Tumor Surveillance Prior to Liver Transplantation Using Gadolinium Enhanced MRI

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Introduction

Hepatocellular carcinoma (HCC) is a common tumor in patients with chronic liver disease. Accurate detection of HCC in the background of advanced cirrhosis is crucial because of possible curative treatment by transplantation. MRI in conjunction with iv. Gadolinium administration has been shown to be both highly sensitive and specific for the evaluation of liver lesions. However, there are several discrepancies among recent trials evaluating gadolinium-based MRI for the detection of HCC. Considerably different overall sensitivity values for detection of HCC using MRI have been reported ranging between 68% and 91% (1, 2). In addition, these studies only encompassed a relatively small number of patients (<40), and detection rate and characterization of small liver lesions (<2cm) has been controversial. The aim of this study was to assess our center data to evaluate the feasibility of performing primary tumor surveillance imaging on MRI, using explant liver with histopathology evaluation for correlation.

Methods

115 patients (38 female and 77 male; average age: 53.9 years; range: 22-73 years) underwent liver transplantation and prior MR imaging of the liver within 90 days (range: 3-89 days, mean value: 46.5 days). All MR examinations were performed on a current generation 1.5T scanner. Routine imaging included precontrast MR examinations using a set protocol of pre-contrast T1-weighted images acquired as breath-hold spoiled gradient dual-echo in- and out-of-phase (SGE) and T2-weighted half-Fourier acquisition single-shot turbo spin echo sequence. Subsequently, 0.1 mmol/kg of gadolinium chelate was intravenously administered at 2 mL/s in all patients. Four sets of breath hold serial axial 3D SGE fat-suppressed (TR 3.7-4.1 ms, TE 0.9 – 1.3 ms, SENSE factor of 2, 2 – 3 mm section reconstruction) images were acquired pre- and post-contrast. The first contrast-enhanced data (hepatic-arterial dominant phase) was individually acquired using a bolus-tracking-technique. Further contrast-enhanced data was collected after a delay time of 60s (portal-venous phase), and 180s (late vascular phase).
Two radiologists assessed the images in a consensus mode. Underlying criteria for the diagnosis of HCC included (a) increased enhancement of the lesion compared to normal liver tissue in the arterial contrast phase, (b) washout of the lesions during the later contrast phases and (c) persistent pseudocapsule enhancement. Lesions were rated as HCC if at least two of these three features were present. Following transplantation, explanted livers were serially sectioned into 5-10 mm contiguous slices. All lesions other than regenerative nodules were sampled for histologic examination. On microscopic examination, malignant nodules were characterized as to their histological type, size, location, number, and stage. Findings of pathology served as the standard of reference. Subgroups were formed for HCC >2cm and ≤2cm. Assessment of diagnostic accuracy for MRI was made both on a patient- and lesion-based analysis.

Results

By means of histopathology, presence of HCC was determined in 27 out of 115 patients. Tumors >2cm were found in 18 patients, while 9 patients showed only HCC ≤2cm. A total number of 36 HCC was found by histopathology including each 18 lesions for both size subgroups. A single HCC was depicted in 20 patients, whereas 7 patients were found to have more than one HCC. Concerning the patient-based analysis, presence of HCC was detected by MRI in 24 of 27 patients resulting in an overall sensitivity of 88.9%. Specificity amounted to 97.7% since two patients showed false positive results. All 18 patients with HCC > 2cm were correctly identified by MRI, while only 6 out of 9 patients with HCC ≤2cm were rated as such. False positive findings included each one patient rated to have a HCC >2cm and another subjects to present a HCC ≤2cm. The lesion-based analysis revealed an over-all sensitivity of MRI of 77.8% rating 28 out of 36 HCC as such. There were two false positive lesions as well as six HCC not depicted at all. Two further pathologically proven HCC were rated as dysplastic nodules. While all 18 HCC >2cm were depicted by MRI, only 10 out of 18 HCC ≤2cm were correctly diagnosed (sensitivity: 55.6%). When correcting the calculation due to a misdiagnosis of HCC as dysplastic nodules, sensitivity for the depiction of HCC ≤2cm increased to 66.7%.

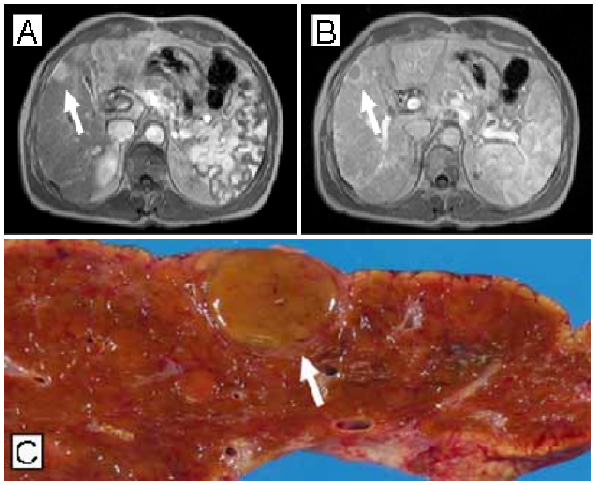

Fig 1: 2.3cm HCC at the border of segments 5/8. A typical strong enhancement can be observed in the arterial phase (A) as well as a contrast washout and capsule enhancement on delayed contrast phases (B). The pathology examination (C) shows a round, subcapsular nodule and surrounding cirrhotic liver parenchyma.

Discussion

Our center-specific experience to date has shown that contrast-enhanced MR imaging can be used as a primary diagnostic methodology for accurate detection and characterization of HCC ≥2cm and may be considered a standard tool for the surveillance of patients prior to liver transplantation. Overall cost benefits remain an area of investigation, but potential reduction in cost and risk may derive from the diminished need for other diagnostic imaging tests or tissue biopsies, and avoidance of iodinated contrast agents in cirrhotic patients that may have impaired renal function.

References

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