Utility of MR imaging for assessment of chronic liver disease has been described, while utility for assessing acute hepatitis has not been established. Here, we propose that acute inflammation of liver parenchyma should lead to irregular hyperemia with altered arterial-capillary blood flow, and that this should be observed on arterial phase gadolinium enhanced T1-weighted MR images. To test this, we retrospectively reviewed 680 consecutive MR imaging liver exams acquired over a 1-year period. We show that multi-phase enhanced MR imaging is a sensitive (84%) test for diagnosis of acute hepatitis, with a high positive predictive value (100%), and that the severity of disease corresponds to the degree of persistence of perfusion abnormalities.

Introduction
In cirrhosis, representing chronic diffuse liver disease, MR imaging has been shown to have sensitivity for demonstrating the different patterns of fibrosis on delayed or equilibrium phase post-gadolinium enhanced T1-weighted images. Where fibrosis represents an end-stage disease process, acute hepatitis represents active disease, for which it is clinically important to develop non-invasive sensitive and specific tests for detection and monitoring. Here, we propose that acute inflammation of liver parenchyma should lead to irregular hyperemia with altered arterial-capillary blood flow, and that this should be observed on arterial phase gadolinium enhanced T1-weighted MR images.

Materials and Methods
Liver MR imaging was performed using 1.5 Tesla magnet systems, and dynamic contrast enhanced acquisitions were obtained 18 seconds (arterial phase), 45 seconds (venous phase), and 120 seconds after initiation of contrast injection using breath-hold spoiled gradient echo T1-weighted imaging (TR/TE 115/4.2 msec, flip angle 80°, matrix 256x128, field of view 380x380 mm, slice thickness/gap 8.1 mm, 22 slices in 23 seconds. Gadolinium contrast was administered at a dose of 0.1 mmoles per kg, at 2 ml per second by power injector, followed by 20 ml of normal saline flush at 2 ml second. 620 consecutive liver scans acquired over a 1-year period were examined for abnormal arterial phase perfusion hyperemia, and compared against liver enzyme and pathology assessments.

Results
A total of 48 patients were identified as having either abnormal arterial phase liver enhancement and/or liver enzyme analysis within 1 month of MR imaging. Of 48 cases, 30 showed abnormal liver enhancement as identified by patchy areas of abnormal increased liver enhancement seen on arterial phase images, and 18 showed a more uniform arterial phase enhancement. Of 30 patients with abnormal arterial enhancement, 27 had abnormally elevated liver enzymes, with concurrent enzyme assessment not available in the remaining 3 cases. Of 18 patients with normal arterial enhancement, 13 had normal enzymes, and 5 had elevated liver enzymes. Of the 5 cases with elevated enzymes, 2/5 showed marked fatty infiltration on opposed phase images, 1/5 showed cirrhosis on delayed post-gadolinium images, 1/5 had HIV infection, and 1/5 had a history of alcohol. Serial MR imaging and liver enzyme levels were available in 4 of the 27 patients with abnormal MR scans, showing good correlation between resolution of imaging findings and liver enzyme levels, and histopathological correlation was available in 2 cases, with these findings confirming a diagnosis of acute hepatitis. In 27 patients with abnormal liver enhancement, 23 showed this abnormality only on arterial phase images, while 4 had this finding persist on venous phase enhanced images. Clinical severity and enzyme levels correlated with persistence of perfusion abnormalities, with significantly higher liver enzyme levels in patients with arterial and venous phase abnormal perfusion (Table 1).

Conclusions
Dynamically enhanced MR imaging of the liver can detect reversible perfusion abnormalities that correlate with acute hepatitis. The severity of liver perfusion abnormalities correlates with the severity of hepatitis.