Confluent focal nodular hyperplasia mimicking liver cancer: Value of liver-specific contrast-enhanced MRI for diagnosis

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Abstract

Focal nodular hyperplasia is the second most common benign hepatic tumor. Unlike adenoma as well as the malignant neoplasms, focal nodular hyperplasia can often be managed successfully without surgery. Use of liver-specific contrast-enhanced magnetic resonance imaging allows clinicians to confirm the diagnosis noninvasively in some patients, allowing select patients to avoid surgery. We report a case of a patient who presented with the rare profile of multiple, confluent lesions that were diagnosed, using magnetic resonance imaging with gadolinium-dimeglumine, as focal nodular hyperplasia. This complicated case was managed successfully and noninvasively based on algorithm found in the recent literature that allows patients to avoid unnecessary surgery.

Keywords: focal nodular hyperplasia; gadobenate dimeglumine; Gd-BOPTA; MRI

1. Introduction

Focal nodular hyperplasia (FNH), typically found in young to middle-aged asymptomatic women, is the second most common benign liver tumor after hemangioma, with a cited prevalence in adults of between 1% 1 and 8%. 2 Reported prevalence rates may rise because an increasing number of FNH lesions are being found incidentally due to improvements in imaging technology. 3

FNH presents with a single lesion in roughly 70% of patients, and with two to four lesions in the vast majority of the remaining patients. 4 We identified only five case reports involving a patient with more than four FNH, and the reports noted the rarity of such a presentation. 4–8 FNH is not associated with significant malignancy potential and is uncommonly associated with rupture and hemorrhage. Therefore, it usually can be managed conservatively. 3,9 This high likelihood for conservative management emphasizes the need to noninvasively diagnose FNH.

In this report, we describe our use of a published algorithm for the identification of benign liver lesions 10 in a young patient who presented with multiple, confluent liver lesions first suspected to represent hepatocellular carcinoma. We discuss the current literature on the use of liver-specific contrast agents for magnetic resonance imaging (MRI) and demonstrate the efficacy of recently described techniques for the diagnosis of patients with complicated FNH in real-world practice.

2. Case report

An 18-year-old woman was referred to our institution for evaluation of liver lesions detected on an ultrasound examination. The ultrasound study was performed to evaluate the patient’s symptoms of mild, intermittent epigastric pain of 6 months’ duration. The patient’s personal history was negative for alcohol ingestion, oral contraceptive use, or infection with...
hepatitis B or C. Laboratory evaluation revealed normal serum levels of aminotransferases, gamma glutamyltranspeptidase, alkaline phosphatase, bilirubin, and α-fetoprotein.

Unenhanced computed tomography (CT) showed isoattenuation of a mildly enlarged left lobe (Fig. 1A). Hepatic arterial-phase (HAP) CT imaging demonstrated a large lesion with a mosaic pattern of enhancement involving both lobes of the liver (Fig. 1B). The tumor measured approximately $16 \times 12 \times 11$ cm$^3$; however, neither splenomegaly nor dilatation of the biliary tract was noted. On portal venous-phase (PVP) imaging, there was less heterogeneous enhancement, but some washout effect from the large tumor and mild enhancement of a portion of the external capsule and internal septa of the lesion (Fig. 1C). Hepatocellular carcinoma (HCC), one of the most common hepatic malignancies in this high-prevalence area, was suspected, and the patient initially was prepared for surgery. Preoperative abdominal angiography revealed a large, hypervascular hepatic tumor (Fig. 1D). After further review of the patient’s history, clinical presentation, and imaging studies, which collectively did not provide a high-probability diagnosis, MRI was recommended.

Precontrast MRI showed a large hepatic tumor with an iso-intense mosaic pattern on gradient-echo (GRE) T1-weighted images (T1WI) and an iso-intense pattern on fast spin-echo T2-weighted images (T2WI). These results are shown in Fig. 2A and B. Portions of the lesion had slightly lower signal intensity on the out-of-phase imaging compared with the in-phase images, and a small nodular shadow within the tumor appeared to have low signal on out-of-phase imaging and high signal on in-phase GRE chemical shift images, suggestive of focal fatty infiltration within the tumor. On dynamic MRI after intravenous injection of the liver-specific agent gadobenate dimeglumine [(Gd-BOPTA) Multihance; Bracco Imaging SpA, Milan, Italy], the tumor demonstrated a hyperintense mosaic pattern on HAP images (Fig. 2C), but became iso-intense to surrounding liver parenchyma in the PVP (Fig. 2D) and in the 6-minute early-delayed-phase images (Fig. 2E). The internal reticular septa and external capsule appeared to have a mildly low signal on T1WI images, a low- to isointense signal on T2WI images, a hypointense signal in the arterial phase, and delayed enhancement on later phases of dynamic MRI.

Subsequently, in the 1-hour and 3-hour delayed images, the mosaic pattern of the large tumor appeared homogeneously isointense or of slightly higher intensity compared to the surrounding normal hepatic parenchyma (Fig. 2F). These findings indicated the presence of normal functioning hepatocytes and excessive hepatocellular accumulation of

![Fig. 1. Non-enhanced CT scan of the abdomen in an 18-year-old woman with mild, intermittent epigastric pain. (A) Isoattenuated or slightly hypoattenuated hepatic parenchyma is noted throughout most of the left lobe and a portion of the right lobe of the liver; (B) the hepatic arterial-phase CT image reveals a large mass with a mosaic pattern of enhancement and less-enhanced septa (arrows); (C) the large mass demonstrates homogeneous enhancement on the portal venous phase images, with a slight washout effect (*) and capsular enhancement (arrowheads); and (D) abdominal angiography reveals a huge mass with dense tumor blush (white arrows). CT = computed tomography.](image-url)
gadobenate within the mosaic lesions. The low-intensity external capsule and internal septa were visualized in the delayed images, suggesting fibrotic components.

Based on the characteristic morphological, hemokinetic and functional information, a tentative diagnosis of focal nodular hyperplasia with confluent multiple lesions was made. Needle biopsy confirmed the diagnosis. No further surgical intervention was performed. After four years of follow-up, the patient is well, without symptoms, and a repeat MRI showed no change in the hepatic lesion.

3. Discussion

Unlike adenoma or hemangioma, FNH is not associated with potential for malignancy or rupture.3,9 As noted in a recent paper on the identification of liver lesions (that provided our algorithm for diagnostic imaging)10 “…accurate diagnosis of a liver lesion often precedes proper management…” FNH is an apt example of the clinical value of noninvasive diagnosis because accurate diagnosis allows patients to avoid unnecessary surgery.

The classic lesion of FNH is a small mass with septa radiating from an obvious central scar. The lesion has clear boundaries from surrounding normal parenchyma, but no true capsule. The lesion does not have normal cord architecture11; blood vessels are malformed, the mass as a whole is hypervascular, and there is clear bile duct proliferation.1,12 The lack of connection between the malformed bile canalicular systems leads to slowed biliary excretion.9

Nonclassic FNH also exists. The lesion may not show abnormal nodular architecture or malformation of vessels, but bile duct proliferation is always present.1 Large lesions may occur with either classic or nonclassic FNH, and both may manifest with more than one lesion.1

Both CT and MRI have been used to diagnose FNH. A study comparing imaging of benign and malignant focal hepatic lesions with multidetector row helical CT and gadobenate dimeglumine-enhanced MRI found that MRI had better diagnostic accuracy and sensitivity for lesion identification and characterization than CT.13 This finding is comparable with results from earlier studies, which showed that MRI could consistently characterize over 90% of identified lesions.14,15 Gd-BOPTA, the contrast agent used in most of the studies identified and which was also used in our patient, is particularly helpful for liver imaging because the gadobenate ion is selectively taken up by hepatocytes and then excreted into the bile. This distinguishes it from conventional contrast agents, which are almost exclusively excreted through the kidneys.16 Our findings with Gd-BOPTA—enhanced dynamic MRI fit the descriptions found in the literature,1—3,9 and enabled us to determine how lesion anatomy and physiology can result in the characteristic imaging findings.

In conclusion, we applied algorithm from the recent literature to noninvasively diagnose FNH that presented with multiple confluent lesions in a young woman. The MRI findings allowed avoidance of unnecessary surgery. In addition, since MRI involves no radiation exposure, the patient can continue to be repeatedly monitored without concern for

Fig. 2. MRI of the liver tumor using Gd-BOPTA. (A) The large tumor exhibits an isointense mosaic pattern (white arrows) with irregular hypointense septa on the precontrast gradient echo T1-weighted image; (B) fast-spin echo T2-weighted imaging with fat saturation shows a large lobulated tumor that is isointense to normal hepatic parenchyma. Some parts of the tumor (*) are mildly low in intensity on out-of-phase imaging compared to the in-phase images, indicating mild fatty infiltration; (C) on hepatic arterial-phase images the tumor shows intense mosaic enhancement pattern, and the irregular septa and capsules appear hypointense; (D) on portal venous-phase imaging, the tumor is isointense to surrounding liver parenchyma, and most septa are hyperintense; however, some have low signal intensity; (E) on the 6-minute early delayed-phase images, the irregular septa, capsule and eccentric scar appear hyperintense (black arrowhead), and the tumor is homogeneously isointense; and (F) on the 3-hour delayed images, most of the tumor is hyperintense, and the fibrous septa, pseudocapsule and scar are hypointense (black arrow). Gd-BOPTA = gadobenate dimeglumine; MRI = magnetic resonance imaging.
complications associated with ionizing radiation. Given two recent review articles on the use of MRI for liver lesions, it is clear that clinicians now have the capacity to make accurate, noninvasive diagnoses with confidence for many patients with FNH and other primary hepatic lesions.

References


