11 Action of β-alanine on the Substantia Gelatinosa Neurons of the Adult Rat Spinal Cord

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【Background】 β-alanine is a naturally occurring β-amino acid and acts as a depressant in the central nervous system. β-alanine pharmacologically activates the glycine and GABA receptors with less efficacy than their native ligands in the hippocampus. There is therefore the possibility that β-alanine acts as a neurotransmitter and/or neuromodulator. However, little is known of the action of β-alanine on the spinal cord neurons. To clarify whether β-alanine has effects in the dorsal horn and whether the GABAergic system or the glycinergic system is its major target, we investigated the action of β-alanine on the inhibitory synaptic responses in SG neurons of the rat spinal cord, where the glycinergic and GABAergic system has been reported to play a major inhibitory roles.

【Methods】 Thick (500-600 μm) spinal cord slices were prepared from adult rats (6-8 weeks). Blind whole-cell patch-clamp recordings were made from lamina Ⅱ (SG) neurons in voltage clamp mode. Membrane currents were amplified with an Axopatch 200B. Data were collected and analyzed using pClamp9.0. Paired *t*-test was used where appropriate. $P < 0.05$ was considered significant.

【Results】 In SG neuron held at 0 mV, application of β-alanine (0.3 mM) induced outward currents. Plots of the I-V relationship of the β-alanine-induced current revealed a reversal potential around −70 mV indicating an increase in chloride conductance. In order to evaluate the concentration-response relationship for β-alanine-induced current, β-alanine was applied at the concentration from 0.01 mM to 3 mM. We found that the increase in amplitude caused by β-alanine was concentration-dependent. In SG neuron held at 0 mV, application of β-alanine (0.3mM) induced outward currents and bath-application of bicuculline (20μM) did not significantly inhibit this currents while strychnine (2 μM) inhibited it significantly.

【Conclusions】 In summary, β-alanine increases the membrane chloride conductance in the SG neurons. The increase in amplitude caused by β-alanine was concentration-dependent. β-alanine selectively activates postsynaptic glycine receptors but not GABA receptors in the SG neuron.

12 Aδおよび C線維を介した痛覚伝達に対するオピオイド受容体の作用の違いについて

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オピオイドが脊髄に作用し，Aδと Cどちらの線維を介する痛みをより強く抑制するかについて調べるために，後根付き脊髄スライス標本の脊髄膠様質細胞からホールセルパッチクランプ法を用いて，後根を刺激することによる興奮性シナプス後電流（excitatory postsynaptic current; EPSC）を記録し，Aδと C線維を介する応答に対するオピオイドの抑制作用を比較した．

μオピオイド受容体アゴニストは Aδ，C線維誘起 EPSC の振幅をコントロールに比してそれぞれ 71±5%，48±6%に減少させた．μ受容体アゴニストによって Aδ線維よりも C線維を介する応答が有意に抑制された要因として μ受容体の分布密度の違いが考えられる．本研究の結果から，μ受容体アゴニストのシナプス前抑制作用は Aδ線維よりも C線維を介するもののほうが強いことが示された．