Differential involvement of anterior cingulate and primary sensorimotor cortices in sensory and affective functions of pain

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摘要

Abstract

The present study examined the role of neurons in different pain-related functions of the anterior cingulate cortex (ACC) and primary sensorimotor cortex (SmI) by assessing their abilities to code different levels of noxious heat and activity changes evoked by classical fear conditioning involving electric shocks. Multiple single-unit activity was recorded with microwires implanted in the SmI and ACC of each rat. In the first set of experiments, the middle segment of the tail in each rat was irradiated with laser-heat pulses of various intensities. Neuronal responses in both the SmI and ACC increased with the intensity of the laser heat, although there was a significantly higher percentage of intensity-related units in the SmI. Furthermore, the stimulus – response curve of SmI ensemble activity had a steeper slope than that of the ACC. In the second set of experiments, rats were trained and tested on a conditioned fear-potentiated startle task in which a light was paired with an electric shock and, later, the startle response was elicited by a burst of noise in the presence or absence of light. A higher percentage of ACC units changed their neuronal responses to the conditioned stimulus after the light – shock pairing and the average activity change was also significantly stronger. Our results suggest that SmI neurons are better at coding laser-heat intensity than ACC neurons, whereas more ACC neurons are involved in conditioned fear associated with an electric shock than SmI neurons. These data provide evidence for differential contributions of the SmI and ACC to sensory and affective dimensions of pain