THE INFLUENCE OF PERIPHERAL INPUTS ON THE PAIRED-PULSE FACILITATION IN THE ANTERIOR CINGULATE CORTEX FOLLOWING THE STIMULATION IN THE MEDIATE THALAMUS

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Background and purpose

Paired-pulse facilitation (PPF) is an example of frequency dependent short-term plasticity of synapses. It is an ideal preparation for investigating the synaptic change and its underlying mechanisms in vivo.

In our previous study, PPF was found in rat's anterior cingulate cortex (ACC) following the stimulation of the medial thalamus (MT). The present study examined the effects of different peripheral stimulation on the PPF in awake, freely moving and anesthetized rats.

Material and methods

Awakened animals and electrodes implantation

Stimulating and recording electrodes were implanted in the MT and ACC respectively while rats were anesthetized with pentobarbital (5.25mg/kg,100g). Monopolar tungsten electrodes were placed in the MT (AP: 2.5 mm, ML: 1.0 mm, depth 5 mm). Electrical paired-pulse stimuli (2.0mA, 300A, after-pulse interval, 100ms) were delivered to the MT. Field potentials were recorded in the ACC (AP: 2.5 mm, ML: 0.5 mm, depth: 1.5 mm). Three screws were mounted on the skull for fixation. One of the screws connected with a male plug was placed on the sines (AP 4.5 mm, ML 0.5 mm) as a reference. One Ag-AgCl ground electrode was placed on the muscle of the scalp. The tests were performed one week after the surgical operation.

Peripherial stimuli

Effects of different peripheral stimuli on PPF were measured in aneked, freely moving rats. These stimulatations were noise (85dBA), brushing, pinch, laser stimulation and formulin injection.

Fear conditioning test

PPF was tested with fear conditioning test. Rats were placed in a box with copper grid floors. Fear conditioning test (CS, tone sound, 85dBA, 600 Hz; 2s; US, an elect shock, DC, 2mA, 0.5s delay 1.5s) was performed 10 times in box A. 24 hours later, rat was placed in box B for 6.5h for habituation and PPF were recorded continuously. Then rat was transferred to box C and CS was delivered after 75s.

Effects of formalin and laser stimulation on the PPF.

![Image](image1)

Effects of halothane on the PPF.

![Image](image2)

Effects of scolic nerve stimuli on the PPF in anesthetized rats.

![Image](image3)

Discussion

Present results showed that PPF in the ACC was diminished during innocuous and noxious peripheral stimulus in awake and anesthetized condition. Thus it strongly indicated that the short term plasticity in the ACC could be modulated by somatic afferent inputs. It appeared that movement, arousal and stress may play an important role in this phenomena.

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