Original Research

Diffusion-Weighted Imaging of the Liver: Optimizing *b* Value for the Detection and Characterization of Benign and Malignant Hepatic Lesions

Satoshi Goshima, MD, PhD,[1]* Masayuki Kanematsu, MD,[1,2] Hiroshi Kondo, MD,[1] Ryujiro Yokoyama, RT,[2] Kimihiro Kajita, RT,[2] Yusuke Tsuge, MD,[1] Haruo Watanabe, MD,[1] Yoshimune Shiratori, MD,[3] Minoru Onozuka, PhD,[4] and Noriyuki Moriyama, MD[5]

Purpose: To determine the optimal *b* values required for diffusion-weighted (DW) imaging of the liver in the detection and characterization of benign and malignant hepatic lesions.

Materials and Methods: MR images obtained in 76 patients including 28 malignant hepatic lesions (21 hepatocellular carcinomas and 7 metastases) and 27 benign lesions (12 hemangiomas and 15 cysts) were reviewed. DW-echo planner images (EPIs; *b* values with100, 200, 400, and 800 s/mm^2) were reviewed solely first, and then with T2-weighted EPIs (b = 0 s/mm^2).

Results: Sensitivity for malignant lesions (74%) was highest on DW-EPIs with *b* value of 100 s/mm^2 and T2-weighted EPIs combined ($P < 0.05$), and sensitivity for benign lesions (87%) was highest on DW-EPIs with *b* value of 800 s/mm^2 and T2-weighted EPIs ($P < 0.05$). Specificities were comparably high for all sequences. The *Az* values for malignant lesions were 0.94, 0.90, 0.87, and 0.89, and those for benign lesions were 0.91, 0.89, 0.87, and 0.94 on DW-EPIs with *b* values of 100, 200, 400, and 800 and T2-weighted EPIs combined, respectively. Hepatic cysts were clearly distinguished with the cutoff ADC value of 2.5 $\times 10^{-3}$ mm^2/s using a *b* value of 400 s/mm^2 or greater.

Conclusion: DW-EPIs with middle *b* values were not required in the detection and characterization of benign and malignant hepatic lesions.

Key Words: liver; MRI; diffusion
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DIFFUSION-WEIGHTED SEQUENCES are now widely used in magnetic resonance (MR) imaging of the liver. Parallel imaging technique can significantly improve the quality of echo-planar images by reducing the echo-train length necessary for image reconstruction, which significantly decreased image blurring. Several previous studies have suggested that measurement of apparent diffusion coefficient (ADC) was useful in the characterization of focal hepatic lesions and in the evaluation of diffuse liver disease (1–5). However, these previous studies also showed wide ranges of ADCs for abdominal organs and for focal hepatic lesions probably related to the different *b* values. To our knowledge, there have been no previous reports on optimal *b* values and on liver lesion detectability with diffusion-weighted imaging with different *b* values. The purpose of this study was to evaluate the observer performance with four different *b* values in the detection of benign and malignant hepatic lesions and determine the optimal *b* value required for diffusion-weighted echo-planar imaging (DW-EPI) of the liver.

MATERIALS AMD METHODS

Patients

During a 4-month period (December 2006 to March 2007), 79 consecutive patients suspected of having suspected liver disease (i.e., elevated tumor marker, elevated liver coenzyme, known malignancy out of the liver, hepatic lesions seen on ultrasound, or CT) underwent MR imaging of the liver which included diffusion-weighted MR imaging. The protocol in our study was

[1]Department of Radiology, Gifu University School of Medicine, Gifu, Japan.
[2]Department of Radiology Services, Gifu University School of Medicine, Gifu, Japan.
[3]Department of Medical Informatics, Gifu University School of Medicine, Gifu, Japan.
[4]Department of Physiology and Neuroscience, Kanagawa Dental College, Yokosuka, Japan.
[5]Research Center for Cancer Prevention and Screening, National Cancer Center Hospital, Tsukiji, Japan.
*Address reprint requests to: S.G., Department of Radiology, Gifu University Hospital, 1-1 Yanagido, Gifu 501-1193, Japan.
E-mail: gossy@par.odn.ne.jp
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