In Vivo Proton MR Spectroscopic Evaluation of Hepatocellular Carcinoma, Metastasis and Hemangioma in the Liver

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Abstract

The purpose of this study was to evaluate the in vivo proton (1H) magnetic resonance (MR) spectroscopic features and relative metabolite-to-lipid ratios of phosphomonoester (PME) of hepatic tumor. Thirty-eight patients with liver masses (25 HCCs, 5 metastasis and 8 hemangiomas) were examined with 1H MR spectroscopy. Each liver mass was calculated relative metabolite-to-lipid ratios of PME. The calculated mean value relative metabolite-to-lipid ratios were lower in the hemangioma group than in the hepatocellular carcinoma (HCC) and metastasis group (p<0.05). In vivo 1H MR spectroscopy is able to assess human hepatic tumor.

Introduction

MR spectroscopy in vivo has expanded rapidly in recent years finding increasing use in clinical research. Recent reports have analyzed in vivo 31P MR spectra of human hepatic tumor, showing increased PME signals1,2. Cho et al4 demonstrated that calculated mean value relative metabolite-to-lipid ratios of PME, glutamine and glutamate complex, glycogen and glucose complex in liver, various chronic liver diseases: in vivo 1H MR spectroscopic evaluation of the liver. To our knowledge, no studies in vivo 1H MR spectroscopic findings for hepatic tumors have been performed to date. The purpose of this study was to evaluate the in vivo 1H MR spectroscopic features and relative metabolite-to-lipid ratios of PME of HCC, metastasis and hemangioma.

Material and Methods

Thirty-eight patients with liver masses (22 male and female, age range 49-88 years, mean 69 years) were examined with 1H MR spectroscopy. These masses were HCCs (n=25), metastases (n=5) and hemangiomas (n=8); all liver masses were diagnosed by radiological features, including abdominal ultrasonographic, computed tomographic (CT) and MR imagings. 1H MR spectroscopy was performed with each liver masses. 1H MR spectra were obtained a 1.5T super conducting system (Magnetom Symphony; Siemens, Erlangen, Germany). For acquired 1H MR spectra, the sequence (TR 1500ms, TE 135ms, 90° flip angle, voxel size 1X1X1 cm3) was used, and the voxel was positioned maximum tumor diameter (4X4, 16 voxels). 1H MR spectroscopy was performed without respiratory interruption. 1H MR spectra was acquired approximately five minutes. The peak areas of PME and lipid were measured on the liver mass spectra. Each liver mass was calculated relative metabolite-to-lipid ratio of PME. Indirect evaluation parameters, radiological features, including CT and MR imaging findings which diagnosed and measured size of each masses; and biochemical serum markers (α fetoprotein: AFP, protein induced by Vitamin K absence or antagonist: PIVKA-II, carcinoembryonic antigen: CEA), being were used to assess relative metabolite-to-lipid ratio of PME. Data analysis was performed using a student t-test with p<0.05.

Results

1H MR spectroscopy depicted PME and lipid all liver masses. The calculated mean value relative metabolite-to-lipid ratios of HCC, hemangioma and metastasis were 1.61±1.99, 0.32±0.16, and 2.89±2.12. The relative metabolite-to-lipid ratios were lower in the hemangioma group than in the HCC and metastasis group (p<0.05) (Fig. 1). Comparison of biochemical serum markers and relative metabolite-to-lipid ratios indicated no significant difference, demonstrating the absence of effect of biochemical serum markers. No statistically significant differences were found between tumor size and relative metabolite-to-lipid ratio (Fig. 2).

Discussion

The use of MR spectroscopy in the abdominal organs has lagged behind that in the central nervous system because of motion artifact such as respiratory movement. However, in this study, 1H MR spectra were successfully obtained from the human hepatic tumors. The result of this study showed that the relative metabolite-to-lipid ratios were lower in the hemangioma group than in the HCC and metastasis group. Thus, the result of this study suggested that the relative metabolite-to-lipid ratios were difference between malignant liver masses and benign liver masses. Relative metabolite-to-lipid ratios demonstrated the absence of effect of biochemical serum markers and tumor size, and the ratios could be useful independent parameters for characterizing the human hepatic tumor.

Conclusion

In vivo 1H MR spectroscopy is able to assess human hepatic tumor. This method can be extended to study hepatic tumor metabolism, and relative metabolite-to-lipid ratios could be valuable parameters for characterizing the human hepatic tumor.

References


Figure 1 Metabolite-to-lipid ratio
Difference between liver masses

Figure 2 Correlation between metabolite-to-lipid ratio and tumor size