Interaction between dopaminergic and opioidergic systems in dorsal hippocampus region in modulation of formalin-induced orofacial pain in rat

Amir Haghparast[1,2], Zahra Reisi[1], Pouyan Pahlevani[1,3], Ali Shamsizadeh[4], Abbas Haghparast[1]

[1]Neuroscience Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2]Faculty of Dentistry, International Branch of Shahid Beheshti University of Medical Sciences, Tehran, Iran
[3]Faculty of Medicine, Hamadan University of Medical Sciences, Hamadan, Iran
[4]Physiology-Pharmacology Research Center, Rafsanjan University of Medical Sciences, Rafsanjan, Iran

Introduction. Several studies have shown that dopaminergic system involves in pain modulation. On the other hand, hippocampus plays major role in various functions of brain including pain modulation. In addition, trigeminal nerve transmits sensory information such as pain from orofacial region to upper parts of brain like hippocampus. In the present study, we tried to examine interaction of opioidergic and dopaminergic systems in dorsal hippocampus (CA1) region on formalin-induced orofacial pain.

Materials and Methods. Two guide cannulae were stereotaxically implanted in CA1 region. After intra-hippocampal administration of naloxone (1 µg/0.5µl Saline) as an opioid receptor antagonist, SKF-38393 (1 µg/0.5µl Saline) or quinpirole (2 µg/0.5µl saline) as a D1 and D2 receptor agonist or vehicles were administered respectively. For induction of orofacial pain, 50 µl of 1% formalin was injected into the left side of the upper lip subcutaneously. The formalin-induced face rubbing was measured in two early (0-3 min) and late (18-33) phases.

Results. Results showed that SKF-38393 and quinpirole significantly reduced the formalin-induced orofacial pain in both phases. The antinociceptive effect of SKF-38393 was less than that of quinpirole in early phase. Naloxone (1 µg) significantly reduced the antinociceptive responses of mentioned agonists.

Conclusion. Our findings suggest that there is a cross-talk between dopaminergic and opioidergic systems in modulation of orofacial pain in the hippocampus. It seems that opioid system involves in dopamine-induced antinociception in this region.

Keywords: Orofacial Pain; Hippocampus; D1 Dopamine receptor; D2 Dopamine receptor; Opioid receptor; Rat

Changes in analgesia and hyperalgesia induced by intraperitoneal administration of morphine in the formalin test during intrathecal administration of Menaquinone-4 in rats

Fatemeh Hajipoor [1], Masoud Fereidoni [2], Ali Moghimi [3]

[1,2,3]Department of Biology, Faculty of Sciences, Ferdowsi University of Mashhad, Mashhad, Iran

Introduction. Various studies suggest Menaquinone-4 in inhibiting the pain and inflammation. Vitamin K2 inhibits the release of bradykinin and NMDA receptors activity in the spinal cord can be considered for its probable analgesic effect. Systemic administration of opioids such as morphine causes pain relief by inhibitory effects on neurotransmitter systems, nitric oxide (NO) and NMDA receptors. Interference between intrathecal administration (i.t) of Menaquinone-4 and systemic morphine induced analgesia/hyperalgesia in formalin test were investigated in this study.

Materials and methods. The adult male Wistar rats (250-300 g) were used. Rats were then subjected to i.t. surgery. Groups include: control, sham (salin+DMSO, i.t) and treatments consists of vitamin K2 (2µg/10µl, i.t), initially hyperalgesia and analgesia doses of morphine were intraperitoneal injected, after 25 minute intrathecal administration of vitamin K2 was performed, a subplantar 0.05 ml injection of formalin %2.5 in the right hind paw was take placed 5 minute later, then animal responses to pain was recorded for 60 minutes.

Results. Intrathecal administration of vitamin K2 (2µg/10µl) significantly increased morphine induced analgesia ($P<0.001$) and reduced morphine induced hyperalgesia, So that even in the latest case hyperalgesia was converted to a reduction in pain responses ($P<0.001$).

Conclusion. Vitamin K2 potentiated the analgesic effect of morphine may be because of its indirect inhibitory effect on the activity of NMDA receptors and another direct effects which still is not so clear; also inhibitory function of vitamin K2 on the activity of iNOS and thus NO production has to be concidered. So perhaps vitamin K2 and morphine produce a synergistic analgesic effect via some common pathways.

Keywords: Menaquinone-4; Chemical pain; Intrathecal injection; Mmorphine; Formalin test