

Transient arterial enhancement in a hepatic peritumoral fat-spared area

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ABSTRACT

Early-enhancing areas that are perfusion abnormalities rather than tumor deposit are sometimes encountered on arterial dominant-phase images in multisection dynamic magnetic resonance imaging. Focal sparing in diffusely fatty liver is also a well recognized entity. However, both conditions occasionally create problems in the diagnosis of hepatic mass lesions. Familiarity with these abnormalities on ultrasonography and multisection dynamic magnetic resonance images is important to prevent misinterpretation of these pseudolesions as real masses. In addition, focal sparing can be the only clue for a space occupying lesion in the liver. We present here the ultrasonography and magnetic resonance imaging findings of a case with liver metastasis from pancreas cancer which caused a wedge-shaped fat-spared enhancing area on dynamic magnetic resonance imaging.

Key words: • fatty liver • tomography, X-ray, computed • tumor

Transient increased enhancement on hepatic arterial phase is a finding that appears secondary to perfusion abnormalities in biphasic computed tomography (CT) and magnetic resonance (MR) imaging examinations (1-3). This finding might reflect normal vascular differences of liver or microscopic or macroscopic balance variations at dual blood flow. The involved area can be observed in different forms depending on the etiology; however, there is no mass effect and the vessel structures in this area keep their normal courses. In terms of typical imaging findings, on hepatic arterial phase this area is brighter relative to other areas and returns to normal or close to normal density or intensity on portal phase images. This finding might also appear due to primary and secondary liver masses. This appearance is referred to as perilesional transient increased enhancement in the presence of existence of a mass and indicates a transient increase in the enhancement of liver parenchyma that is adjacent to the mass (1-6). Perilesional increased enhancement might be observed as a wedge-shaped or circumferential pattern.

Focal areas of fat sparing might accompany perfusion abnormalities and might be seen in a similar pattern at the existence of parenchymal involvement (7). Fat-spared areas might rarely develop due to liver masses (8-9). This finding is important since it can be the only finding in some cases, indicating the existence of a mass.

In this report, we aim to present MR imaging and ultrasonography findings of a case who had a mass lesion in the pancreas as well as liver metastases that showed perilesional and wedge-shaped perilesional increased enhancement distal to one of the metastatic lesions and accompanying wedge-shaped fat-spared area in the same region.

Case report

A 58-year-old man, who suffered from stomach ache for a month, was admitted to our department for ultrasonographic examination. Laboratory findings were within normal limits except the mildly elevated indirect bilirubin levels. In ultrasonographic examination, there were a 7x5x4-cm hypoechogenic, well-defined mass in the body and tail of pancreas, nodular lesions with target sign consistent with metastasis in the left hepatic lobe medial segment, right lobe anterior segment and right lobe posterior segment, and mild dilatation of intrahepatic bile ducts in the right lobe anterior segment and left lobe medial segment. In addition, grade 2 steatosis was seen in the whole liver parenchyma except for the right lobe anterior segment (Figure 1).

Following ultrasonographic examination, T2 weighted fat suppressed fast spin echo (TR/TE, 4000/110 msec), in phase (TR/TE, 140/4.5 msec, flip angle: 80°) and out of phase (TR/TE, 200/6.7 msec, flip angle: 80°), T1 weighted spoiled gradient echo (SGE) in transverse plane with 6

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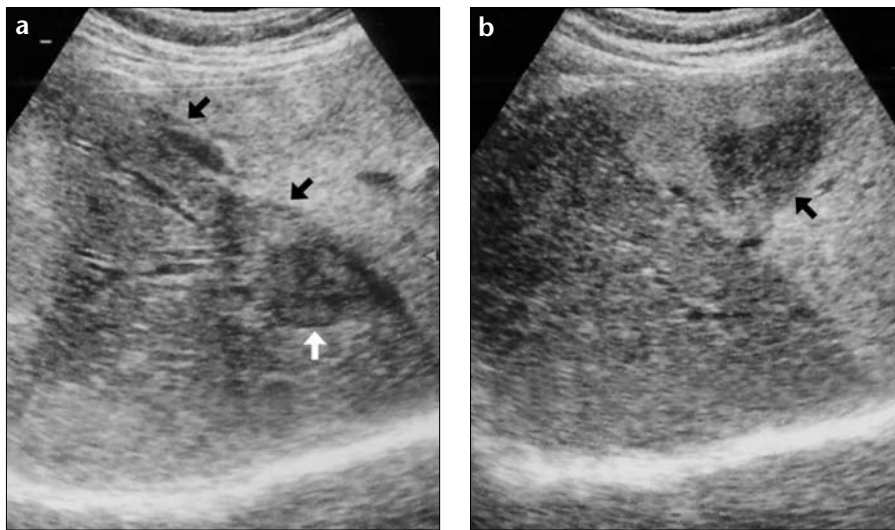


Figure 1. a, b. In transverse ultrasonography images, a well defined, hypoechoic fat-spared area (black arrows, a) and hypoechoic lesion consistent with metastasis at the apex of this area (white arrow) are observed. A second similar lesion (black arrow, b) is present within the fatty liver parenchyma.

mm slice thickness, and dynamic MR imaging examination following the contrast administration at 35th second, 60th second and 3rd minutes T1 weighted SGE (TR/TE, 200/4.5 msec, flip angle: 80°) sequences in transverse plane were performed (Figure 2). MRI examination was performed with a 1.5 T (25 mT/m) scanner. 0.01 mmol/kg intravenous contrast agent was administered. MRI examination revealed that the mass, which involved the proximal body and tail of pancreas, was hypointense on T1 weighted images, prominently hypointense relative to pancreas parenchyma on T1 weighted fat suppressed SGE, and slightly heterogeneous and hyperintense on T2 weighted images. Before contrast agent administration, three lesions with dimensions of 24x22 mm, 20x18 mm and 16x15 mm (anterior, posterior and mediolateral, respectively) were observed on T1 weighted SGE images in the same locations in liver as were described by ultrasonography (Figure 2c). Lesions were observed as hyperintense on T2 weighted images (Figure 2a). Out of phase images revealed fat suppression consistent with those regions that were observed to be consistent with fatty liver by ultrasonography (Figure 2b). Right lobe anterior segment of the liver was observed as a non-suppressed wedge-shaped focal area of fat sparing by the fat suppression technique. In this area, relatively more enhancement is detected compared to other paren-

chymal areas at 35th second images in dynamic examinations (Figure 2d). One of the nodular lesions described above was present at the apex of this region. Following contrast administration, ill-defined rim enhancement in the parenchyma at the periphery of the nodular liver lesions was observed. In 35th second image, dimensions of the lesions were measured as 29 x 26 mm, 25 x 23 mm and 19 x 18 mm (anterior, posterior and mediolateral, respectively). In 60th second image, this parenchymal enhancement faded prominently but rim enhancement was observed in the lesion itself (Figure 2e). Intrahepatic bile ducts in the right lobe anterior segment were mildly dilated. In the light of these findings, CT-guided fine needle aspiration biopsy of the pancreatic mass was performed. The histopathological findings of the biopsy were consistent with adenocarcinoma characterized with atypical cells.

Discussion

Increased focal enhancement on arterial phase images in dynamic MRI examinations develops due to perfusion abnormalities rather than tumoral deposits. Possible etiologic causes of this finding are compression, obstruction, or iatrogenic ligation of portal vein as well as obstruction of hepatic vein, existence of arteriportal shunts, plumbing effect of hypervascular tumors, aberrant venous drainage, inflammatory changes, percutaneous alcohol injection or needle

biopsy, and cirrhosis (1-3). Perilesional increased enhancement due to masses might be seen as wedge-shaped or circumferential pattern (4-6). Wedge-shaped lesions are lobar, segmental or subsegmental and they frequently have well-defined borders. Such perilesional enhancement pattern is seen often with the metastasis of pancreas adenocarcinoma. It is thought that the wedge-shaped increased transient enhancement might develop due to prevention of portal venous flow by thrombus or compression of a mass resulting in increase in the hepatic arterial flow or due to excessive plumbing effect of a hypervascular tumor (1, 2, 4, 5). Ferguson, in cirrhotic patients, showed increase in hepatic arterial blood flow following transient ligation of portal vein by operation (10). Location of mass may be helpful in differentiation of these two mechanisms. While the mass is observed at the apex of the increased enhancement area in the case compression of portal vein due to a mass lesion; mass is seen to be located inside this area in case of plumbing effect by hypervascular tumors (4-6). Since we did not detect thrombus of portal vein neither proximal nor distal to the lesion in T2 weighted images, we thought that the increased enhancement occurred due to compression of metastatic lesion of portal vein. However, we could not confirm our assumption with angiography or CT arteriportography, since these are invasive methods.

Circumferential perilesional increased enhancement often has ill-defined contours and can be seen due to metastasis of colon carcinoma and, rarely due to metastasis of pancreas adenocarcinoma, lymphoma, and breast carcinoma (4, 6). In a study that compares MRI and pathologic findings, atrophy of hepatic cords, desmoplastic reaction, infiltration of eosinophils and lymphocytes, and vascular proliferation have been detected in the perilesional increased enhancement areas (5). It has been postulated that perilesional perfusion increase may occur due to parenchymal release of some local factors secondary to cell inflammation around the lesion (5). Perilesional enhancement can cause the lesions to be evaluated as bigger than their actual size (4-6). The awareness of such pseudo increase of lesion size is important for planning of surgery, for determining of applicability

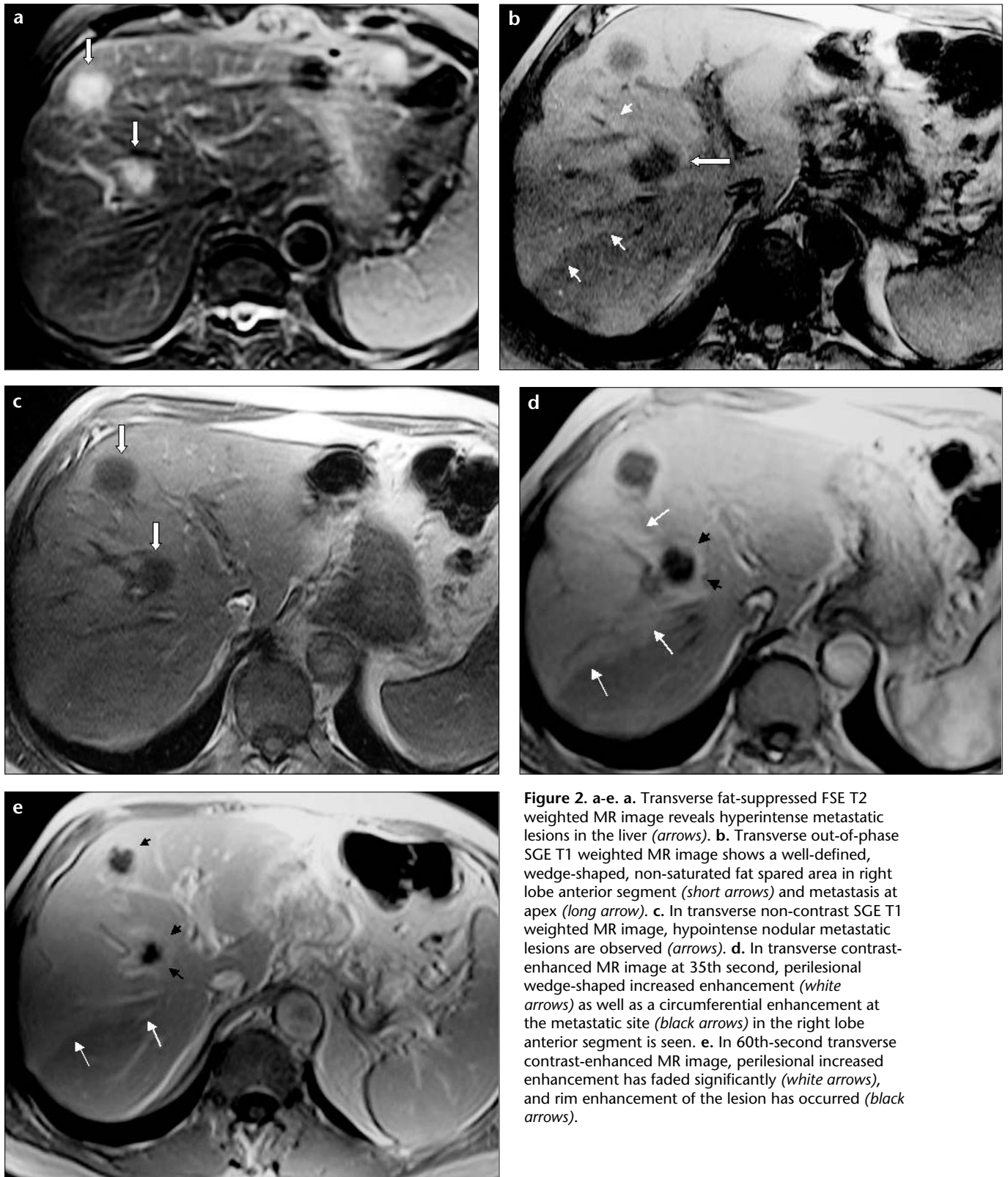


Figure 2. a-e. **a.** Transverse fat-suppressed FSE T2 weighted MR image reveals hyperintense metastatic lesions in the liver (*arrows*). **b.** Transverse out-of-phase SGE T1 weighted MR image shows a well-defined, wedge-shaped, non-saturated fat spared area in right lobe anterior segment (*short arrows*) and metastasis at apex (*long arrow*). **c.** In transverse non-contrast SGE T1 weighted MR image, hypointense nodular metastatic lesions are observed (*arrows*). **d.** In transverse contrast-enhanced MR image at 35th second, perilesional wedge-shaped increased enhancement (*white arrows*) as well as a circumferential enhancement at the metastatic site (*black arrows*) in the right lobe anterior segment is seen. **e.** In 60th-second transverse contrast-enhanced MR image, perilesional increased enhancement has faded significantly (*white arrows*), and rim enhancement of the lesion has occurred (*black arrows*).

of minimally invasive therapy alternatives, and for evaluation of response to therapy. In our case, we observed an increase in the size of metastatic lesion following contrast agent administra-

tion on arterial phase images and we evaluated this increased enhancement to be consistent with perilesional enhancement.

Similar to transient increased enhancement, fat-spared areas may also be observed to be of lobar, segmental or subsegmental or circumferential pattern (7-9). It is thought that hepatic

steatosis occurs due to insulin, fat or toxins (alcohol, chemotherapy drugs, etc.) that reach liver via portal vein (7, 11). Different studies postulated that heterogeneous fatty liver and focal fat-spared areas might develop secondary to regional differences in portal venous blood flow. Marianne et al. and Aria et al. presented the cases where they observed decrease in portal blood flow at liver parenchyma surrounding the mass as well as fat-spared areas in the same regions (7, 8). Based on this information, we thought that decrease in portal vein blood flow and, therefore, decreased amount of fat, toxins or insulin delivered to this region might explain the occurrence of fat-spared area in our case.

Segmental, lobar or increased perilesional enhancement in the liver might be observed in dynamic CT and MRI examinations. It is thought that segmental or lobar areas of increased enhancement and increased perilesional enhancement develop secondary to perfusion abnormalities or due to some substances that are released

by the inflammatory cell infiltration surrounding tumors. Perfusion abnormalities might cause focal steatosis or fat-spared areas due to variation of portal vein blood flow in the liver. Since loss of differences in echo patterns in these areas can suggest an undetected underlying tumor; it is important to know that this finding can be observed in the presence of primary or secondary hepatic tumors thus emphasizing the necessity of further examination.

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