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Focal Sparing in Fatty Liver: Mimicking Hypervascular Tumor on Gadolinium-Enhanced Opposed-Phase Gradient-Echo Images[1]

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We describe the magnetic resonance imaging findings in a case of focal sparing in fatty liver that showed homogeneous hyperintensity on gadolinium-enhanced opposed-phase gradient-echo images and mimicked a hypervascular mass due to paradoxical suppression of signal intensity of surrounding liver parenchyma with fatty infiltration.

Index words : Liver, fatty
Liver, MR
Magnetic resonance (MR), chemical shift
Magnetic resonance (MR), contrast enhancement

Focal sparing in fatty liver is caused by decreased portal flow from the small intestine or arterioportal shunting of any kind (1 - 3). The imaging features characteristic of focal fat sparing include a wedge shape, lack of mass effect, and the presence of normal vascular structures (4). The condition usually occurs around the gallbladder fossa, the posterior edge of segment IV of the liver, the subcapsular portion of the liver, or the porta hepatis (2, 5). If focal fat sparing is round, and has an atypical location, differentiation from liver tumor may be difficult, however (6).

Opposed-phase gradient-echo magnetic resonance (MR) imaging has been useful in the diagnosis of fatty infiltration of the liver and the characterization of focal sparing in fatty liver (6, 7). The echo time (TE) of the opposed-phase sequence is usually shorter than that used in in-phase sequence. Therefore, the opposed-phase pulse sequence in gadolinium-enhanced dynamic MR imaging has several advantages because of its use of shorter TE, including a higher signal-to-noise ratio, fewer artifacts adjacent to the bowel, and more sections obtained per repetition time (TR) (8). There is, however, a potential pitfall in opposed-phase imaging following the administration of contrast agents, namely the paradoxical suppression of the signal intensity of fatty tissues (8). We describe the gadolinium-enhanced opposed-phase dynamic MR findings in a case of focal sparing in fatty liver that mimicked a hypervascular mass because of paradoxical suppression of signal intensity in the surrounding liver parenchyma with fatty infiltration.

Case Report

A 67-year-old man was referred for further evaluation of a hepatic mass discovered at ultrasonography (US). Upon admission, liver function tests were all normal except for slight elevation of aspartate aminotransferase (AST) and alanine aminotransferase (ALT). Hepatitis B surface antigen, hepatitis C antibody, alpha-fetoprotein, and carcinoembryonic antigen (CEA) were negative. Repeated US demonstrated increasing echogenicity of the liver and a hypoechoic lesion measuring 1.5×1.5 cm was seen in the right hepatic lobe (Fig. 1A).

For abdominal MR imaging, a 1.5 T scanner

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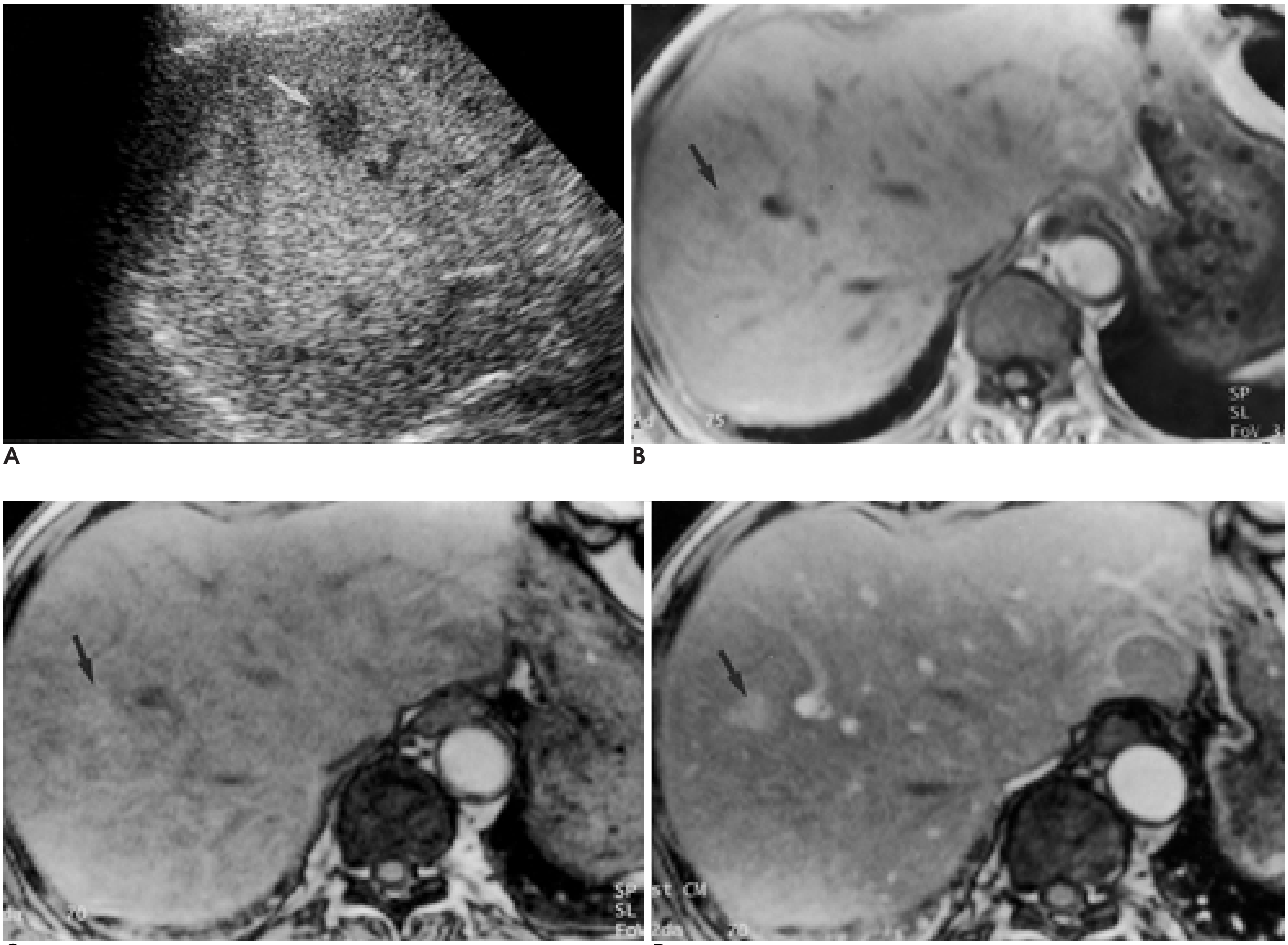
(Magnetom Vision, Siemens, Erlangen, Germany) was used. In-phase T1-weighted gradient-echo fast low-angle shot [FLASH] imaging with a repetition time/echo time of 187/4.8 and a flip angle of 75° showed that the liver was much more hyperintense than the spleen, and a focal hypointense lesion was seen in the right hepatic lobe (Fig. 1B). An opposed-phase T1-weighted gradient-echo (105/2.2, flip angle 70°) image showed this lesion to have slightly higher signal intensity than adjacent liver parenchyma (Fig. 1C). Three-phase, contrast-enhanced, opposed-phase T1-weighted gradient-echo (105/2.2, flip angle 70°) images obtained 10 secs, 40 secs, and 2 mins after the administration of 0.1 mmol/kg gadopentetate dimeglumine showed that the lesion was more hyperin-



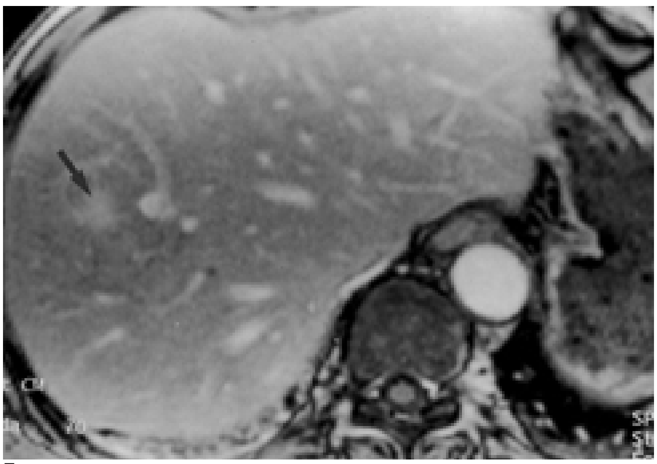


Fig. 1. A 69-year-old man with focal sparing in fatty liver.
A. Abdominal sonography shows a round-shaped hypoechoic mass (arrow) in the right hepatic lobe. The entire liver shows hyperechoic, indicating fatty liver.
B. In-phase T1-weighted MR image (187/4.8) shows a focal hypointense lesion in the right hepatic lobe (arrow).
C. On pre-enhanced opposed-phase T1-weighted MR image (105/2.2), this lesion is slightly hyperintense compared with adjacent liver parenchyma (arrow). Opposed-phase dynamic MR images obtained 10 sec (**D**) and 2 min (**E**) after administration of contrast agents show a homogeneously hyperintense lesion (arrow) in the right hepatic lobe.

tense than on unenhanced opposed-phase images, and measured 1.5 cm at all three phases of gadolinium-enhanced opposed-phase imaging (Figs. 1D, E). T2-weighted images (5000/83, 165) failed, however, to show the liver mass.

Although percutaneous US-guided biopsy was recommended because a hypervascular mass could not be excluded, the patient refused. Although he was not treated during follow-up, the hepatic lesion was not observed on liver sonography and abdominal MR images obtained five months later.

Discussion

Opposed-phase gradient-echo MR imaging is a technique which requires the selection of an echo-time to which the phases of water and fat are opposed. The sequence demonstrates relatively small amounts of fat deposition as loss of signal intensity relative to that of inphase images, thus permitting differentiation between focal sparing in fatty liver and a space-occupying lesion (6, 7).

In our case, however, the focal sparing in fatty liver was slightly hyperintense compared with adjacent liver parenchyma on opposed-phase images before the administration of contrast agents. The lesion, on the other hand, demonstrated high signal intensity on gadolinium-enhanced opposed-phase images. Thus, it mimicked hypervascular tumors such as hepatocellular carcinoma, focal nodular hyperplasia, and hypervacular metastases or arterioportal shunts. Although the lesion in our case was not pathologically or angiographically confirmed, we believe, for several reasons, that it is unlikely to have been a hypervascular tumors or arterioportal shunt. First, although our patient had undergone no treatment, the hepatic lesion was not revealed by sonography and MRI performed five months after initial sonography and MRI. Second, this patient's hepatic lesion was seen to have low signal intensity on in-phase T1-weighted gradient-echo images and a slightly high signal intensity on opposed-phase T1-weighted gradient-echo images. We think that this change of signal intensity indicates sparing in fatty liver. Third, in our case, the focal sparing in fatty liver was seen as a homogeneously high signal intensity on all three phases of gadolinium-enhanced opposed-phase imaging, a finding which is unusual for hypervascular tumors (9, 10). Addtionally, arterioportal shunts usually remain undetected during the portal and delayed phase (11). Thus, on the basis of the radiological and clinical findings, we believe that this hepatic lesion is focal sparing in fatty liver.

Although the exact cause of this finding in our case is unknown, we suggest that the paradoxical signal intensity suppression of liver parenchyma with fatty infiltration leads to pseudoenhancement of focal sparing in fatty liver. Mitchell et al found that because an increased water signal caused by contrast agents within fatty tissues eliminates the lipid signal through destructive interference, the signal intensity of severely involved portions of fatty liver seen on opposed-phase images following the administration of contrast agents may decrease (8). We therefore believe that the focal sparing seen in fatty liver in our case was more hyperintense on gadolinium-enhanced opposed-phase images due to the decreased signal intensity of the remaining liver parenchyma with fatty infiltration, rather than to increased blood flow or blood volume in the focal sparing in fatty liver.

Our case shows that due to paradoxical suppression of signal intensity in the liver parenchyma with fatty infiltration, the focal sparing in fatty liver seen on gadolinium-enhanced opposed-phase images may mimic a hypervascular mass. An understanding of this pitfall and its MR findings may help the misinterpretation of opposed-phase images and unnecessary percutaneous biopsy.

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지방간의 국소비침범: 역위상 경사에코를 이용한 가돌리늄 조영증강영상에서 과혈관성 종괴와 유사[1]

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양달모 · 김학수 · 김형식 · 진 욱 · 조성휘

역위상 경사에코(opposed - phase gradient - echo)를 이용한 조영증강 자기공명영상에서 주위 지방간의 역설적(paradoxical) 신호강도 감소로 인해 지방간의 국소비침범(focal sparing)이 균질한 고신호 강도로 보여 과혈관성 종괴와 유사하게 보였던 1예를 보고한다.