



ICONOGRAPHIC REVIEW / *Gastrointestinal imaging*

## Fat-containing lesions of the liver : A pictorial essay



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### KEYWORDS

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**Abstract** The presence of fat within a hepatic lesion is unusual and can help to direct the radiologist's diagnosis. The aim of this iconographic review is to specify the various hepatic lesions that may contain fat and their appearance particularly on MRI. A histological correlation is also suggested for the most commonly found tumors. The identification of fat within a hepatic tumor, along with other radiological signs and reflection on the clinical and epidemiological context, can lead to a diagnosis being reached or suggested, with confirmation if necessary, by a pathological examination.

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The presence of fat in a liver lesion is not a standard finding and it can help to guide the radiologist towards a diagnosis. Fat may be macroscopic or microscopic. MRI is the modality of choice for detecting a fatty component in a hepatic tumor: fat-saturation sequence detects extracellular fat while chemical shift imaging identifies microscopic or intracellular lipids [1].

Once intracellular lipids are demonstrated, this allows a range of diagnoses to be considered, including multifocal hepatic steatosis, focal nodular hyperplasia (FNH), adenomas, hepatocellular carcinoma, and some hepatic metastases.

By contrast, the presence of fat in a tumor that is not within the hepatocytes is suggestive of angiomyolipoma, pseudolipoma of the Glisson capsule, fat deposits around the intrahepatic wall of the inferior vena cava or "pericaval fat", hydatid cyst, teratoma, liposarcoma and some metastases [2,3].

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## Liver lesions containing intracellular fat

When steatosis is demonstrated within a focal hepatic lesion through signal drop on the out-of-phase sequence, the following diagnoses should be the first to come to mind: focal steatosis, focal nodular hyperplasia, HNF1 $\alpha$  mutated adenoma, inflammatory hepatic adenoma, and hepatocellular carcinoma.

The next stage in the diagnostic process for the radiologist is to determine whether the steatosis within the tumor is homogeneous and diffuse or focal, and whether or not the lesion is hypervascularised, and, if relevant, whether there is contrast washout. These features, taken together with a study of the adjacent parenchyma and the context, will usually allow a diagnosis to be made or strongly suspected.

### Focal pseudo-nodular steatosis

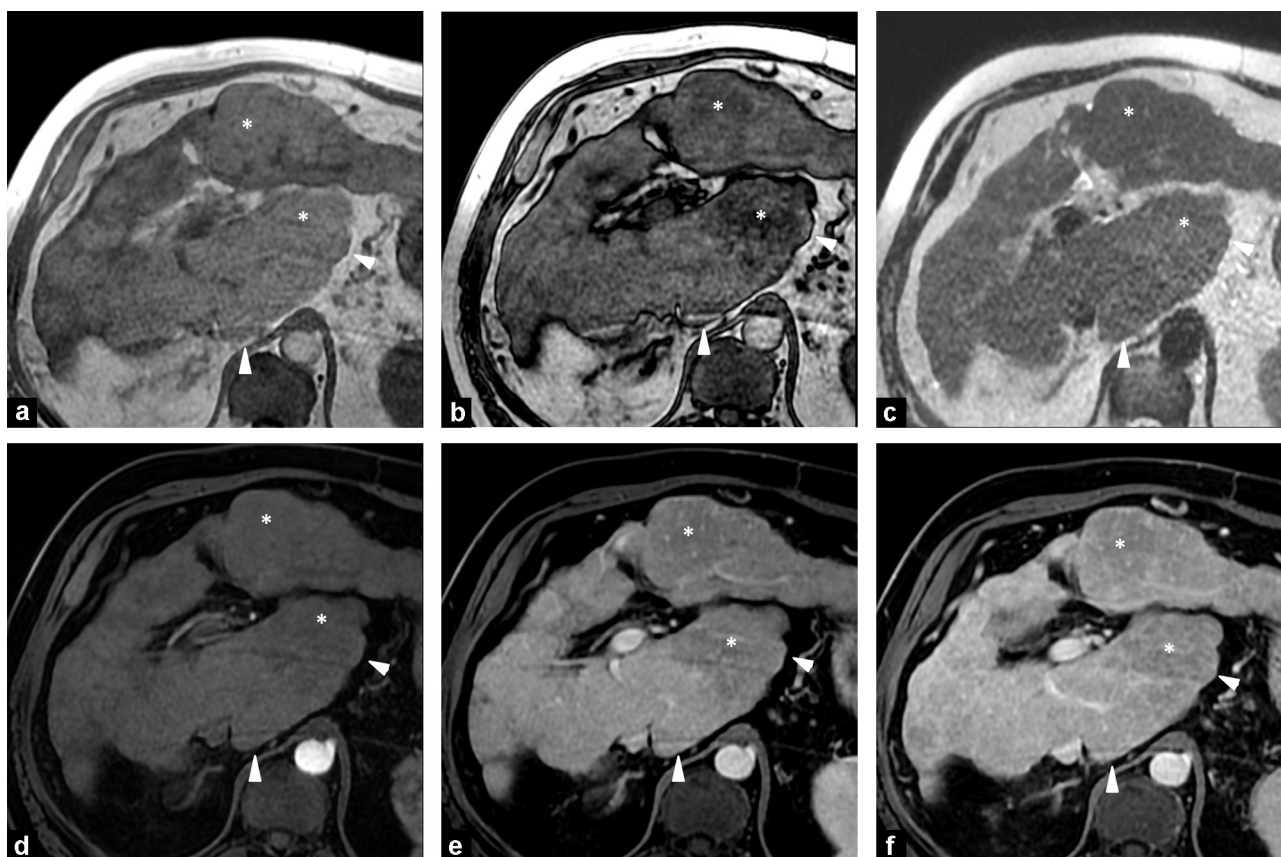
The conditions under which hepatic steatosis is most often found are excessive alcohol consumption, insulin resistance, obesity, hyperlipidaemia, hepatitis B and C infection, and the use of certain medications. Hepatic steatosis is the result of a build-up of fat vacuoles in the hepatocytes, and it can be diffuse, focal, or multifocal (Fig. 1). Focal pseudo-nodular hepatic steatosis can be mistaken for a focal lesion on sonography or CT [4]. Areas of focal hepatic steatosis are usually found in the periportal region, in contact with the

falciform ligament or the gall bladder. This positioning is due to variations in venous flow within the hepatic parenchyma, resulting from the links to the vascular networks of the pancreas and duodenum, gall bladder, and digestive system [5]. Insulin has also been suggested to play a role due to steatosis being demonstrated in contact with insulinoma metastases [6].

Chemical shift imaging shows fat present in the hepatocytes with a signal drop on the out-of-phase sequence. This finding, when seen together with a characteristic location, a lack of mass effect, geographic borders, and a parallel enhancement gradient to that of the adjacent parenchyma, allows the diagnosis to be made with certainty [6].

### Focal nodular hyperplasia

This is the most commonly seen benign tumor of the hepatocytes, with an estimated prevalence of 9/1000 and a female to male ratio of 8:1 [7]. FNH is thought to be an abnormal proliferation of the hepatic parenchyma in response to a congenital vascular malformation. It is usually discovered incidentally or further to non-specific symptoms. It is essential to identify FNH correctly because no monitoring is needed, and contraception does not need to be discontinued. MRI is the most sensitive modality for diagnosis of this condition [8]. Typically, FNH is a well-circumscribed, lobulated lesion with no capsule, with iso- or low signal



**Figure 1.** Focal steatosis mimicking a tumor (\*) in the left lobe and segment I in a patient with chronic liver disease with indented contours and hypertrophy of the caudate lobe (arrow heads). These areas of steatosis appear in iso-signal on in-phase T1 images (a) and T2 images (c), with a marked signal drop on the out-of-phase sequence (b). With contrast enhancement, these areas have iso-signal intensity in the arterial phase (d) and slight low signal intensity in the portal (e) and delayed phases (f). There are vessels coursing through these areas, without displacement.

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