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Title : MAGNESIUM ION ENHANCES LIDOCAINE INDUCED NERVE BLOCK

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Introduction. Magnesium plays a pivotal role in many of the functions of the nervous system. For example, its inhibitory action at the neuromuscular junction has been well documented.[1] The importance of magnesium for peripheral nerve conduction and blockade with local anesthetics remains to be well defined. The work that has been previously reported in this area was performed on single nerve fibers, employing the voltage clamp model.[2] However, attention has been recently drawn to the importance of determining frequency dependent conduction block as a model more closely approximating the physiologic circumstance.[3]

The following study is designed to examine the influence of magnesium ion concentration upon nerve conduction of stimuli of varying frequency. The interaction of magnesium ion concentration and lidocaine induced conduction block is also examined. These data are compared to similar observations previously reported for calcium ions.[4]

Methods. The sciatic nerves of large northern rana pipens frogs were removed, desheathed, and placed in a sucrose gap chamber. The nerves were stimulated by trains of 20 impulses at 3, 10, 20, 50, and 90 Hz with 20 seconds between trains. Control samples were taken with the nerve immersed in frog Ringer's solution. Subsequently, a 10 mm portion of nerve between the stimulating and recording electrodes was treated with Ca^{++} free frog Ringer's solution containing magnesium concentrations of either 1 mM/l, 2 mM/l, 3 mM/l, 20 mM/l or 40 mM/l. In one half of the experiments the bathing solution also contained lidocaine 0.5 mM/l. Sampling was done by computer for the subsequent 25 minutes. The first and twentieth action potentials of the last train at 90 Hz were measured to determine the non-frequency and the frequency dependent block, respectively.

Results. In the absence of lidocaine, variations in magnesium ion concentration had little effect upon the conduction of the first (non-frequency dependent block) or the twentieth (frequency dependent block) stimulus of the last train at 90 Hz. The frequency dependent block produced by lidocaine was enhanced by alterations of magnesium ion concentration above and below the normal physiologic range (Fig. 1). Similarly, non-frequency dependent block resulting from lidocaine was enhanced by altered magnesium concentrations but the effect was less pronounced than in the case of frequency dependent block.

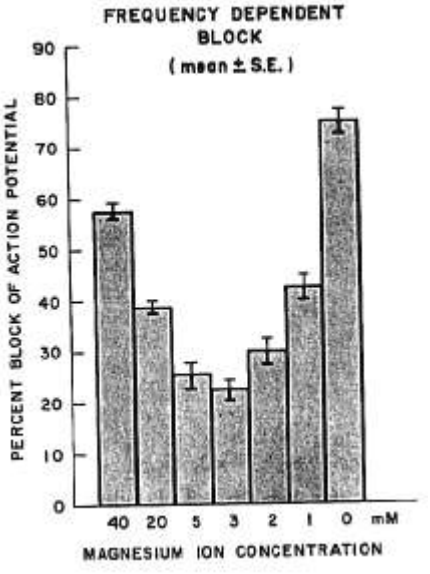

Fig. 1. Conduction block resulting from variations in Mg^{++} concentration in a solution of Ca^{++} free frog Ringer's and 0.5 mm lidocaine.

Discussion. Alteration of magnesium ion concentration to either side of the normal physiologic range produces an enhancement of lidocaine nerve block that qualitatively resembles that previously reported with calcium ion variations.[4] The greater sensitivity of higher frequency conduction to these ionic variations suggests a possible clinical role for cationic manipulation in producing differential nerve block.

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References.

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