

POSTER PRESENTATION

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# Detecting reperfusion myocardial hemorrhage with T2 and T2\* maps at 1.5T

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From 2011 SCMR/Euro CMR Joint Scientific Sessions  
Nice, France. 3-6 February 2011

## Introduction

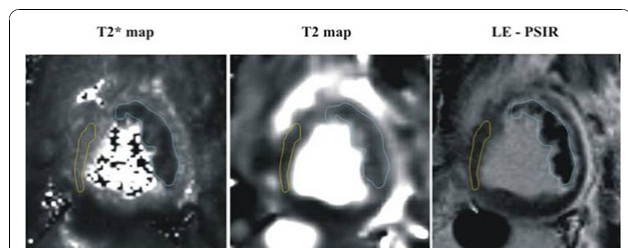
Reperfusion into severely ischemic myocardium can lead to myocardial hemorrhage (MH). Recent studies have employed T2- and T2\*-weighted imaging to assess MH. However, a direct comparison of myocardial T2 and T2\* changes in the setting of MH is not available.

## Purpose

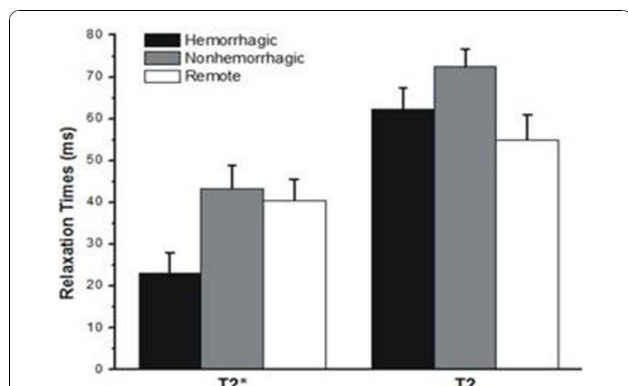
To examine the T2 and T2\* changes associated with MH and thereby determine the effectiveness of each method for detecting MH.

## Methods

Canines (n = 9) were subjected to a 3-hour occlusion of the LAD followed by reperfusion. Serial CMR studies (1.5T Siemens Espree) were performed post-reperfusion on days 2, 5 and 7. Short-axis images of the entire LV (resolution = 1.1x1.1x8mm<sup>3</sup>) were obtained using T2-prepared SSFP (T2-preparation= 0, 24 and 55ms), multi gradient-echo (TE=3.43ms, 6.42ms, 9.41ms, 12.40ms, 15.39ms and 18.38ms) and PSIR Late-Enhancement (LE-PSIR) imaging. T2 and T2\* maps were computed from T2-prepared and gradient-echo acquisitions. Hemorrhagic infarctions (MH+) were determined by the presence of hypointense territories on T2\* maps within the infarcted zones identified from LE-PSIR images. In the MH+ group, manually drawn ROIs on the T2\* maps around the hemorrhagic cores and remote territories were copied to the T2 maps. In non-hemorrhagic infarctions (MH-), manually drawn ROIs on LE-PSIR images around the infarcted zones and remote territories were copied to T2 and T2\* maps. T2 and T2\* values from the MH+, MH-



**Figure 1** T2\* map, TW map and Late-Enhancement (LE) PSIR image from an LAD instrumented canine 5 days post reperfusion are shown. ROIs were manually traced around the hemorrhagic cores (represented here with a blue boundary) on the basis of T2\* maps, and remote territories (yellow boundary) on the basis of L-PSIR images. As evident from the images, T2\* changes with respect to remote territories were more pronounced than the T2 changes in the presence of hemorrhage.



**Figure 2** Mean T2\* and T2 values for hemorrhagic (black), non-hemorrhagic (gray) and remote territories (white) are shown. T2\* values in the presence of hemorrhage were significantly lower than the non-hemorrhagic infarctions and remote territories. T2 values of hemorrhagic infarctions were not significantly different from those of the remote territories. However, the T2 values of non-hemorrhagic infarctions were significantly higher than the hemorrhagic and remote territories.

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**Table 1 Mean T2\* and T2 values from hemorrhagic, non-hemorrhagic and remote territories were computed by averaging across all the days from all the animals**

Region	Remote Myocardium	Hemorrhagic infarction (MH+)	Non-hemorrhagic infarction (MH-)	% Change with respect to remote myocardium	
				MH+	MH-
Technique					
T2* (ms)	40.5 ± 5.0	23.0 ± 4.9	43.3 ± 5.6	-42.1 ± 14.1%*	7.9 ± 17.3%
T2 (ms)	54.9 ± 6.0	62.3 ± 5.1	72.5 ± 4.3	12.8 ± 14.4 %	35/3 ± 11.3%*

Mean percentage changes of T2\* and T2 values in hemorrhagic and non-hemorrhagic infarctions with respect to remote territories are shown. Statistically significant changes ( $p < 0.05$ ) are denoted with an asterisk (\*). While there was a significant decrease in T2\* in hemorrhagic infarctions with respect to remote territories, T2 changes were insignificant. In non-hemorrhagic infarctions T2 was significantly higher, while T2\* change was insignificant.

and remote territories were measured and compared ( $p < 0.05$ ).

## Results

MH was observed in 6 dogs (MH+), but not in the remaining 3 dogs (MH-). Figure 1 shows a representative set of T2\* and T2 maps and the corresponding LE image in a canine with MH. Figure 2 shows the mean T2\* and T2 values from MH+, MH-, and remote territories. Table 1 lists the respective relaxation values and the change in T2 and T2\* between MH+, MH-, and remote territories. In the MH+ group, T2\* values decreased by 46% compared to the MH- group, while T2 decreased by only 16% ( $p < 0.05$ ).

## Conclusion

T2\* of MH+ territories were significantly lower than those of MH- and remote territories. This was not the case amongst T2 of MH+, MH- and remote territories. The reduced conspicuity of MH on T2 maps is likely due to the refocusing effects of the 180° pulses and its intrinsic sensitivity to myocardial edema. We conclude that the potential insensitivity of T2\*-weighted CMR to myocardial edema and strong sensitivity to hemorrhagic byproducts makes T2\* mapping a more effective approach for detecting MH.

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Published: 2 February 2011

doi:10.1186/1532-429X-13-S1-P112

Cite this article as: Kali et al.: Detecting reperfusion myocardial hemorrhage with T2 and T2\* maps at 1.5T. *Journal of Cardiovascular Magnetic Resonance* 2011 **13**(Suppl 1):P112.

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