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Multiple liver pseudotumors due to hepatic steatosis and fatty sparing: A non-invasive imaging approach

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ABSTRACT

Hepatic steatosis is a frequent benign liver condition that can be idiopathic or secondary. The degree of fatty liver infiltration can be focal, diffuse or patchy. In this study, we present two patients with hepatic steatosis and multiple nodular liver lesions, due to fatty infiltration and fatty sparing respectively, mimicking a primary tumor or metastases ("pseudotumors").

Since the differential diagnosis of this kind of lesions can be difficult based on imaging alone, the knowledge of Contrast-Enhanced Ultrasound (CEUS) and Magnetic Resonance Imaging (MRI) findings may help radiologists to avoid an incorrect diagnosis of liver tumor, and unnecessary biopsies.

1. Introduction

Hepatic steatosis is a benign condition characterized by diffuse or focal fatty infiltration of the liver parenchyma. It is mostly idiopathic but it has been often related to obesity, diabetes mellitus, alcohol use, hepatitis, starvation, steroid therapy or parenteral nutrition [1]. The degree of the fatty infiltration can be focal, diffuse or patchy [2]. In this study, we present two patients with hepatic steatosis and multiple nodular liver lesions due to fatty infiltration and fatty sparing respectively, mimicking a primary tumor or metastases ("pseudotumors").

1.1. Case 1

A 49-year-old man was referred to our Institution for left pelvic pain associated with rectal bleeding. His past medical history included tabagism and hypertension. He had no history of diabetes mellitus, alcohol consumption or steroid therapy.

Laboratory tests revealed leukocytosis (white blood cells count 12.500/mm^3) and mild anemia (Hb 10.3 g/dl).

The contrast-enhanced abdominal CT scan (Astelion 16-multislice CT System; Toshiba, Kawasaki, Japan) showed a mass-like thickening of the sigmoid colon wall with isolated diverticula and fat stranding. Multiple hypodense focal lesions of the liver with a maximum diameter of 2.5 cm were also noticed in both hepatic lobes (Fig. 1a–c). The CT findings were suggestive for a sigmoid cancer with liver metastases.

Two days later the patient underwent colonoscopy which revealed chronic diverticulosis with acute inflammation foci of the sigmoid bowel wall, but no findings suspicious for malignancy. Therefore, the patient underwent medical therapy consisting of anti-inflammatory drugs and antibiotics, with complete resolution of the symptoms in few days.

In order to further investigate the liver lesions, a CEUS (iU22 Ultrasound System, Philips Medical System, Best, the Netherlands) was performed 1 month later. US images showed several hyperechoic nodules in both liver lobes (Fig. 1d). The Doppler-US revealed a vein entering the lesion (Fig. 1e). After the i.v. administration of 2.4 ml of contrast medium (SonoVue, Bracco, Milan, Italy) the nodules showed the same hemodinamic behavior of the surrounding liver in the arterial, portal and delayed phases appearing isoechoic to the liver (Fig. 1f, Video 1). Therefore, a diagnosis of multinodular steatosis was made.

An ultrasound (US) follow-up performed at 6 and 12 months demonstrated the stability of the liver nodules.

1.2. Case 2

A 66-year-old woman with a history of breast cancer treated with hormone therapy was referred to our Institution for a 6-month follow-up CT exam. The CT images (SOMATOM Definition AS 128-Lines

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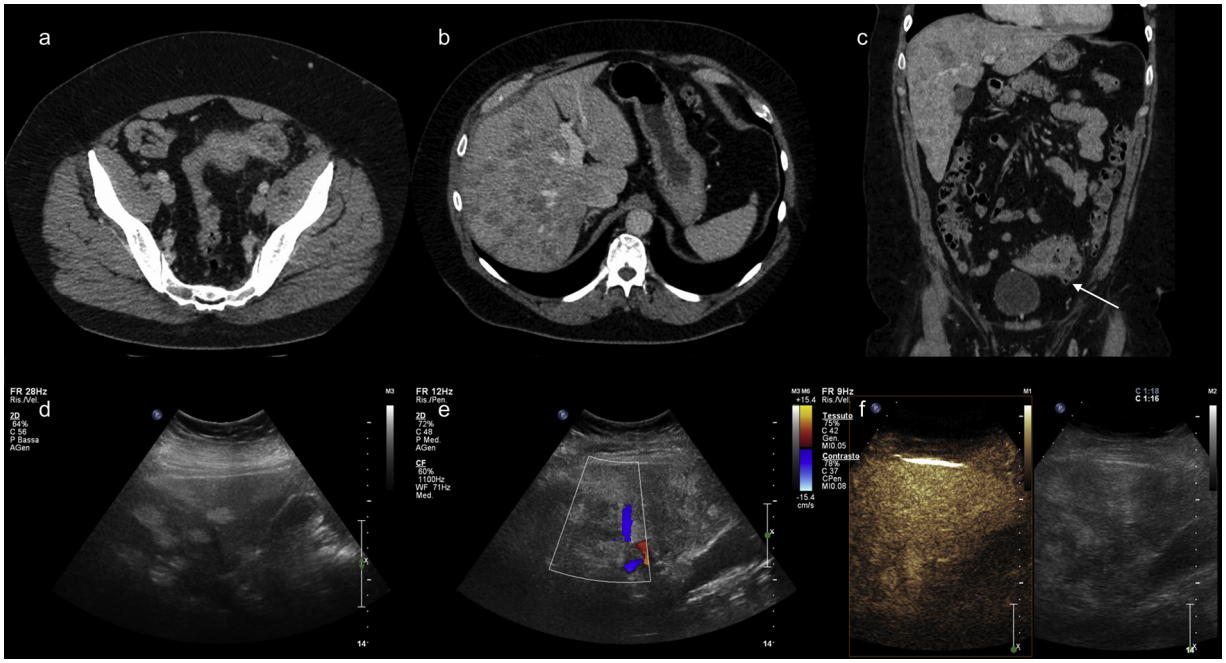

Fig. 1. Axial (a, b) and coronal (c) CT and CEUS (d, e, f) images in a 49-year-old man with rectal bleeding and left pelvic pain. CT exam shows a mass-like thickening of the sigmoid colon wall (a) with isolated diverticula (white arrow in c) and multiple hypodense nodules of the liver (b, c). These findings were suggestive for a colon cancer with liver metastases. CEUS images shows several hyperechoic nodules in both liver lobes (d) and a vein entering the nodule was noted on the Doppler-US (e). After the intravenous contrast administration, the nodules appeared isoechoic in all vascular phases (f) to the surrounding liver and a diagnosis of multinodular steatosis was made.

multislice CT System; Siemens Healthineers, Germany) showed a 1.8 cm lung nodule, stable from the previous CT exam and consistent with metastasis, along with multiple lytic bone metastases. Additionally, a new 1.2 cm hypovascular nodular lesion was noted in the VI liver segment, suspicious for metastasis.

A consensus meeting between radiologists and oncologists led to further investigate the liver lesion with a CEUS (iU22 Ultrasound System, Philips Medical System, Best, the Netherlands) (Fig. 2f, i, Videos 2.1 and 2.2). The US examination demonstrated diffuse hepatic steatosis with multiple slightly hypoechoic liver nodules with a hyperechoic peripheral halo, in both lobes. After the i.v. administration of 2.4 ml of contrast medium (SonoVue, Bracco, Milan, Italy) these focal lesions were homogeneously iso-enhancing to liver parenchyma in all vascular phases, and were thus interpreted as nodular fat-sparing areas. In addition, a 1.2 cm hypovascular nodule in the VI segment was noted in the portal-venous phase. This lesion was already detected in the previous CT examination, and therefore its secondary nature was confirmed.

In order to support the CEUS findings and investigate the presence of any other potentially unseen liver metastasis, the patient was further investigated with an MRI (Fig. 2a–e, g, h). On MRI (Achieva 1.5 T Scanner, Philips Medical System, Best, the Netherlands), all the lesions previously described by CEUS were poorly visualized on T2-weighted, fat-saturated T2-weighted and dynamic gadolinium-enhanced T1-weighted images, with an exception for the metastatic nodule in the VI segment. On opposed-phase T1-weighted images, the liver showed diffuse reduction in signal due to “patchy” distribution of the steatosis. Moreover, on the same images, multiple slightly hyperintense nodules with a peripheral signal drop were detected, and a final diagnosis of fatty sparing nodules was made. No other liver nodules suspected for metastases were detected.

A 6-month and a 12-month follow-up MRI exams showed the substantial stability of the liver nodules interpreted as fatty sparing nodules, and a slight increase in size of the metastatic nodule in the VI segment.

2. Discussion

Fatty infiltration and fat-sparing areas in the liver may occasionally show a multinodular appearance on imaging, mimicking a multifocal primary tumor or multiple metastases [1,3]. Therefore, they are often named liver “pseudotumors” [1,4]. Further differential diagnoses include lymphoma, abscesses, candidiasis, hemangiomatosis and biliary amartomas [5].

The pathogenesis of the hepatic steatosis may be related to vascular supply alterations forcing hepatocites close to central veins to accumulate lipids earlier compared to those in the peripheral liver parenchyma [6]. On the other hand, fat sparing areas may represent the result of local vascular anatomical variations occurring mostly in some typical regions, such as those adjacent to the falciform ligament and near the gallbladder [3].

Although a certain interest on this peculiar pattern of presentation was recently developed in literature, the incidence of the multinodular pattern of hepatic steatosis is currently unclear [7]. Moreover, most of these studies are focused on a single imaging modality [4,8–18]. On the other hand, to the best of our knowledge, only two studies on multinodular fatty sparing, were reported in literature in the last 20 years [1,19].

Our cases underlined the role of CEUS as an effective tool both in the detection and differential diagnosis of focal hepatic lesions in patients with liver steatosis [20–22]. The liver metastasis described in Case #2 was detected on CEUS as hypoechoic lesions in the portal-venous phase while the fatty changes of the liver were homogeneously iso-enhancing to liver parenchyma in all vascular phases [23]. Furthermore, due to its superior soft tissue resolution, MRI is becoming the most successful modality for the diagnosis of hepatic metastases [24]. In line with Tom et al., MRI and more specifically the “in and out-of-phase” images were crucial in Case #2 for the differential diagnosis between liver metastases and fatty sparing nodules. In fact, fatty sparing areas were poorly visualized on T2-weighted, fat-saturated T2-weighted and dynamic gadolinium-enhanced T1-weighted images. Conversely, on opposed-phase T1-weighted images, they were clearly

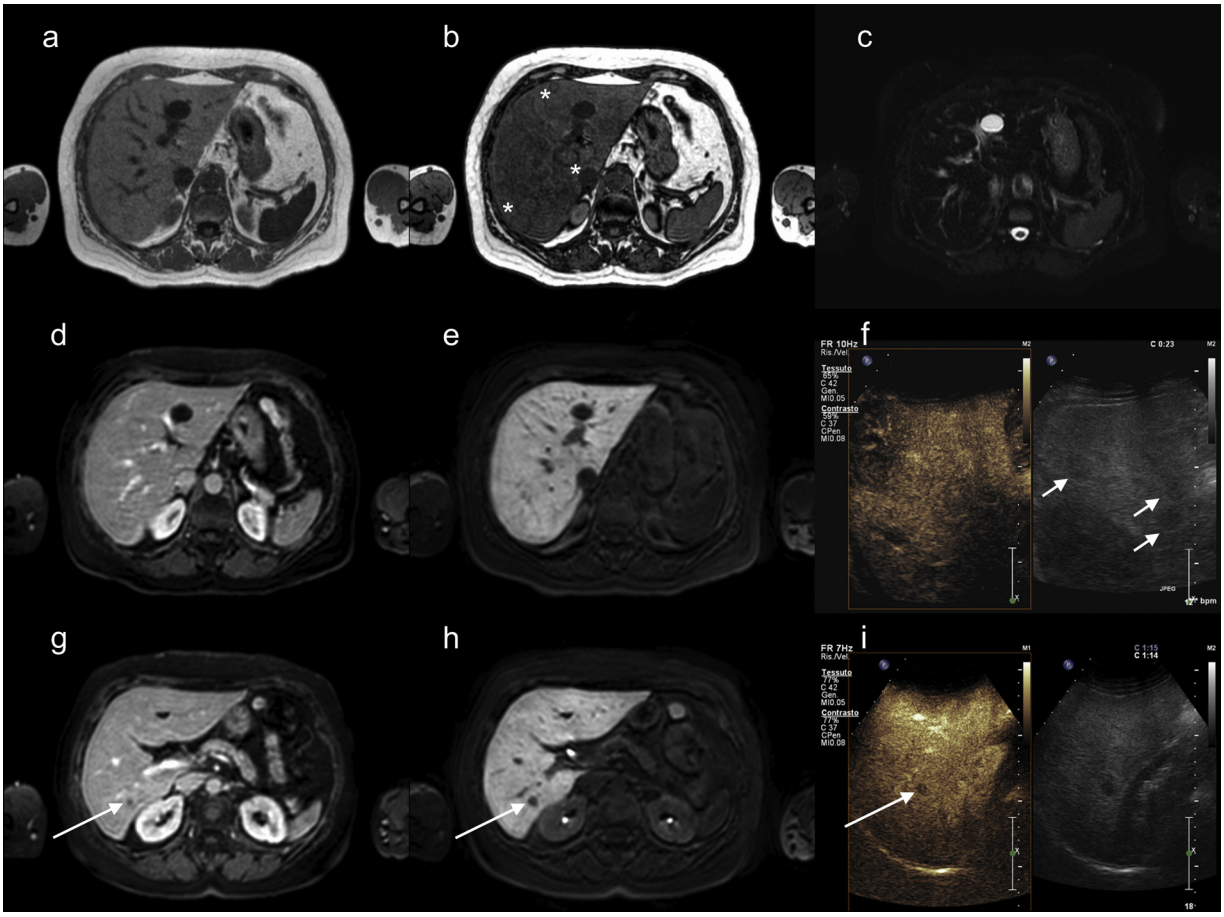

Fig. 2. Contrast-enhanced MRI (a–e, g, h) and CEUS (f, i) images in a 66-year-old woman with a breast cancer treated with hormone therapy.
Opposed-phase T1-weighted images (b) showed diffuse reduction in signal compared to in-phase T1-weighted images (a), due to "patchy" liver steatosis. Moreover, in both liver lobes, multiple slightly hyperintense nodules (*white asterisks* in b) with a peripheral signal drop (Fig. 1 f, g) were detected. The same nodules appeared isointense to the surrounding liver in the delayed hepatobiliary phase (e) and slightly hypoechoic with hyperechoic peripheral halo (*right white short arrows* in f) on US. On CEUS, they were homogeneously iso-enhancing to liver parenchyma in all vascular phases (*left white asterisk* in f). A diagnosis of multinodular fatty sparing was made.
In the VI liver segment a one-centimeter diameter hypovascular nodule in the portal-venous phase (*white arrow* in g, *white arrow* in i) that appeared hypointense in hepatobiliary phase (*white arrow* in h) was interpreted as metastasis. A cyst was detected in between the III and IV liver segments (c).

detected as areas of relative hyperintensity compared with the diffuse reduction in signal of the remaining fatty liver. On the other hand, metastases usually appears slightly hyperintense on T2-weighted images, may show a rim enhancement with i.v. contrast administration and do not show contrast uptake during the hepatobiliary phase with hepatospecific contrast agents [1].

In this context, it is important to underline how the radiologist's assessment should be always consistent with the patient's clinical condition and medical history. For instance, in Case #1 (no oncologic history), the result of colonoscopy definitely helped excluding the presence of malignancy. Moreover, in light of the CEUS findings, further investigations were not necessary. On the other hand, for Case #2 (history of breast cancer), albeit the CEUS findings were suggestive for a benign lesion, MRI was mandatory for a conclusive diagnosis. In both cases, unnecessary biopsies were avoided.

3. Conclusion

In conclusion, this report underlined the role of CEUS and MRI for a non-invasive diagnosis of liver pseudotumors due to the coexistence of hepatic steatosis and fatty sparing. Since the differential diagnosis of this kind of lesions can be difficult on imaging alone, the knowledge of CEUS and MRI findings may help radiologists to avoid incorrect diagnosis of liver tumor and unnecessary biopsies.

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Ethical approval

Procedure performed in this report involving human participant was in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from the patients.

Conflict of interest

Authors declare that they have no conflict of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ejro.2019.01.002.

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