

POSTER PRESENTATION

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Time-dependency of edema-based assessment of area-at-risk in reperfused acute myocardial infarction

Veronica LM Rundell^{1*}, Xiangzhi Zhou¹, Avinash Kali¹, Ying Liu¹, Richard Tang¹, Rachel A Klein¹, Andreas Kumar², Rohan Dharmakumar¹

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Introduction

Relative edema volume, computed from T₂-based CMR images, has been used to define the Area-At-Risk in myocardial infarction and in the determination of salvagable myocardium in patients. Following infarction, edema presents as hyperintense regions in T₂-weighted CMR, however, the literature reports disparate data resulting from delayed imaging and type of MR acquisition.

Purpose

To investigate the time course and extent of myocardial edema in reperfused myocardial infarction on the basis of T₂ maps and T₂-weighted STIR imaging.

Methods

Cardiac MR was used to investigate the development and persistence of edema volume increases in the acute post-infarct period using both T₂-weighted STIR imaging and T₂ maps. LAD instrumented canines (n=9) underwent three hours of no-flow ischemia followed by reperfusion and were studied [using Siemens 1.5 T Espree scanner] at five time points (before and during ischemia and 2, 5, 7 and 56 days post-reperfusion). Scan parameters for T₂-STIR acquisitions were: TE=64ms, TR=2-3 R-R intervals, resolution=0.9x0.9x8.0mm³. T₂ maps were computed from multiple T₂-prepared acquisitions with different preparation times (0, 24, and 55 ms) with spatial-resolution of 1.0x1.0x8.0mm³. Late-enhancement imaging confirmed LAD infarction. Areas of interest were determined as follows: For T₂ maps - region with T₂ values greater than 2SD from remote territories; and for T₂-STIR

images- regions exceeding 2SD of the signal intensity of the remote regions. Edema volume was computed as highlighted areas multiplied by imaging slice thickness. Percent volume of edema was computed relative to total myocardial volume. Results are reported as mean ± SEM for each time point.

Results

Percent volume of edema (Area-At-Risk) - T₂ Maps: Pre-ischemia: 0.8±0.4%; Ischemia: 2.5±1.4%; Day 2: 18.3

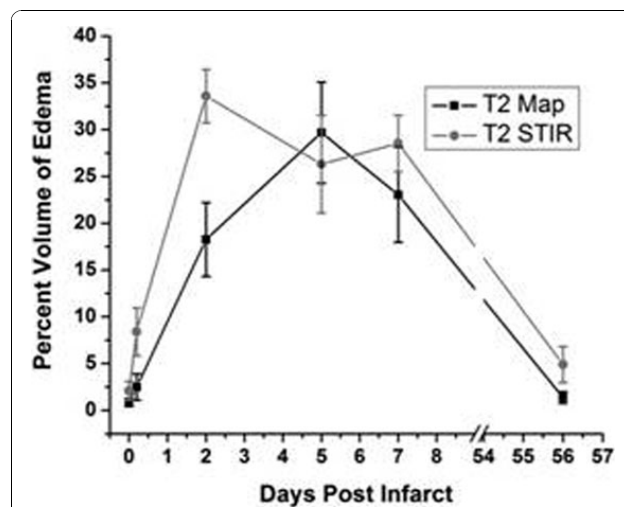


Figure 1 Time evolution of edema volume in a canine model of ischemia-reperfusion injury measured on the basis of changes in T₂ and signal intensity on T₂-STIR images: Note that the percent volume of edema measured from T₂ maps is generally lower than that from T₂ STIR and that the edema volume is variable within the acute period of tissue injury and resolves to near baseline levels by week 8.

¹Northwestern University, Chicago, IL, USA
Full list of author information is available at the end of the article

$\pm 3.9\%$; Day 5: $29.7 \pm 5.4\%$; Day 7: $23.0 \pm 5.1\%$; and Day 56: $1.4 \pm 0.6\%$. **T₂-STIR:** Pre-ischemia: $2.1 \pm 1.0\%$; Ischemia: $8.4 \pm 2.6\%$; Day 2: $33.6 \pm 2.9\%$; Day 5: $26.1 \pm 5.2\%$; Day 7: $28.5 \pm 3.0\%$; and Day 56: $4.9 \pm 1.9\%$. $p < 0.01$ by ANOVA. T₂ maps showed a continuous rise in relative edema volume post reperfusion that peaked at day 5. Although edema volume decreased by day 7, it remained significantly elevated from pre-ischemic levels. In T₂-STIR analysis, edema volume rose rapidly, peaking at day 2 and remaining elevated throughout the acute study period. T₂-STIR images showed an earlier peak in edema volume compared to that determined from T₂ maps. Both measures demonstrated regression of edema after 56 days. Figure 1.

Conclusion

This data indicates that the time following ischemia-reperfusion injury, as well as the mode of MR interrogation, are critical variables in the determination of Area-at-Risk.

Author details

¹Northwestern University, Chicago, IL, USA. ²Laval University, Quebec City, QC, Canada.

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