frequent neurological condition that shows despite multimodal treatment very often intractability (Jette and Wiebe, 2013; Kwan et al., 2011). Imbalance in excitatory-inhibitory tone of the hippocampal synapses, especially in CA1 and CA3 regions, leads to over-excitation and hypersynchronization of neuronal network (Morelli et al., 2014; Müller et al., 2013; Zhang et al., 2010). These synaptic changes disrupt network homeostasis, resulting in memory impairments and making neuronal networks susceptible to show epileptiform activities (Ameri et al., 1999; Lopantsev et al., 2009; Supcun et al., 2012). Most studies have been pointed to the role of selective ion channels in TLE (Lerche et al., 2013), and the potential role of non-selective ion channels needs to be more investigated.

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