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Multiple echogenic liver masses from multifocal nodular steatosis in a 55-year-old male with chronic hepatitis C

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Hepatic steatosis is often seen in patients with hepatitis on screening ultrasound as generalized increased liver echogenecity. However, its nodular form can present as multiple echogenic masses, which can mimic hepatocellular carcinoma or metastasis by ultrasound and computed tomography. Small hepatocellular carcinomas are often hyperechoic and have a trend towards lower alpha-fetoprotein levels. Magnetic resonance imaging can accurately identify microscopic fat within the lesions and demonstrate lack of associated enhancing soft tissue. If this entity is not appropriately characterized using magnetic resonance imaging, it can lead to additional imaging workup and unnecessary biopsy.

Case report

An otherwise asymptomatic 55-year-old man with chronic hepatitis C, status postantiviral treatment with a normal alpha-fetoprotein (AFP), presented for routine followup ultrasound (US) screening to exclude hepatocellular carcinoma (HCC). Previous screening US demonstrated a diffusely fatty liver but no focal liver lesions to suggest HCC. US tests performed at the time of presentation showed multiple small round homogeneous hyperechoic liver masses in both lobes without associated mass effect or posterior acoustic enhancement (Fig. 1). No internal vascularity appeared on Doppler evaluation. Subsequent magnetic resonance imaging (MRI) showed multiple small, irregular areas of signal loss on the opposed-phase compared to the in-phase sequence (Figs. 2A-D), consistent with multifocal areas of focal fat deposition. A fat-suppressed T2-weighted fast-spin-echo (FSE) image sequence showed homogeneous liver parenchyma without any focal lesions (Fig. 2E). Contrast-enhanced axial 3-D fat-suppressed fast-gradient-echo (GRE) images using gadobenate dimeglumine (MultiHance, Bracco) did not show arterial phase

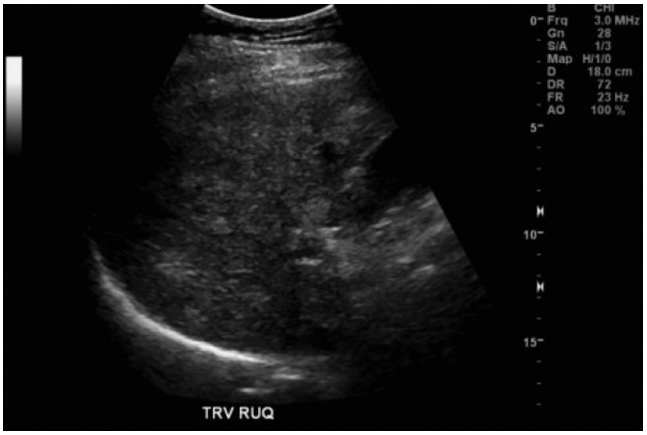

Figure 1. A 55-year-old man with chronic hepatitis C and multifocal nodular steatosis. US shows multiple focal hyperechoic hepatic masses.

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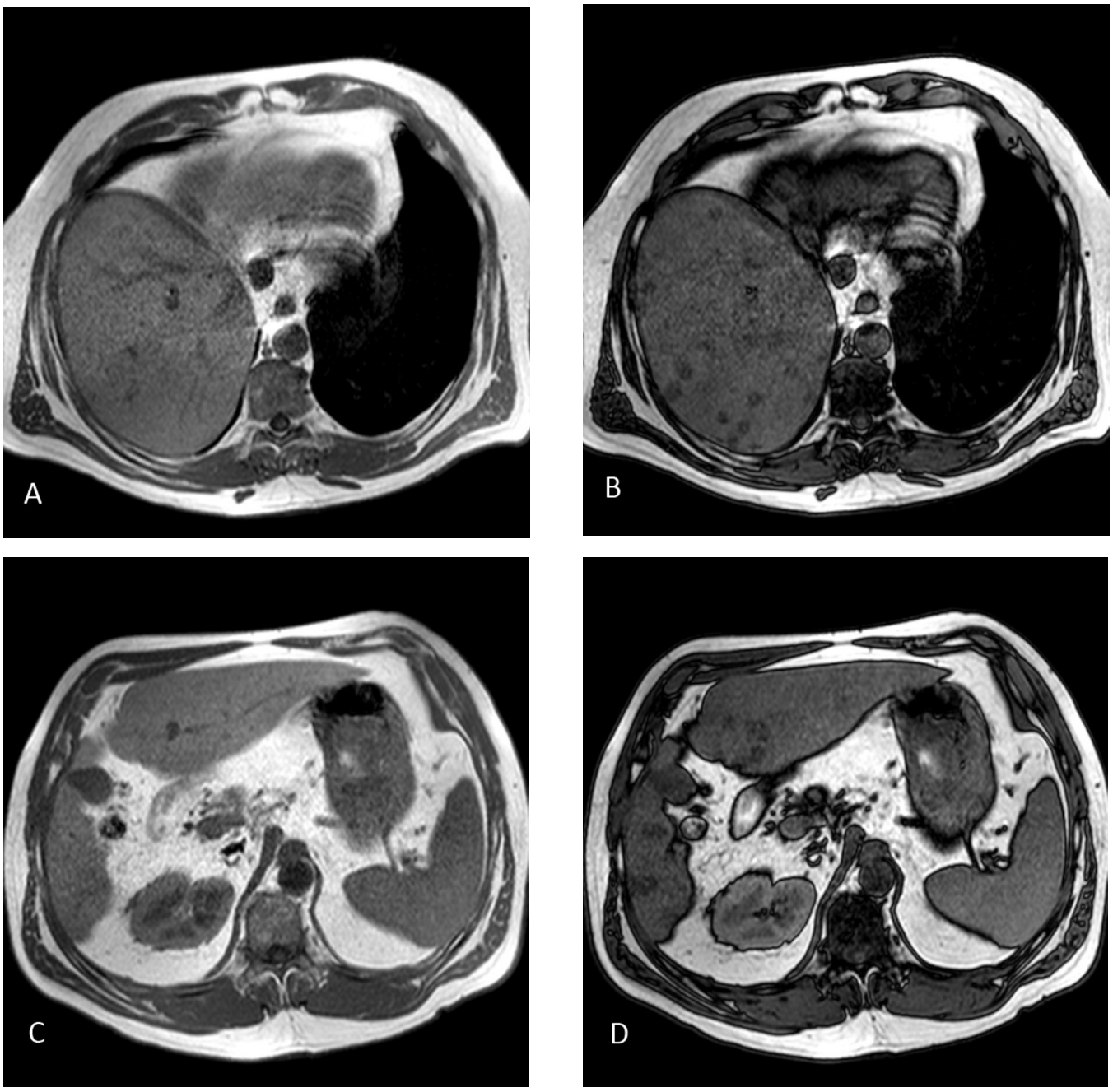


Figure 2, A-D. A 55-year-old man with chronic hepatitis C and multifocal nodular steatosis. Axial MRI images at two levels show multiple small, irregular areas of signal loss on the opposed-phase compared to the in-phase sequence, consistent with multifocal areas of focal fat deposition

enhancement or washout on the portal venous phase (Fig. 2F, G) to suggest HCC. Since accurate characterization was done using MRI, a biopsy was not performed. The patient is currently being followed up using MRI and has not developed a HCC.

Discussion

Hepatic steatosis is a common finding with many different imaging characteristics. It is usually diffuse or geographic but can be focal and, rarely, multifocal (1). When multifocal, it can mimic metastasis or HCC as seen on US and computed tomography (CT), which are used as screening tools for at-risk populations. If hepatic steatosis is not recognized, unnecessary biopsy can result. Accurate diag-

Figure 2E. A 55-year-old man with chronic hepatitis C and multifocal nodular steatosis. Fat-suppressed T2-weighted fast-spin-echo (FSE) sequence shows a homogeneous liver parenchyma without any focal lesions.

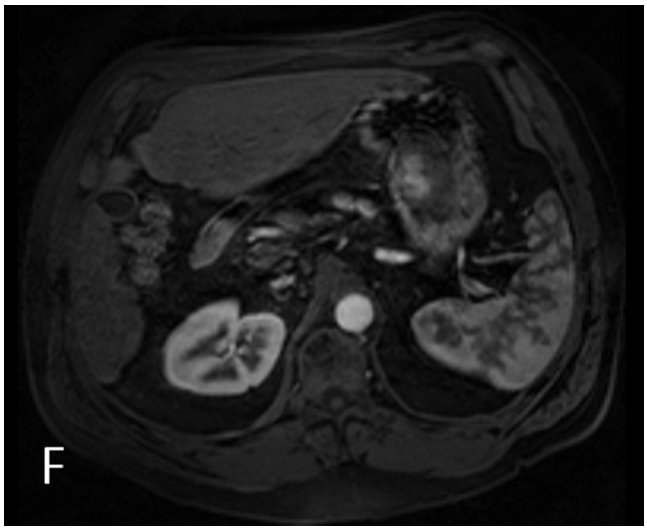
nosis depends on detection of microscopic fat within the lesions, coupled with a lack of associated enhancing soft tissue.

Fat seen on US is mostly hyperechoic, although in some areas it may be hypoechoic. Hyperechoic lesions seen on US can be classified based on presence or absence of a peripheral hypoechoic halo. Although some lesions have a variable appearance, the two most common lesions that are hyperechoic without a halo are focal fat and hemangioma (2-4).

Focal fatty infiltration often occurs in characteristic locations such as in the gall bladder fossa, adjacent to the falciform ligament, and anterior to the portal vein bifurcation in segment 4 (4, 5). Margins of focal fat are geographic, and vessels are seen to course normally through the area of fatty infiltration without displacement or encasement. A typical cavernous hemangioma is uniformly echogenic with sharp margins, without a capsule, and with a hypoechoic halo. Posterior acoustic enhancement may be seen if these are larger than 3 cm in size, but larger lesions can have atypical appearances on US (6). On Doppler imaging, there is absent to minimal flow within, but these lesions are never hypervascular. Such an appearance is diagnostic and is seen in approximately 80% of hemangiomas. Both these lesions are benign, but when they are multifocal, further imaging is needed to exclude metastatic disease or multifocal HCC (especially if there is underlying malignancy, hepatitis, cirrhosis, or chronic liver disease). A hypoechoic halo around a liver lesion is suspicious for malignancy and was not present in our case (4).

Small HCCs have variable US echogenecity (4, 7, 8). These can be hypoechoic, hyperechoic, or isoechoic, or can have a nodule-in-nodule appearance, with the hypoechoic pattern being the most common. The hyperechoic pattern is more common in hepatitis C-related cirrhosis and in patients under 69 years, and it has a trend towards lower AFP levels (9) .

On CT, fat is hypodense relative to the liver, with attenuation values ranging from -10 to -100. A hypodense appearance on CT makes differentiation from focal liver tumor or metastatic disease difficult when the lesions are



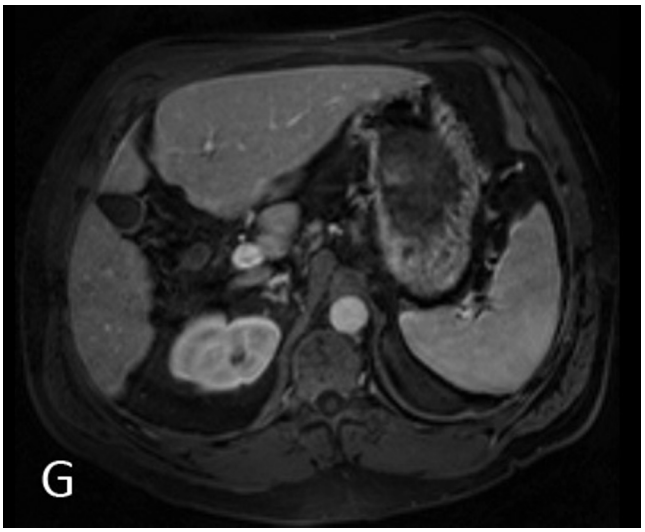


Figure 2F, G. A 55-year-old man with chronic hepatitis C and multifocal nodular steatosis. Contrast-enhanced axial 3-D fat-suppressed fast-gradient-echo images do not show areas of arterial enhancement or washout on the portal venous phase to suggest HCC.

multifocal. A central core of normal-appearing hepatic tissue within focal areas of fatty replacement (reversal of the typical tumor necrosis pattern) suggests hepatic steatosis (10). However, the most specific imaging technique to demonstrate the presence of fat is MRI.

MRI using fat suppression and chemical shift imaging with opposed-phase sequences can detect even a small amount of fat within lesions. During the in-phase, lipid and water signals are additive, but in the opposed-phase, the signal consists of the water signal minus the lipid signal, allowing detection of small amounts of fat (11).

The differential for liver lesions with only intracellular fat, without associated soft tissue, is small and consists of benign lesions such as focal steatosis, multifocal nodular steatosis, and some adenomas. Focal nodular hyperplasia (FNH) may have areas of intracellular fat, but has associated soft tissue. Angiomyolipoma (AML) and adenoma can have both microscopic and macroscopic fat. HCCs have an associated soft-tissue component but can have both intracellular and macroscopic fat. In general, hepatic metastases (with the exception of liposarcomas) do not contain fat, though some cases have been reported. These are associated with a soft-tissue component (12).

Fat is demonstrated in 10% of hepatic adenomas on CT and in 36% to 77% on MRI (13-16). However, they can be heterogeneous from necrosis, old hemorrhage, or calcification and can demonstrate early arterial enhancement with a centripetal pattern due to subcapsular feeding vessels. Enhancement does not persist because of arteriovenous shunting. Lack of uptake in the delayed phase using hepatocyte-specific contrast agents (gadolinium benzyloxypropionictetraacetate, Gd-BOPTA) distinguishes them from FNH (13).

HCC is the most common malignant primary liver tumor. Fatty change in HCCs is seen in up to 35% of small HCCs (12, 17). Smaller HCCs usually have diffuse fatty change, while larger HCCs have patchy fatty change (5). Hyperintensity on T1-weighted images may relate to intratumoral fat or hemorrhage, or to copper or zinc content of the surrounding liver parenchyma (18).

FNH is the second most common benign liver lesion after hemangioma; it is often incidental, and occurs in young asymptomatic women. On US, these are isoechoic and may show the characteristic "spoke-wheel" vascularity on color Doppler US (19). Fat within these lesions is rare, usually patchy, rarely peripheral, and may be associated with underlying fatty liver (20). On CT and MRI, FNH demonstrates intense homogeneous enhancement with rapid washout. A central scar bright on T2-weighted images with delayed enhancement is characteristic (12).

Hepatic involvement in Langerhans-cell histiocytosis is uncommon; it is seen in extensive disease and is associated with a high mortality rate. These lesions can look identical to multinodular hepatic steatosis but are characteristically located in the periportal regions with mass effect. This diagnosis should be considered if there are stigmata of the disease such as cutaneous, osseous, or pulmonary lesions with diabetes insipidus or pituitary insufficiency (12, 21).

Hepatic lipomas are rare, usually asymptomatic, with imaging characteristics typical of lipomas. Fat is present in only 50% of hepatic AMLs (22). Adrenal rest tumors are usually subcapsular, and they often contain macroscopic fat with briskly enhancing soft tissue. They can be difficult to distinguish from fat-containing HCCs (12).

In conclusion, we present the US and MRI findings for multifocal nodular steatosis and review the differential diagnosis of liver lesions containing microscopic fat. In high-risk patients, liver masses seen on screening raise the possibility of HCC. MRI has an advantage over other modalities because of its superior soft-tissue characterization. The use of various MRI sequences allows for a confident diagnosis of multifocal nodular steatosis. Awareness of imaging findings of this entity can avoid further workup and liver biopsy.

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