

EFFECTS OF CALCIUM AND MAGNESIUM ON PERIPHERAL NERVE CONDUCTION

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Divalent cations, such as calcium and magnesium, are constantly present in extracellular compartment of most organisms. Modification of extracellular concentrations of divalent ions causes changes in physiologic functions, such as excitability and conduction of the nerves. The present study was designed to investigate and compare the effects of calcium and magnesium on nerve conduction and lidocaine-induced nerve conduction block. The aim of our study was to contribute to better understanding of physiological and pharmacological roles of divalent cations.

Experiments were conducted on the sciatic nerves by using the sucrose-gap recording technique. We evaluated the effects of test solutions containing different calcium or magnesium concentrations, prepared with or without lidocaine, on compound action potentials to determine physiological and pharmacological roles of these cations. After the control recordings, the nerve was exposed to Ringer's solution containing 0, 1.9, 3.8 mM Ca²⁺ and 1.9 and 3.8 mM Mg²⁺ with or without 1 mM lidocaine. Decreasing the Ca²⁺ concentrations in Ringer's solution with or without lidocaine enhanced both tonic and phasic blocks. However, increased Mg²⁺ concentration did not change the tonic blocks but increased the phasic blocks.

In conclusion, the results suggested but not prove that Ca²⁺ and Mg²⁺ may have different mechanisms of action on peripheral nerves. While Ca²⁺ directly affects the gating of Na⁺ channels, action of Mg²⁺ can be explained by surface charge theory.

Key words: *divalent ions, calcium, magnesium, lidocaine, nerve conduction, frog sciatic nerve*

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