Distinction between benign and malignant nodules in the cirrhotic liver with multi-phase gadolinium-enhanced MR imaging

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Synopsis: Distinction between benign and malignant nodules in the cirrhotic liver is essential for planning transplantation. MR signal characteristics and enhancement patterns are not always specific, especially for small lesions. We found that lesion hypointensity on delayed post-gadolinium imaging to be a more specific than arterial enhancement for the diagnosis of hepatocellular carcinoma

Introduction: Distinguishing between early HCC (hepatocellular carcinoma), dysplastic, and benign hepatic nodules in the cirrhotic liver using non-invasive methods is problematic, and cytopathological analysis remains the gold standard for definitive diagnosis. Liver biopsy in cirrhotic patients carries significant risks and is not always feasible or successful. MRI is a sensitive method for evaluating the cirrhotic liver, but there is major overlap in the signal characteristics of benign and malignant lesions. Arterial enhancement is considered the most consistent feature of hepatocellular carcinoma but is also seen in other benign and malignant conditions.

Purpose: To assess the accuracy of gadolinium-enhanced MR imaging criteria in differentiating HCC from benign lesions in cirrhotic patients with a solid liver mass, and to determine if incorporation of clinical and laboratory data will increase the accuracy of diagnosis of HCC.

Materials and Methods: Between May 2001 and February 2003, dynamic gadolinium-enhanced MRI of consecutive patients with liver cirrhosis and a solid mass were prospectively reviewed by two radiologists, prior to performing liver biopsy, surgical excision or transplantation. Clinical, laboratory and radiological data were recorded for all patients. Dynamic gadolinium-enhanced imaging was performed using a 3D spoiled-gradient-echo sequence (TR:5, TE:2.1, spectral fat suppression, 4 mm section, 320 x 160 matrix) following intravenous administration of 20 mLs of Gadolinium in the arterial phase (timed using automated contrast detection), portal-venous phase, and at 2 and 5 minute. Lesion signal intensity compared to liver (iso, hypo, hyper) on the gadolinium-enhanced images was recorded, as well as the probability of the lesion being malignant (high or low).

Results: 117 patients with cirrhosis and a solid liver mass were studied, 70 of whom had HCC. The most important radiological parameters for the prediction of HCC were tumor size (OR=2.53; 95%CI:1.15-5.56) and lesion hypointensity compared to liver on delayed post-gadolinium imaging (Figs 1 and 2) (OR=40.1;95%CI:11.6-138). The sensitivity and specificity of the regression model with these two radiological characteristics in the prediction of HCC were 84% and 84%, respectively, and the area under the ROC curve was 0.83. Addition of alpha fetoprotein (AFP) and model for endstage liver disease (MELD) score to the model increased the sensitivity to 92% while retaining the same specificity, and the area under the ROC curve increased to 0.95 (p=0.03).

Conclusion: MRI characteristics, AFP and MELD score may obviate the need for liver biopsies in about 90% of the patients with cirrhosis and a solid liver mass. Lesion hypointensity on delayed post gadolinium imaging is more specific than arterial enhancement for the diagnosis of HCC.

References:

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Figures 1 and 2 demonstrate two arterial-enhancing lesions (arrows) in the right lobe of the liver. The lesion in figure 1 remains iso to hyperintense compared to liver parenchyma on delayed phase imaging, and was shown on pathology to be a dysplastic nodule. The lesion in figure 2 becomes hypointense, and was shown to be hepatocellular carcinoma