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Magnetic Resonance (MR) Differentiation of Hepatocellular Carcinoma from Hepatic Cavernous Hemangioma: Efficacy of T2 Values for Tumors Smaller than 2 cm

Kuni OHTOMO, Yuji ITAI[1], Tsutomu ARAKI[2], Yasuhito SASAKI[2], and Guio UCHIYAMA

Department of Radiology, Yamanashi Medical College, 1110 Shimokatou, Tamaho, Nakakoma, Yamanashi 409–38,
1) Department of Radiology, University of Tukuba, 1–1–1 Tennoudai, Tukuba, Ibaragi 305,
2) Department of Radiology, The University of Tokyo,
7–3–1 Hongo, Bunkyo-ku, Tokyo 113, Japan

Abstract: Fifty-seven patients with a total of 68 hepatocellular carcinoma (HCC) lesions smaller than 2 cm and 84 with a total of 108 cavernous hemangioma lesions smaller than 2 cm were studied with magnetic resonance (MR) imaging (1.5T) to evaluate the efficacy of T2 values in differential diagnosis. T2 values were calculated by the two-point method. The mean T2 value for HCC and hemangioma was 47.1 msec±6.9 and 81.3 msec±23.7 respectively. There was a significant difference ($p<0.001$) between T2 values for HCC and those for hemangioma. When the cutoff T2 value was set at 60 msec, 162 (92.8%) of 176 lesions were correctly classified. Sensitivity and specificity for HCC were 100% and 87%, respectively. We conclude that MR imaging with T2 measurement is very useful in differentiating between HCC and hemangioma smaller than 2 cm.

Key words: Liver, MR studies, Liver neoplasm diagnosis, Liver neoplasm, MR studies

INTRODUCTION

Recent reports have revealed that MR imaging is a highly specific noninvasive method useful in the diagnosis of hepatic cavernous hemangiomas[1)–5)]. T2 relaxation time[4)] and contrast/noise ratio (C/N) on heavily T2-weighted spin-echo images[5)] have also been reported to be useful in the differentiation of hemangioma from hepatocellular carcinoma (HCC). Our previous study revealed that T2 values of hemangiomas less than 2 cm in diameter were usually briefer than the cutoff value (80 msec at 1.5 tesla) for the differentiation of hemangioma because of volume averaging, and that another shorter criteria was required to differentiate these small lesions[4)]. The importance of size-specific quantitative criteria in the differentiation between small cavernous hemangiomas and small hepatic metastases has been also emphasized[6)]. We undertook this retrospective study in a large number of patients to determine the efficacy of the application of a briefer cutoff T2 value in the differentiation of small cavernous hemangioma from small HCC less than 2 cm in diameter.

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MATERIALS AND METHODS

We studied 57 patients with a total of 68 HCC lesions smaller than 2 cm and 84 with a total of 108 cavernous hemangioma lesions smaller than 2 cm using a superconducting MR imager at the University of Tokyo. The diagnosis of HCC was established by means of

pathologic examination in 15 patients and by means of angiography with clinical data in 43 patients. The diagnosis of hemangioma was established by means of angiography in 10 patients, computed tomography (CT) enhanced with a bolus contrast material in 10, and ultrasound with more than 6 months of follow-up in 64.

MR imaging was performed with a superconducting Magnetom unit (Siemens, Erlangen, Federal Republic of Germany) operating at 1.5 tesla. Images were constructed using the two-dimensional Fourier transformation technique. The matrix size was 256×256, and the imaging diameter was 50 cm. Spin-echo images (TR/TE: 2000/28, 75 or 2000/2390) with section thickness of 10 mm at 12–15-mm intervals were obtained. T2 values were calculated from a pair of images with different TE. T2 measurements were obtained from calculated T2 images by using operator-defined regions of interest. When T2 values varied in different regions of a single tumor, we adopted the most frequent T2 value as the T2 value of the tumor. Statistical analysis was done using un-paired t test.

Results

Widest lesion diameter ranged from eight mm to 2 cm in HCC and from six mm to 2 cm in hemangioma. The mean diameter was 1.6 cm ± 0.4 (± S.D.) in the 68 HCC lesions and 1.5 cm ± 0.4 in the 108 hemangioma lesions and there was no significant difference between the two groups. T2 values ranged from 32.1 msec to 59.2 msec in HCC lesions and from 47.9 to 188.1 in hemangioma lesions. The mean T2 value was 47.1 msec ± 6.9 in the 68 HCC lesions and which was significantly lower than 81.3 msec ± 23.7 observed in the 108 hemangioma lesions ($p < .001$). T2 value was below 60 msec in every HCC lesion and 60 msec or longer in 94 of the 108 hemangiomas. When the cutoff T2 value between HCC and hemangioma was set at 60 msec, 162 (92.8%) of 176 lesions were correctly classified. The sensitivity and specificity for HCC were 100% and 92.8%, respectively. On the other hand, T2 values was below 80 msec in 60 of the 108 hemangiomas. When the cutoff T2 value was set at 80 msec, only 116 (65.9%) of 176 lesions were correctly classified. and the sensitivity and specificity for HCC were 100% and 44.4%, respectively.

Discussion

The incidental detection of small hepatic lesions has increased with the increased use of screening ultrasonography. Differential diagnosis of these small lesions is very important, since HCC smaller than 2 cm are good candidates for curative surgical therapy or percutaneous ethanol injection and patients have fairly good outcome[7),8)]. Ultrasonography and CT with bolus injection of contrast material are widely accepted as useful and mandatory methods in the differentiation of cavernous hemangiomas from other hepatic malignancies. However, the detection rate of small hepatic lesions is influenced by the ultrasonographic technique, and there is some overlap between the ultrasonographic appearance of HCC and that of hemangioma. Dynamic CT in visualizing small hepatic lesions is usually disappointing, because of respiratory misregistration. Our previous study suggested that MR imaging with T2 measurement is a highly reliable method which is the examination of choice for differentiation of small cavernous hemangioma from HCC[3),4)]. The results of this study corroborate our previous data, and confirm the efficacy of T2 values and the importance of size-specific quantitative criteria.

However, two important provisos should be taken into consideration. The first is the limitation of the method used to obtain the T2 values examined in this study. The two-point method is very approximate, and the calculated values are also influenced by the strength

of the magnetic field, equipment and pulse sequences. We consider that the T2 values discussed in this article are only clinically significant and are valid only at 1.5 tesla.Other cutoff values might be necessary if other equipment or ther pulse sequences were used, even at 1.5 tesla. The second proviso is that the possibility of exceptional T2 prolongation in HCC probably due to increased water content, should always be kept in mind[9]. Differentiation of small hepatic lesions should be based upon all the information obtained clinically and radiologically including calculated T2 values.

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