Can gadolinium-enhanced MRI be used for the grading of liver fibrosis and acute hepatitis?

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Introduction

Hepatitis results from a variety of etiologies and chronic hepatitis can lead to hepatic fibrosis and cirrhosis. The diagnosis and grading of liver disease severity depends upon invasive biopsy. Histopathology is based on percutaneously sampled liver tissue for grading of liver interstitial fibrosis and inflammation. There are limitations associated with liver biopsies including complications such as hepatic bleeding. Thus, gadolinium enhanced MRI as a non-invasive imaging technique has been proposed for the evaluation of chronic liver disease and inflammation. Our hypothesis is that: 1) the degree of gadolinium-chelate contrast agent (Gd) accumulation within the liver, assessed on T1 weighted (T1W) 3D gradient echo (3D GRE) interstitial phase images, will correlate with the degree of histologically defined hepatic fibrosis; and 2) the conspicuity of abnormal transient Gd non-uniform enhancement pattern identified on arterial phase T1W 3D GRE images will correlate with the histologically defined degree of hepatic inflammation.

Methods

25 normal subjects, 25 patients with intermediate and 25 patients with severe cirrhosis were studied. Diagnosis and grading of cirrhosis, as well as hepatic inflammation activity, was based on histopathology according to the 5-point Scheuer ranking (0=absence of disease, 4=severe cirrhosis/inflammation). MRI scans were performed on a current generation 1.5T scanner (Magnetom Avanto, Siemens Medical Solutions; Gyroscan Intera, Philips Medical Systems; or Twin-EXCITE, GE Healthcare) within 14 days of biopsy and histopathologic tissue analysis. A torso phased-array surface coil was used for signal reception. Breath-hold serial axial T1-weighted 3D spoiled gradient-echo fat-suppressed images were acquired before contrast administration and during the contrast enhanced hepatic arterial dominant phase and delayed late vascular and interstitial phases. Acquisition parameters were TR/TE, 3.4–3.8/1.2–1.4; flip angle, 12°; sensitivity encoding factor, 2; section thickness, 2–3 mm; matrix size, 192 × 256; field of view, 400 mm; acquisition time, 12-15s. Gadolinium (MultiHance, Bracco) was administered in a bolus of 0.05 mmol/kg at 2 mL/s.
MR images were evaluated by two radiologists by consensus. Abnormal patchy enhancement patterns on the arterial phase images were evaluated as a marker for acute hepatic inflammation (figure 1). Abnormal reticular pattern liver enhancement on the interstitial phase images was graded as a marker of hepatic fibrosis (figure 2). MRI based grading was performed using a scoring system of 0-4 in accordance with methods used for pathology. A t-test was used for comparison between the pathology and MRI results.

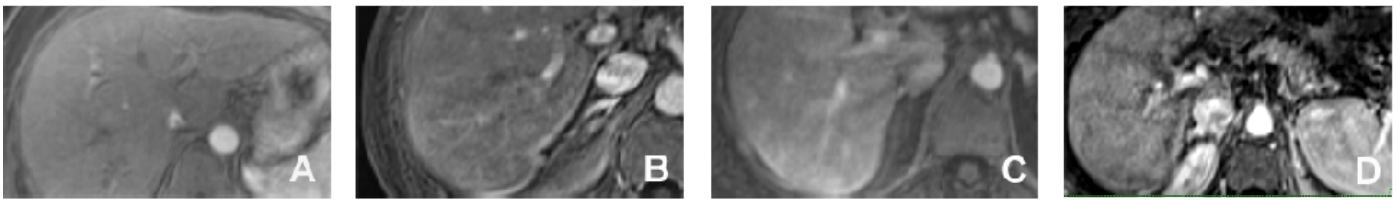

Fig 1: MRI grading of acute hepatic inflammation based on patchy enhancement on arterial phase images. Different degrees of acute hepatitis are displayed: (A) no hepatitis; (B) mild hepatitis (grade 1); (C) moderate hepatitis (grade 2/3); (D) severe hepatitis (grade 4).

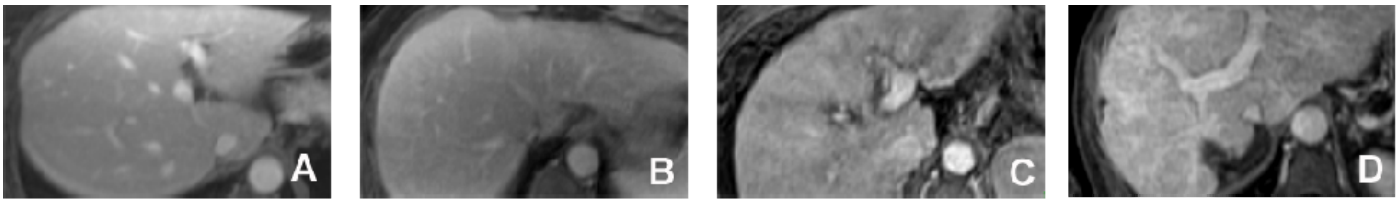

Fig 2: MRI grading of hepatic fibrosis based on reticular enhancement on interstitial phase images. Different degrees of fibrosis are displayed: (A) no fibrosis; (B) mild fibrosis (grade 1); (C) moderate fibrosis (grade 2/3); (D) severe fibrosis (grade 4).

Results

The MRI based scoring for cirrhosis evaluation correlated well with histopathologic findings. Average MRI values amounted to 1.90 (histopathology: 1.92, p=.88). There were minor discrepancies with cirrhosis being underestimated in 9 patients and overestimated in 8 patients. The discrepancy between MRI and histopathology grading did not exceed one ranking point. Regarding the assessment of acute hepatic inflammation, there was also a good correlation between MRI (mean score: 0.90) and histopathology (mean score: 0.85; p=.35). Concordance of findings was found in 48 of 75 patients. Inflammation was overestimated (underestimated) in 16 (11) patients. In 21 patients discrepancy of scoring amounted to one ranking point.

Discussion

The significance of our study is that it provides a measure for the potential use of routine Gd-enhanced multiphase MRI for the detection and staging of liver fibrosis and inflammation. Our findings suggest that routine Gd-enhanced MRI can be used as a surrogate for liver biopsies. It provides advantages over biopsy due to its non-invasiveness and the evaluation of the entire liver.

References

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