Introduction: Hemorrhage within the myocardium often occurs following myocardial infarction (MI) and is believed to be a substantial risk factor for poor outcome. MRI is a valuable tool for assessing myocardial hemorrhage. In particular, hemorrhage leads to shortening of the T2* relaxation time and therefore is often observed as hypo-intensity in T2* weighted images. Assessing and optimizing methods for quantifying the extent of hemorrhage is an important step in developing good predictors of outcome. This work is a preliminary assessment of a signal classification method known as k-means clustering as a tool for segmenting short T2* regions within the infarcted area. This approach utilizes a series of images rather than relying on a single image. Although segmentation within the myocardium is based on k-means clustering and therefore is automated, our delineation of the myocardium itself is based on manual outlining. The objective of this work is to investigate the influence of inter-rater differences in myocardial delineation on segmentation of the short T2* regions, and to compare inter-rater differences for segmentation applied to T2*-weighted images versus inter-rater differences for segmentation applied to T2* maps.

Methods: The analysis was performed on previously acquired canine multi-gradient echo MR images (eight echo times (TE) covering the range 3–23 ms). A single short axis slice was selected for analysis. On the first image (TE=3 ms), the myocardium was delineated by two different raters. A third myocardial delineation was simulated by eroding the myocardial region from one rater. (Erosion involves removing a boundary layer of pixels.) The images were also processed to generate a T2* map by applying exponential curve fitting to the signal on a pixel by pixel basis. The three myocardial delineations were applied to all eight images and the T2* map. K-means clustering was applied to the myocardial region on the 8 images, and repeated with the first 7 images, the first 6 images etc. K-means clustering was also applied to the T2* map. The Dice similarity coefficient (DSC) was used to compare the segmentations from the 3 “raters” in each case (8 images, 7 images…, T2* map). The DSC is a measure that quantifies the degree of overlap between two regions. DSC values of 1.0 and 0 indicate complete overlap and no overlap, respectively.

Results: The Dice index results revealed that the best correspondence between raters was obtained using the T2* map. The Dice index values ranged from 0.85 to 0.91 for multi-gradient echo MR images and approximately 0.94 for the T2* map.

Conclusion: This preliminary result suggests that for the purpose of segmenting short T2* regions on post-MI images, applying k-means clustering to the T2* maps may lead to lower inter-rater differences compared to k-means clustering applied to the T2*-weighted gradient echo images.