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Increase of free Mg^{2+} in the skeletal muscle of chronic fatigue syndrome patients

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Abstract

In a previous study we evaluated muscle blood flow and muscle metabolism in patients diagnosed with chronic fatigue syndrome (CFS). To better understand muscle metabolism in CFS, we re-evaluated our data to calculate free Magnesium levels in skeletal muscle. Magnesium is an essential cofactor in a number of cell processes. A total of 20 CFS patients and 11 controls were evaluated. Phosphorus magnetic resonance spectroscopy from the medial gastrocnemius muscle was used to calculate free Mg^{2+} from the concentrations and chemical shifts of Pi, PCr, and beta ATP peaks. CFS patients had higher magnesium levels in their muscles relative to controls (0.47 + 0.07 vs 0.36 + 0.06 mM, $P < 0.01$), although there was no difference in the rate of phosphocreatine recovery in these subjects, as reported earlier. This finding was not associated with abnormal oxidative metabolism as measured by the rate of recovery of phosphocreatine after exercise. In summary, calculation of free Mg^{2+} levels from previous data showed CFS patients had higher resting free Mg^{2+} levels compared to sedentary controls.

Muscle Mg^{2+} in CFS

In a previous study we evaluated muscle blood flow and muscle metabolism in patients diagnosed with chronic fatigue syndrome (CFS) [1]. In this study as well as others [2-4], it has not been clear whether muscle metabolism is abnormal in CFS. To better understand muscle metabolism in CFS, we re-evaluated our data to calculate free Magnesium levels in skeletal muscle.

Magnesium is an essential cofactor in a number of cell processes. Magnesium ions influence the equilibria of many reactions involved in cellular bioenergetics interacting with phosphorylated molecules and interfering with the kinetics of ion transport across plasma membranes. Most ATP in cells is bound to Mg^{2+} since $MgATP^{2-}$ is the active species in enzyme binding and the energy producing form in active transport and muscular contraction [5]. Therefore, any alteration in free Mg^{2+} could have significant consequences in muscle metabolism. Evidence for changes in intracellular magnesium has been reported in a number of diseases [6-9] and a previous study showed a

Table 1: Resting metabolite values for control and CFS subjects. Values are means and SD.

		PCr (mM)	pH	Mg^{2+} (mM)
Controls	Mean	34.88	6.94	0.36
N = 11	SD	3.19	0.02	0.05
CFS	Mean	34.72	6.93	0.47
N = 20	SD	3.18	0.03	0.07