Diagnostic Imaging of Hepatic Lesions in Adults

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KEYWORDS

• Liver mass • Hepatocellular carcinoma • Magnetic resonance imaging
• Computed tomography

KEY POINTS

- Often multiple imaging modalities may be necessary to characterize liver lesions.
- Each modality has unique advantages and disadvantages.
- A knowledge of the common benign and malignant lesions observed in the liver is necessary for optimal differential diagnosis and subsequently management.
- Imaging is crucial along the entire trajectory of the management of patient with malignant lesions in the liver.
- A interdisciplinary team is requisite to obtain optimal oncologic outcomes.

INTRODUCTION

In patients without a known extrahepatic malignancy, a hepatic mass may be discovered incidentally on ultrasonography, computed tomography (CT) or magnetic resonance imaging (MRI). Metastatic disease should always be considered in the differential for a mass that does not meet imaging criteria for a simple cyst in a patient with known extrahepatic malignancy undergoing imaging surveillance. However, not infrequently these masses can represent an incidental benign mass such as a hemangioma or focal nodular hyperplasia (FNH). In patients with chronic liver disease or cirrhosis, a hepatic mass may be detected during imaging surveillance. Although hepatocellular carcinoma (HCC) is the leading differential for such masses, benign masses can occur in the cirrhotic liver, and nodules less than 2 cm in diameter in the cirrhotic liver frequently represent regenerating or dysplastic nodules.[1]

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Imaging, especially MRI and CT enhanced by contrast material, is instrumental in noninvasive characterization of a liver mass. The American College of Radiology (ACR) Appropriateness Criteria are evidence-based guidelines developed by experts in the field to guide referring physicians in choosing the most appropriate imaging test for a specific clinical condition.[2] Advances in MRI now allows rapid imaging and 3-dimensional acquisition, which, coupled with the soft-tissue contrast, renders MRI the imaging standard for noninvasive characterization of focal liver masses, also endorsed by the ACR.[3] The ACR Appropriateness Criteria guidelines for initial characterization of a focal liver lesion larger than 1 cm encountered in different clinical and imaging scenarios are summarized in **Table 1**. ^{18}F-Fluorodeoxyflucose (FDG) positron emission tomography (PET) combined with CT has an ancillary role in the evaluation of liver metastases if the primary tumor is FDG-avid.[4] Conventional catheter angiography and CT hepatic arteriography and portography, used historically, are no longer used for evaluation of liver masses. Technetium-99m (^{99m}Tc) sulfur colloid scan and ^{99m}Tc red blood cell (RBC) scintigraphy are rarely used for evaluation of liver masses. The choice of an imaging modality can vary significantly across institutions based on local radiologic expertise, availability of equipment, and the wishes and biases of treating physicians and radiologists.

Knowledge of the underlying key pathologic features and imaging findings of liver masses on MRI and CT allows characterization in most cases. Some masses, however, may exhibit overlapping and nonspecific radiologic features, and in such cases percutaneous image-guided biopsy may become necessary. This article discusses the typical gross morphologic and imaging features of malignant liver masses and certain benign liver masses that may mimic malignancy, preceded by a brief overview of the imaging techniques in current use.

MAGNETIC RESONANCE IMAGING

MRI has high sensitivity and specificity for both detection and characterization of benign and malignant focal liver masses. An important advantage of MRI over CT is the lack of ionizing radiation. However, disadvantages include greater cost, longer imaging times, and higher frequency of suboptimal imaging caused by motion artifacts, particularly in patients who cannot perform adequate breath-holding (15–20 seconds).

Of the variety of different protocols that exist for imaging the liver with MRI, a group of core pulse sequences are routinely obtained. The first of these is most often a set of T2-weighted images. Fluid is hyperintense on T2-weighted imaging, allowing for identification of cysts and cystic masses. Other lesions such as hemangiomas are typically markedly intense (slightly less so than cysts) on T2-weighted images. Both benign and malignant solid tumors may be mildly to moderately hyperintense, but T2-weighted imaging alone is neither highly sensitive nor specific in characterizing focal liver lesions. All liver protocols should also include T1-weighted “in and out of phase” imaging. These sequences are used to identify tissues with internal microscopic fat; which can be seen in some hepatic masses such as hepatocellular adenomas and HCCs. The mainstay of liver imaging with MRI is dynamic contrast-enhanced fat-saturated T1-weighted imaging using a gadolinium chelate. Conventional extracellular gadolinium-based contrast agents are analogous to iodinated contrast used in CT, and lesions will follow similar enhancement patterns on both modalities. First, precontrast images are acquired, which provide information regarding T1 characteristics of lesions (internal hemorrhage showing increased signal intensity) and serve as a baseline to evaluate for contrast enhancement. Following this, at least 3 dynamic acquisitions are obtained in the arterial, portal venous, and equilibrium