Subcellular distribution of thallium: Morphological and quantitative study in rat myocardium

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The purpose of this study is to determine the subcellular distribution of thallium (SDTl) by electron microscopy and a newly designed fixation method that makes insoluble grains of Ti visible. Methods: To obtain the high dose necessary for electron microscopic visualization, we employed TICl instead of 209TICl. EM was performed in fixed rat myocardium resected at 20 min (early phase) and 3 hr (delay phase) after intravenous injection of TICl. To fix Ti in the cell, we used orthovanadate in our fixative. Atomic absorption spectroscopy (AAS) of Ti and quantification of subcellular distribution of 205Ti (SD205Ti) were studied to prove the propriety of our fixation. Results: AAS detected Ti in the Ti-loaded specimen but not in the control, indicating that Ti was the origin of the grains observed in the former. In the early phase, numerous grains were observed in mitochondria, sarcoplasmic reticulum (SR), myofibrils, and nuclei, but no such grains were visible in controls. In the delay phase, grains were retained in mitochondria, SR and nuclei, but not in myofibrils. Electron microscopic SD2Tl (%) correlated with SD205Ti(%) calculated from isolated fractions. Conclusion: In both the early and delay phases, mitochondria are the major site of Ti and 205Tl uptake.

Key words: thallium, myocardial cell, mitochondria, atomic absorption spectroscopy, electron microscopy