·Original Article·

Effects of electrical stimulation of dorsal raphe nucleus on neuronal response properties of barrel cortex layer IV neurons following long-term sensory deprivation

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Abstract: Objective To evaluate the effect of electrical stimulation of dorsal raphe nucleus (DRN) on response properties of layer IV barrel cortex neurons following long-term sensory deprivation. **Methods** Male Wistar rats were divided into sensory-deprived (SD) and control (unplucked) groups. In SD group, all vibrissae except the D2 vibrissa were plucked on postnatal day one, and kept plucked for a period of 60 d. After that, whisker regrowth was allowed for 8-10 d. The D2 principal whisker (PW) and the D1 adjacent whisker (AW) were either deflected singly or both deflected in a serial order that the AW was deflected 20 ms before PW deflection for assessing lateral inhibition, and neuronal responses were recorded from layer IV of the D2 barrel cortex. DRN was electrically stimulated at inter-stimulus intervals (ISIs) ranging from 0 to 800 ms before whisker deflection. **Results** PW-evoked responses increased in the SD group with DRN electrical stimulation at ISIs of 50 ms and 100 ms, whereas AW-evoked responses increased at ISI of 800 ms in both groups. Whisker plucking before DRN stimulation could enhance the responsiveness of barrel cortex neurons to PW deflection and decrease the responsiveness to AW deflection. DRN electrical stimulation significantly reduced this difference only in PW-evoked responses between groups. Besides, no DRN stimulation-related changes in response latency were observed following PW or AW deflection in either group. Moreover, condition test (CT) ratio increased in SD rats, while DRN stimulation did not affect the CT ratio in either group. There was no obvious change in 5-HT_{2A} receptor protein density in barrel cortex between SD and control groups. **Conclusion** These results suggest that DRN electrical stimulation can modulate information processing in the SD barrel cortex.

Keywords: sensory system; barrel cortex; 5-hydroxytryptamine receptors

1 Introduction

Whiskers, as sensory organs, are important for tactile exploration, equilibrium, orientation, spatial learning, *etc*.[1-3]. The representation of the whiskers in the rat somatosensory cortex is magnified relative to those of other body parts, since it forms histologically distinctive regions named "barrels"[4].

Experience-dependent plasticity, an important characteristic of cerebral cortex, is present not only during neonatal development, but throughout the whole life[5,6]. The plastic-

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