Regulation of Intracellular Free Magnesium Concentration in Cardiac and Vascular Smooth Muscle Cells.

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Summary

We estimated cytoplasmic Mg^{2+} concentration in single ventricular myocytes of rats. The myocytes were enzymatically isolated and were loaded with the fluorescent indicator, furaptra, and the fluorescence signals of single quiescent myocytes were measured at 32°C. The excitation spectrum of furaptra measured in the myocytes was well-fitted by the spectra obtained *in vitro*; thus it was possible to calibrate the fluorescence signal in terms of cytoplasmic free Mg^{2+} concentration. The analysis implied that about 20% of the indicator molecules were Mg^{2+}-bound. If the *in vitro* value of the indicator dissociation constant for Mg^{2+} (2.6 mM) is assumed for the cytoplasm, free Mg^{2+} concentration in the cytoplasm is calculated to be 0.67 mM. Superfusion with a high extracellular Mg^{2+} concentration (20 mM) caused a slow and slight elevation in the cytoplasmic Mg^{2+} concentration over a period of a few hours. Other experimental interventions, including application of a low extracellular Na^{+} concentration and isoproterenol, and CO_2 acidosis, did not cause a detectable change in the cytoplasmic Mg^{2+} concentration, whereas the application of an uncoupler, a blocker of oxidative phosphorylation in mitochondria, caused a rapid and large increase in the cytoplasmic Mg^{2+} concentratin. It is suggested that the Mg^{2+} concentration in the cytoplasm is tightly maintained at around 1 mM, unless intracellular ATP is depleted.