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BRAIN RESEARCH

Research Report

Dorsal horn antinociception mediated by the paraventricular hypothalamic nucleus and locus coeruleous: A comparative study

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ARTICLE INFO

Article history:
Accepted 22 April 2012
Available online 1 May 2012

Keywords:
Pain
Antinociception
Spinal cord
Noradrenaline
Oxytocin

ABSTRACT

The noradrenergic descending projection originating in the locus coeruleous (LC), as well as the oxytocinergic descending projection originating in the paraventricular hypothalamic nucleus (PVN), plays a pivotal role in nociception. The mechanisms used by these two systems to modulate synaptic nociceptive transmission in the dorsal horn have been well studied independently. However, little is known about interactions between them. Here, it is shown that both PVN and LC electric stimulation inhibit A-delta, C-fiber, and postdischarge nociceptive neuronal responses in the same dorsal horn wide dynamic range neurons. Moreover, simultaneous stimulation of both the PVN and LC produces synergic inhibitory effects. In addition, LC electrolytic lesion or intrathecal administration of the alpha-2-adrenoceptor antagonist yohimbine (YOH) blocks the inhibitory effect produced by PVN stimulation in A-delta and the postdischarge, without affecting the inhibition of C-fiber responses. The results suggest that the PVN could inhibit dorsal horn nociceptive responses directly or indirectly by modulating the LC descending noradrenergic system.

1. Introduction

Nociceptive information arriving at the dorsal horn could be modulated by multiple descending systems which exert a complex control on the signals transmitted to higher centers. The most studied descending systems that regulate the transmission of nociceptive information arise from the hypothalamus and a number of brainstem sites, including the periaqueductal gray (PAG), parabrachial nucleus, dorsal raphe, locus coeruleus (LC), the medullary reticular formation, and the paraventricular hypothalamic nucleus (PVN) (for review see Millan, 2002). The mechanisms by which all these systems modulate nociceptive information involve different neurotransmitters and neuromodulators. Although descending modulatory systems have been extensively studied, little is known about the functional interactions between them.

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Abbreviations: LC, locus coeruleus; PVN, paraventricular hypothalamic nucleus; PAG, periaqueductal gray; WDR, wide dynamic range; YOH, yohimbine

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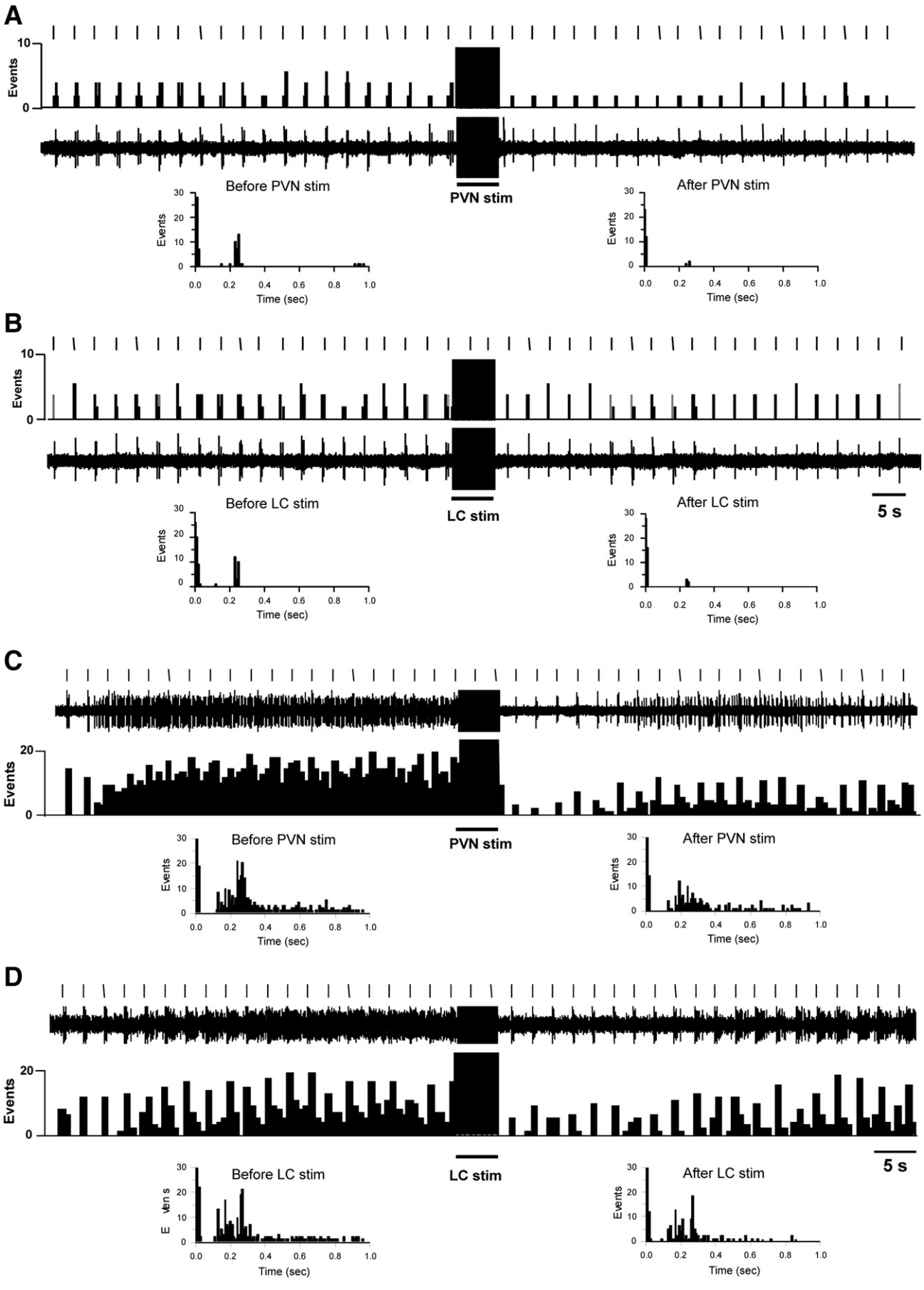
doi:10.1016/j.brainres.2012.04.042


A
Events
10
0
Before PVN stim
PVN stim
After PVN stim
Time (sec)
B
Before LC stim
LC stim
After LC stim
5 s
C
20
D