Double Contrast MRI For The Detection And Characterisation Of Hepatocellular Carcinoma In The Cirrhotic Liver

J Ward, J Scott, JA Guthrie, D Wilson, PJ Robinson
St James's University Hospital, Leeds LS9 7TF, UK.

Introduction: Hepatocellular carcinoma (HCC) develops against a background of cirrhosis by a multi-step dedifferentiation process from regenerative nodules to dysplastic nodules to HCC. Liver transplantation provides the most effective treatment for HCC providing the diagnosis is made at an early stage, but because the liver is structurally abnormal, HCC is often difficult to detect and distinguish from benign nodules. SPPIO-enhanced MRI [1] and dynamic Gd-DTPA enhanced MRI [2,3] have been shown to improve the detection and characterisation of HCC. In the only clinical study to combine an iron colloid preparation and Gd-DTPA in the investigation of HCC, images obtained several minutes after injection of Gd-DTPA and iron colloid provided a significant improvement in characterisation but no improvement in confidence [4]. Combining SPPIO with rapid sequential imaging after Gd-DTPA may further improve the diagnosis of HCC. The purpose of this study therefore was to investigate the role of double contrast MR (DCMR) with SPPIO and bolus injection of Gd-DTPA in the detection and characterisation of HCC in the cirrhotic liver.

Materials and Methods: Patients – 12 men and 10 women (age range 39-76) with MR features of dysplastic nodules and/or HCC were included in the study. All the patients were potential liver transplant candidates. Imaging – all imaging was performed on a Siemens Magnetom 42SP system. T2WSE (TR 2000, TE 45/90) and T1W GRE (TR 135, TE 4, FA 80°) images were obtained before and after SPPIO. Immediately after acquisition of the SPPIO-enhanced images a bolus injection of Gd-DTPA was given with T1W GRE images obtained at 10, 40 and 120 seconds later. Qualitative analysis – 3 sets of images (a – unenhanced, b – unenhanced + SPPIO-enhanced (SPPIO) and c – unenhanced + SPPIO-enhanced + Gd-enhanced (DCMR)) were reviewed independently by two blinded observers who recorded the number and segmental location of lesions, assigning each one a confidence rating using a four point scale. The results were correlated with histopathology following transplantation in 11 patients and biopsy in 11. Biopsy was typically performed for only one lesion – where multiple present lesions were present those which had the same imaging characteristics as the biopsied lesion were considered positive for tumour. Alternative free response receiver operating characteristic (AFROC) methodology was used to analyse the results. Each observer also characterised each lesion as dysplastic nodule or HCC, indicating their degree of certainty: ROC methodology was used for analysis. Quantitative analysis – using user defined ROI’s positioned to the lesion, adjacent liver and background noise, CNR was calculated by SI lesion – SI liver / SI noise, percentage signal intensity loss (PSIL) by SI pre – SI post / SI pre x100 and percentage enhancement (PE) by SI post / SI pre x100. The Mann Whitney ‘U’ test was used to test the significance of differences between the techniques.

Results: 78 true positive lesions were present in 21 patients; their sizes are shown in table 1. Sensitivity was calculated for lesions detected at the two highest confidence levels (table 2). For each imaging technique the area under the AFROC curves was shown for each observer and each technique. For dysplastic nodules compared with HCC (p<0.01)(table 6). For dysplastic nodules, maximum PE occurred on images obtained 120 secs after Gd and for HCC on images obtained at 80 secs; there was no significant difference in PE between the two lesions.

Conclusion: DCMR significantly improves the accuracy of detection of HCC compared with SPPIO-enhanced and unenhanced MR. There was no statistically significant difference between the techniques for lesion characterisation.