

# A Time-based Study of Changes in T1 and T2 Components in Excised Rat Myocardium

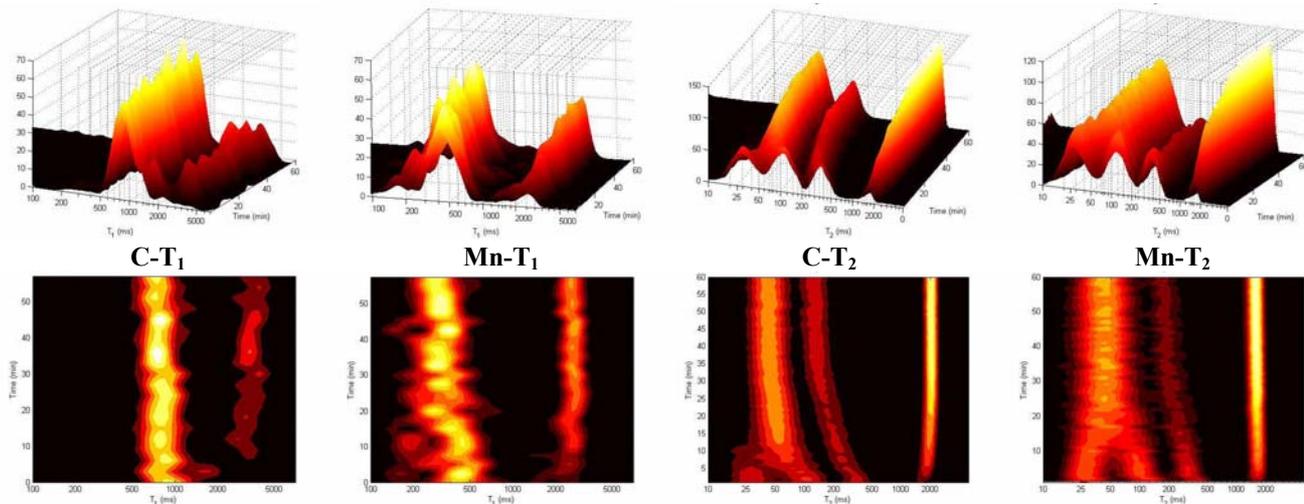
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**Introduction.** Myocardial water is affected by two different processes during ischemia: anoxic metabolism leading to a rapid rise in number of intracellular (ic) osmolal molecules<sup>1</sup>; and, ATP reduction elevating resting tension<sup>2</sup>. These processes, cell swelling and contracture, alter distribution of myocardial water between the ic and extracellular (ec) compartments since water accumulates ic during cell swelling but is redistributed to the ec water pool during subsequent contracture. This study aims to follow the progress of water redistribution by relaxographic measurements<sup>3</sup> of multiple T<sub>1</sub> and T<sub>2</sub> components in excised and globally ischemic rat myocardium.

**Material and Methods.** Wistar ♂ rat hearts were perfused in the Langendorff mode with Krebs buffer. 8 control (C) hearts were perfused with buffer only and 8 hearts were perfused with 25μM MnCl<sub>2</sub> (Mn) for 5 min followed by 15 min wash-out. Ventricular myocardium was excised and relaxography (Maran Ultra, Resonance Instruments Ltd, 23MHz, 37°C) was undertaken in 4 hearts from each group using Saturation Recovery (T<sub>1</sub>) every 2.5 min or Carr-Purcell-Meiboom-Gill (T<sub>2</sub>) every minute during the first 60 min after excision. The data were analysed using an Inverse Laplace Transformation (ILT) revealing the distribution of relaxation components present in the myocardium as relaxograms<sup>3</sup>.

## Results.



The figures above visualize the obtained relaxograms as a function of time after excision from the series of data for group C-T<sub>1</sub>, Mn-T<sub>1</sub>, C-T<sub>2</sub> and Mn-T<sub>2</sub>. The upper panel shows surface plots visualizing the change in intensities of each component while the lower panel shows contour plots showing the ischemic influences on the peak position. 20-25% of the total water leaks out from the myocardium during 60 min, forming an extra-tissue component in the system, corresponding to the longest component in each relaxogram. In addition to the extra-tissue peak, T<sub>1</sub>-relaxograms show one main tissue component which is broadened and significantly shortened (approx 50%) by Mn enhancement. T<sub>2</sub>-relaxograms show three tissue components at short times. The two shortest ones merge within 10 min. None of the T<sub>2</sub> components show any significant effect from Mn enhancement.

**Conclusions.** Changes in T<sub>2</sub> relaxograms during ischemia of rat ventricular myocardium seemed to correlate with different phases of complex ischemic processes. Up to 10 min, the two shortest T<sub>2</sub> components could originate from two different sub-cellular and later merging compartments. The extra-tissue component grows steadily during 20 min at the expense of the longest tissue component, which likely originates from ec water. The use of T<sub>2</sub>-relaxography is promising in describing the status of ischemic progress and other processes altering the water distribution and water exchange in biological tissue. In addition, tissue-T<sub>1</sub>, which is strongly influenced by the presence of ic Mn could be used in combination with T<sub>2</sub>-relaxography to obtain information about equilibrium water exchange between ic and ec compartments during ischemic progress.

## References:

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