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

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1. Introduction

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”).

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 ta-bagism and hypertension. He had no history of diabetes mellitus, alcohol consumption or steroid therapy.

Laboratory tests revealed leukocytosis (white blood cells count 12.500/mm³) 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). The 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 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).

An ultrasound (US) follow-up performed at 6 and 12 months demonstrated the stability of the liver nodules.
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 hepatocytes 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
detected as areas of relative hyperintensity compared with the diffuse reduction in signal of the remaining fatty liver. On the other hand, metastases usually appear 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.
References

[1] W.W. Tom, et al., Hepatic pseudotumor due to nodular fatty sparing: the diagnostic role of opposed-phase MRI, AJR Am. J. Roentgenol. 183 (3) (2004) 721–724.

[2] C.K. Yates, R.A. Streight, Focal fatty infiltration of the liver simulating metastatic disease, Radiology 159 (1) (1986) 83–84.

[3] P.O. Decarie, et al., Fatty liver deposition and sparing: a pictorial review, Insights Imaging 2 (5) (2011) 533–538.

[4] G.D. Tebala, et al., Multifocal nodular fatty infiltration of the liver mimicking metastases on CT: imaging findings and diagnosis using MR imaging, Eur. Radiol. 10 (7) (2000) 1095–1100.

[5] H. Ishida, et al., Multinodular fatty change in the liver in patients with chronic hepatic porphyria, Abdom. Imaging 24 (5) (1999) 481–483.

[6] H. Hashimoto, et al., Multifocal fatty infiltration of the liver: report of six cases, Nihon Igaku Hoshasen Gakkai Zasshi 50 (9) (1990) 1063–1067.

[7] H. Tamai, et al., Multifocal nodular fatty infiltration of the liver mimicking metastatic liver tumors: diagnosis using the liver-specific late phase of Levovist-enhanced sonography, J. Ultrasound Med. 25 (3) (2006) 403–406.

[8] M. Marin, et al., Multinodular focal fatty infiltration of the liver: atypical imaging findings on delayed T1-weighted Gd-BOPTA-enhanced liver-specific MR images, J. Magn. Reson. Imaging 24 (3) (2006) 690–694.

[9] U. Daberkow, et al., Multifocal nodular fatty infiltration of the liver associated with porphyria and haemochromatosis, Dtsch. Med. Wochenschr. 129 (12) (2004) 617–620.

[10] J. Kemper, et al., CT and MRI findings of multifocal hepatic steatosis mimicking malignancy, Abdom. Imaging 27 (6) (2002) 708–710.

[11] M.J. Plasencia Martinez, M.A. Corral de la Calle, Cases for diagnosis. Solution to case 5: multinodular focal fatty infiltration of the liver, Radiologia 51 (3) (2009) 333–336.

[12] T. Ichikawa, et al., Education and imaging. Hepatobiliary and pancreatic: multifocal nodular hepatic steatosis associated with the metabolic syndrome, J. Gastroenterol. Hepatol. 22 (10) (2007) 1699.

[13] C. Berkelhammer, et al., Multifocal nodular nonalcoholic steatohepatitis: resolution with rosiglitazone, Gastroenterol. Hepatol. (N. Y.) 3 (3) (2007) 196–198.

[14] J.P. Earls, G.A. Krinsky, Abdominal and pelvic applications of opposed-phase MR imaging, AJR Am. J. Roentgenol. 169 (4) (1997) 1071–1077.

[15] J. Janica, et al., Comparison of contrast-enhanced ultrasonography with grey-scale ultrasonography and contrast-enhanced computed tomography in diagnosing focal fatty liver infiltrations and focal fatty sparing, Adv. Med. Sci. 58 (2) (2013) 408–418.

[16] T.V. Bartolotta, et al., Characterization of hypoechogenic focal hepatic lesions in patients with fatty liver: diagnostic performance and confidence of contrast-enhanced ultrasound, Eur. Radiol. 17 (3) (2007) 650–661.

[17] T.V. Bartolotta, et al., Detection of liver metastases in cancer patients with geographic fatty infiltration of the liver: the added value of contrast-enhanced sonography, Ultrasonography 36 (2) (2017) 160–169.

[18] A.D. Karaosmanoglu, et al., Magnetic resonance imaging of liver metastases, Semin. Ultrasound CT MR 37 (6) (2016) 533–548.