Afferent synaptic contacts on glycine-immunoreactive neurons in the rat cuneate nucleus

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摘要

Abstract

This study was aimed to clarify whether the primary afferent terminals (PATs), GABAergic terminals, and glutamatergic terminals made direct synaptic contacts with glycine-IR neurons in the cuneate nucleus of rats. In this connection, injection of the anterograde tracer WGA-HRP into brachial plexus, antiglycine preembedding immunoperoxidase, and anti-GABA, along with antiglutamate postembedding immunogold labeling, were used to identify the PATs, glycine-IR neurons, GABA-IR terminals, and glutamate-IR terminals, respectively. The present results showed that HRP-labeled PATs, immunoperoxidase-labeled glycine-IR terminals, immunogold-labeled GABA-IR, and glutamate-IR terminals made axodendritic synaptic contacts with immunoperoxidase-labeled glycine-IR neurons. The latter three presynaptic elements also formed axosomatic synapses with glycine-IR neurons. Statistical analysis has shown that the minimum diameter of the glycine-IR dendrites postsynaptic to the above-mentioned four presynaptic elements did not differ significantly. In addition, the synaptic ratio of the glutamate-IR terminals on the glycine-IR dendrites was higher than that of GABA-IR terminals. The synaptic ratio of the GABA-IR terminals on glycine-IR dendrite was in turn higher than that of the PATs and glycine-IR terminals. It is suggested that the PATs and glutamate-IR terminals on the glycine-IR neurons may be involved in subsequent postsynaptic inhibition for spatial precision of lateral inhibition. On the other hand, the GABA-IR and glycine-IR terminals which make synaptic contacts with the dendrites of glycine-IR neurons may provide a putative means for disinhibition or facilitation to maintain the baseline neuronal activity in the rat cuneate nucleus. The results of quantitative analysis suggest that glutamate act as the primary excitatory neurotransmitter, while GABA, when compared with glycine, may serve as a more powerful inhibitory neurotransmitter on glycine-IR neurons in the rat cuneate nucleus.