Correlation of contrast enhancement speed of hepatic hemangiomas on gadolinium-enhanced dynamic T1-weighted images with apparent diffusion coefficient on diffusion-weighted imaging

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Introduction

The purpose of our study was to evaluate the relationship between the contrast enhancement speed of hepatic hemangiomas in gadolinium-enhanced MRI and the apparent diffusion coefficient (ADCs) on diffusion-weighted imaging (DWI).

Materials and Methods

A total of 31 hepatic hemangiomas were diagnosed in 24 patients. Diagnosis of hemangiomas were established with classical contrast enhancement pattern at MR and/or CT with no change in the size of the lesions for six months or more at serial CT. MR imaging was performed with a 1.5-Tesla system and a SENSE body coil. All patients were examined initially with a routine MRI protocol for the upper abdomen that included T2-weighted images, in- and opposed-phase T1-weighted images and dynamic T1-weighted images. Subsequently, Breath-hold fat-suppressed single-shot echo planar DWI was performed prior to performing dynamic T1-weighted imaging with the following parameters: TR/TE, 1338/66 ms; b factors, 0, 50 and 800 sec/mm^2; matrix, 112 × 88; field of view, 36 × 28 cm; acquisition of two signals; section thickness, 6 mm; section gap, 1 mm; receiver bandwidth, 2627 Hz; transverse plane with three directional diffusion gradients; SENSE parallel imaging factor, 2; acquisition time, less than 25 seconds for breath-hold acquisition.

Hemangiomas were classified into three groups according to the contrast enhancement speed of hepatic hemangiomas on gadolinium-enhanced dynamic T1-weighted images, which was determined by enhancing tumor volume of portal phase images; Group A, hemangiomas with rapid enhancement (>75%), Group B, intermediate enhancement (25%-75%), Group C, slow enhancement (<25%). ADC of each hepatic hemangiomas was measured. There was no significant difference among three groups in the size of hemangiomas ($P > 0.05$).

Results

On DWI with the high b value (800 sec/mm^2), there was a statistically significant difference in the ADC value of hemangiomas between Group A and Group C ($P = 0.005$). However, no significant difference was observed between Group A and C and between Group B and C ($p > 0.05$). In addition, there was no significant difference among three groups on DWI with low b value (50 sec/mm^2) ($p > 0.05$).

Table 1. The relationship between enhancement speed of hepatic hemangiomas and ADCs on diffusion-weighted images.

Enhancement Speed of Hepatic Hemangiomas	Size(cm)	ADCs on b=50sec/mm^2	ADCs on b=800sec/mm^2
Group A : Rapid (n=12)	1.43 ± 0.95	7.48 ± 0.65	2.34 ± 0.08*
Group B : Intermediate (n=10)	2.22 ± 0.34	6.74 ± 0.29	2.11 ± 0.13
Group C : Slow (n=9)	1.78 ± 0.37	6.43 ± 1.02	1.86 ± 0.49*

Note. *p < 0.05

Discussions

ADCs of hepatic hemangiomas are lower than those of hepatic cysts possible due to blood flow or perfusion within the hemangiomas. Degree of perfusion may be affected by speed of blood flow within the vascular spaces of hemangiomas and the differences of degree of intravoxel perfusion are reflected by ADC on DWI.

In our study, the ADC values were significantly higher in rapid enhancing hemangiomas (Group A) than slow enhancing hemangiomas (Group C) on DWI with high b value. We believe that the speed of contrast enhancement of hepatic hemangiomas may affect the ADC value on DWI using the high b value.

References

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2. Taouli B, Koh DM. Radiology 2010;254:47-66