

Quantitative analysis for diffusion-weighted and superparamagnetic iron oxide enhanced magnetic resonance imaging in patients with chronic hepatitis C: Correlation with pathologic fibrosis and inflammatory scores and clinical severity

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Background:

Diffusion-weighted magnetic resonance imaging (DW-MRI) has been proposed for non-invasive detection and quantification of hepatic fibrosis [1, 2]; however, has not been validated as a marker for pathologic hepatic necroinflammation and clinical severity. To our knowledge, assessment for hepatic fibrosis or inflammation and disease severity by using superparamagnetic iron oxide enhanced MRI (SPIO-MRI) has not been reported adequately.

Purpose:

The aim of study was to evaluate mean of region-of-interest (ROI) and volume histogram analysis of signal intensities obtained by DWI-MRI and SPIO-MRI for predicting the histopathologic liver fibrosis and inflammation scores and clinical severity.

Materials and Methods:

DW-MRI with single-shot echo-planar technique at b values of 0 and 1000 s/mm^2 and SPIO- MRI of the liver were obtained in 34 patients with chronic hepatitis C and in 9 patients without hepatitis (normal hepatic function but having a small nodule). The hepatic apparent diffusion coefficient (ADC) map and the reduction percentage of liver-to-muscle signal intensity ratio (Reduction-%LMR) of T2-weighted gradient-echo sequences before and after administration of SPIO were analyzed with mean of ROI and volume histograms analysis. In volume histogram analysis, three parameters (contrast, variance, and entropy) were retrospectively calculated in four cubic ROIs placed on the right hepatic lobe. All hepatitis patients' biopsy results ($n=34$) were retrospectively reviewed by two independent expert pathologists to determine stage of fibrosis and grade of inflammation [3] and the final decision was in consensus. Total of 43 patients were classified into 4 groups (normal, Child-Pugh A, B, and C) for evaluating clinical severity.

Results:

Spearman rank coefficient analysis revealed that there were statistically significant negative correlations of ADC values with stage of fibrosis (Spearman $r = -.667$, $P < .001$) and with grade of inflammation ($r = -.420$, $P = .024$). There were statistically significant negative correlations of Reduction-%LMR with stage of fibrosis ($r = -.681$, $P < .001$) and with grade of inflammation ($r = -.500$, $P = .006$). In volume histogram analysis, the contrast of ADC values was correlated negatively with Child-Pugh score ($r = -.458$, $P = .012$). Furthermore, the variance and the entropy of Reduction-%LMR were greater in patients with higher stage of fibrosis rather than those with lower stage (Kruskal-Wallis test, both, $P = .008$).

Conclusion:

The quantitative analysis of ADC values (DW-MRI) and Reduction-%LMR (SPIO-MRI) is helpful in predicting the histopathologic liver fibrosis as well as clinical severity in patients with chronic hepatitis.

References:

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- 3) Batts KP, Ludwig J. Chronic hepatitis. an update on terminology and reporting. *Am J Surg Pathol* 1995; 19:1409-1417.