

SECTION EDITOR: BEVERLY P. WOOD, MD

## Radiological Case of the Month

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**A** 6-YEAR-OLD girl presented with a history of 2 episodes of transient epigastric and upper right abdominal pain associated with fever and vomiting. She was previously healthy. During the last episode of abdominal pain, she was referred for evaluation. Findings from physical examination were normal. No mass was present, and the liver was normal in size. Her white blood cell count, C-reactive protein level, and erythrocyte sedimentation rate were slightly increased, but returned spontaneously to reference values in a few days.  $\gamma$ -Glutamyltransferase was increased to 3-fold the reference level. Findings from other liver function tests as well as levels for serum  $\alpha_1$ -fetoprotein and pancreatic enzyme were normal. Abdominal ultrasonography (**Figure 1**), computed tomography without and with contrast enhancement (**Figure 2**), and magnetic resonance imaging (**Figure 3**) were performed.

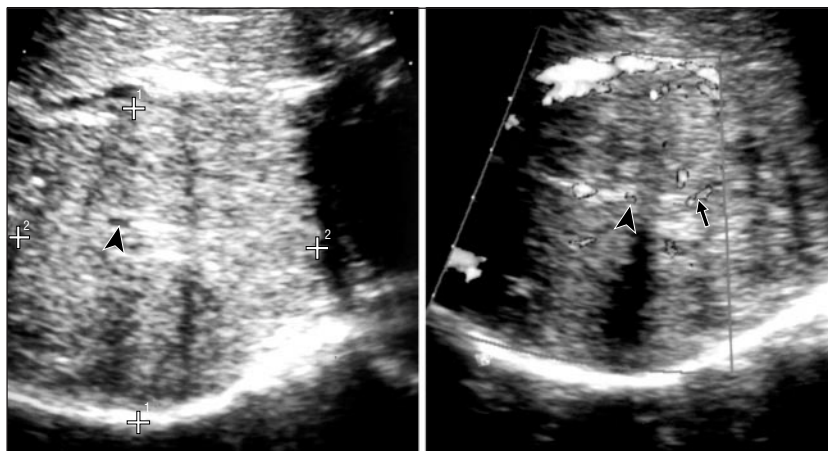


Figure 1.

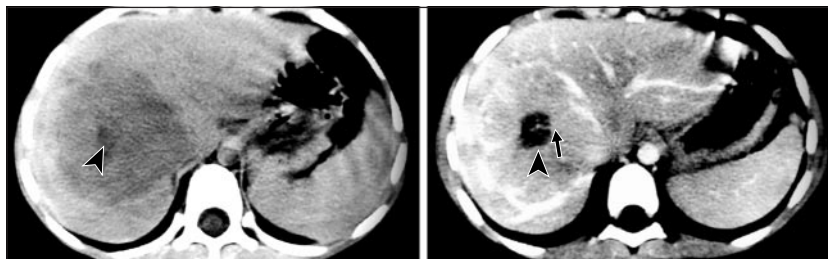


Figure 2.

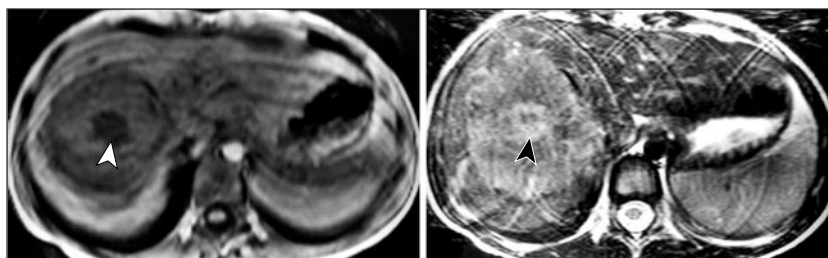


Figure 3.

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# Denouement and Discussion

## Focal Nodular Hyperplasia of the Liver

**Figure 1.** Left, ultrasonogram showing an isoechoic mass in the posterior right lobe of the liver. Note the 2 anechoic vessels in the central scar (arrowhead) confirmed by color Doppler ultrasonography (right) showing the vessels in the central scar (arrowhead) and the presence of vessels distributed radially corresponding to the septa (arrow).

**Figure 2.** Left, computed tomographic scan showing the mass is hypodense relative to liver density. A central scar (arrowhead) is present. Right, after contrast medium injection (arterial phase), the arterial vessels are clearly seen in the central scar (arrowhead) and the septa (arrow).

**Figure 3.** Left, on T1-weighted images, the mass is hypointense. The central scar (arrowhead) is also hypointense. Right, on T2-weighted images, the signal intensity of the mass and the radial scar (arrowhead) is hyperintense.

These findings are indicative of focal nodular hyperplasia (FNH) of the liver, a benign lesion of hepatocyte proliferation that usually occurs in young or middle-aged women (estimated frequency, 2.45 per 1 000 000<sup>1</sup>) affecting them 4.5 times more frequently than men.<sup>2</sup>

Pediatric cases of FNH are unusual, accounting for 7% of reported cases.<sup>3</sup> As in adult patients, there is a female predominance,<sup>3</sup> and 7% to 18% present with symptoms of general malaise or abdominal pain.<sup>4</sup> The usual presentation is an asymptomatic abdominal mass palpated on routine physical examination.<sup>5</sup> Findings from liver function tests are often normal, but a slight elevation of levels of aminotransferases is reported.<sup>6</sup> As is noted in other benign liver lesions, an elevation of  $\gamma$ -glutamyltransferase levels is related to the compression of small biliary ducts by the large lesion. In children with FNH, the mass is usually large and solitary and in adult women there are small and multiple lesions.<sup>5</sup>

Various diagnostic ultrasonographic appearances of FNH occur.<sup>7,8</sup> A hypoechoic lesion is observed in 34.7% of cases, hyperechoic in 34.7%, and isoechoic in 17.4%.<sup>7</sup> There is enlargement of feeding visceral arteries with large vessels feeding the area of FNH. Computed tomography shows a hypodense area with transient hyperdensity following contrast injection. Similar features are present in 80% of hepatic adenomas. A central hypoattenuating stellate area is more specific of FNH, but is present in only 15% of cases.<sup>7,8</sup> To depict the typical arterial vascularization, scanning should start in the first 30 seconds after injection. The vessels in the central scar can be visualized through the septa within the lesion. During peak portal venous enhancement, the enhancement of the mass decreases, and it becomes isointense compared with the liver. Visualization of the peripheral vessels or displacement of the adjacent normal vessels and identification of the central scar help to characterize the mass.

On unenhanced T1-weighted magnetic resonance images, FNH is isointense or hypointense relative to the liver.<sup>9,10</sup> On T2-weighted images, the mass is slightly hy-

pointense.<sup>9,10</sup> The central scar displays a hypointense and hyperintense signal on T1- and T2-weighted images, respectively.<sup>9,10</sup> After gadolinium pentetic acid injection, the features of the mass enhancement resemble those observed on computed tomography. When a mass displays these typical features, the diagnosis of FNH can be made with confidence.<sup>8-11</sup> When the central scar is absent, or when marked hyperintensity on T2-weighted images is observed, other diagnoses may be considered. Typical results of computed tomography and magnetic resonance imaging allow a definite diagnosis of FNH without the need for histopathologic confirmation.

The etiology of FNH is unknown; an association may exist between FNH and oral contraceptive use.<sup>3</sup> When a diagnosis is confirmed, observation without surgery is recommended in asymptomatic patients.<sup>5,12-14</sup> If the patient is symptomatic or if the lesion enlarges, surgical resection is warranted. When resection is not possible, embolization or ligation of the hepatic artery are alternatives.<sup>14</sup> Our patient was observed with imaging follow-up.

Accepted for publication September 9, 1998.

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