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The effect of intraperitoneal administration of vitamin K2 on thermal and chemical pain following global cerebral ischemia in male Wistar rats

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Background and Aim : According to the world health organization (WHO), Stroke is the second leading cause of death globally. Stroke is the lack of sufficient blood flow to the brain tissue. Reduction of oxygen in the brain tissue, leads to impairment in mitochondrial function and production of free radicals. Adverse effects of elevated oxidative stress is a decrease in glutamate absorption that may cause increases in pain perception. Vitamin K2 is a fat-soluble vitamin, easily crosses the blood brain barrier, and increases the activity of glutamate carriers on astrocytes and clearance of glutamate. This assumption amplifies that administration of vitamin K2 following ischemia has negative effect on feeling of pain. The purpose of this research was to investigate the truth of this assumption.

Methods : Male rats weighing 200-280g, were randomly divided into 5 groups (n=5): control, sham surgery (without carotid arteries occlusion), ischemia (carotid arteries closure for 20 minutes), ischemia + solvent (DMSO %0.1) and ischemia + vitamin K2 (1mg/kg). Vitamin K2 was injected during reperfusion and one hour after reperfusion. This process was repeated for ischemia + solvent. Five days after reperfusion, thermal pain was measured by tail flick and chemical pain was evaluated by the Formalin test.

Results : Results showed threshold of thermal pain significantly decreased in ischemia compared to the control ($p<0.001$). Ischemia showed an increase in response to the pain in first phase of formalin test compared to the control ($p<0.05$). Vitamin K2 didn't show any significant effect in both tests.

Conclusion : Oxidative damages in the peripheral nerve cells causes increased activity of glial cells and neural fibers and lead to release of pro-inflammatory factors, such as cytokines and glutamate. Under ischemic condition, mitochondrial activities are disrupted then depolarize the cell and consequently leading to neurotransmitter release, such as glutamate. Accordingly, It's possible that ischemia increases the feeling of pain. The results of this study demonstrated this assumption however administration of vitamin K2 couldn't improve thermal pain in ischemia. As

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expected, in chemical pain test, ischemia causes hyperalgesia in first phase of formalin test, but it had no effect on the second phase. Maybe ischemia has effects on the pain process system from other pathways more than the increase of glutamate and this could provide a probable reason, that way acute administration of vitamin K2 couldn't be effective. To continue, the other doses and chronic methods of vitamin K2 administration is suggested.

Keywords : Ischemia; Vitamin K2; Pain test