Radiologic features of granulomatous hepatitis

Poster No.: C-1176
Congress: ECR 2014
Type: Educational Exhibit
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Keywords: Inflammation, Infection, eLearning, MR, CT, Liver, Abdomen
DOI: 10.1594/ecr2014/C-1176

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Learning objectives

The purpose of this review is to describe imaging findings of granulomatous hepatitis (GH) on ultrasound (US), computed tomography (CT) and magnetic resonance imaging (MRI), emphasizing the diagnostic clues.

Background

Granulomatous hepatitis is a chronic inflammatory disease of the liver associated with granuloma formation. The etiology of GH includes sarcoidosis, tuberculosis, fungal infections, parasitic infestations and other rare conditions. The etiology cannot be determined in 36% of reported patients (1). Diagnosis of GH is made on the basis of histopathological examination. Histopathological examination reveals two types of hepatic granulomas; caseating and non-caseating. Hepatic granulomas usually appear as multiple, distinct, well-defined nodular lesions on imaging. According to excessive inflammatory reaction and tract of parasitic journey, heterogeneous parenchymal areas and branching tracts can also be observed in hepatic fascioliasis.

Findings and procedure details

We performed a retrospective analysis of the clinical and radiologic features of 10 patients with histopathologically proven GH. There were 3 patients with hepatic fascioliasis, 1 patient with candidiasis, 2 patients with sarcoidosis, 2 patients with tuberculosis and 1 patient with the Langerhans’ cell histiocytosis. In one patient no etiology could be determined.

**Hepatic Fascioliasis**

*Fasciola hepatica* is a trematode that infests humans and leads chronic granulomatous inflammation. It is transmitted to humans via contaminated water or uncooked vegetables. In the acute phase, the trematodes penetrate the intestinal wall and migrate through the peritoneal cavity to reach the Glissons’ capsule. Subsequently, the hepatic capsule is perforated by trematodes and hepatobiliary system is involved. Symptoms of the disease involve right upper abdominal quadrant pain, fever, weight loss and systemic allergic reaction findings. In the chronic phase, the trematode migrates into the hepatic bile duct and the biliary system.
Heterogeneous parenchymal areas, branching tracts and/or focal nodular lesions occur in most cases in the affected hepatic parenchyma. There is a diffuse wall thickening and enhancement of the extra-hepatic bile ducts in the majority of the patients. Enlarged lymph nodes in portal region can also be observed. Patterns of enhancement may be peripheral patchy, or nodular in distribution (2) (Figure 1, 2).

Antibiotic therapy with bithionol, praziquantel and triclabendazole is adequate for treatment.

**Hepatic Candidiasis**

Candida species may cause inflammatory reaction, suppurative response or may occasionally lead granulomas in the liver. Infection by the candida is usually observed in immunocompromised patients. The typical histologic pattern of hepatic candidiasis is characterized by microabscesses.

Imaging findings correlate with histologic pattern. Sonographic features of hepatic candidiasis are variable, which involve "wheel-within-a-wheel" appearance, bull's-eye configuration, uniformly hypoechoic nodule, or echogenic foci. On contrast-enhanced CT, fungal microabscesses usually appear as multiple round, discrete hypodense nodular lesions. On MRI, the hepatic nodules are rounded lesions frequently less than 1 cm in diameter that are mildly hypointense on T1-weighted and post-contrast T1-weighted images and markedly hyperintense on T2-weighted images (3) (Figure 3).

Treatment is provided by anti-fungal agents.

**Hepatic Sarcoidosis**

Sarcoidosis is a systemic inflammatory disease of unknown origin that manifests as non-caseating granulomas. Pulmonary and mediastinal lymph node involvements are the most common manifestations. Hepatic sarcoidosis rate at biopsy has been reported in 24-94% however, symptomatic liver disease occurs in less than 5% of patients with sarcoidosis (4, 5).

Hepatomegaly is the most common radiological finding of hepatic sarcoidosis. Liver usually appears homogenous on CT and MRI, however an appearance of multiple low-density intrahepatic septa can also be observed. Focal nodules due to non-caseating granulomas occur in 5% of patients with sarcoidosis. Most liver nodules are hypodense on contrast-enhanced CT. On MRI, the nodules are hypointense on T1-weighted and slightly hyperintense on T2-weighted images. Mild enhancement within hepatic nodules may occur on T1-weighted images after gadolinium administration. Intra-abdominal enlarged lymph nodes may also be found in patients with sarcoidosis (5) (Figure 4, 5, 6).

Liver involvement of sarcoidosis can be treated by steroids.
Hepatic Tuberculosis

Tuberculosis is a granulomatous infection secondary to *Mycobacterium tuberculosis*. Histopathologically the tuberculosis characterized by the formation of caseating granulomas. Systemic tuberculosis has a variable clinical and radiologic features due to dissemination from its primary site. Hepatosplenic involvement is most likely secondary to hematogenous spread of the primary disease.

Hepatic tuberculosis is divided into two groups; a miliary form, which is part of miliary pulmonary tuberculosis, and a local form, which is classified as focal (nodular) tuberculosis and tubular (hepatobiliary) tuberculosis. Miliary hepatic pattern is seen in patients with miliary pulmonary tuberculosis that manifests as discrete, multiple nodules mostly less than 2 mm in diameter. This pattern is seen as multiple, hypodense tiny nodules on CT images. The nodular form is a rare condition secondary to tuberculosis that manifests as multiple hypodense hepatic lesions with hepatomegaly or a single tumor-like mass. On MRI, the nodules appear hypointense on T1-weighted images, slightly hyperintense or hypointense on T2-weighted images (6) (Figure 7, 8). Intrahepatic bile duct obstruction can be observed in hepatobiliary form due to central duct obstruction. Caseating granulomas may mimic hypovascular metastases on radiological images. The definitive diagnosis of hepatic tuberculosis can only be made by histopathological examination.

Anti-tuberculous drugs are used in treatment of hepatic tuberculosis.

Other rare conditions

Langerhans' cell histiocytosis (LCH) is a rare systemic disease that manifests as oligoclonal proliferation of Langerhans cells. It occurs mostly in young adults and children. Common sites of involvement are bone marrow, lung, skin, liver, spleen, hypothalamus and lymph nodes. Hepatic LCH is a part of multisystem disease with a high mortality rate. Histopathologically, LCH presents as a focal nodular disease, which shows periportal infiltration with Langerhans' cells. In early proliferative phase of disease, hepatic lesions appear hypoechoic on US and hypodense on contrast-enhanced CT. Later in the xanthomatous stage, focal nodular lesions appear hyperechoic on US, hypodense on contrast-enhanced CT, and in similar signal as fat tissue on MRI. Peripheral enhancement of hepatic lesions and caudate lobe hypertrophy can also be detected in patients with LCH (7) (Figure 9).

In the numerous patients with GH, the etiology cannot be determined. In this group, liver granulomas are mostly non-caseating granulomas (1) (Figure 10).

Images for this section:
Fig. 1: 65-year-old man with hepatic fascioliasis; Ultrasonographic image (A) shows a large heterogeneous hypoechoic hepatic lesion (arrows). Contrast-enhanced CT image (B) reveals heterogeneous hypodense parenchymal areas in right liver lobe (arrows).
Fig. 2: 43-year-old man with hepatic fascioliasis; Ultrasonographic image (A) shows a trematode, which lies in the gallbladder (arrows). Contrast-enhanced CT image (B) indicates branching hypodense tubular lesions that are compatible with tunnels or the inflammation around the passage tracts of Fasciola hepatica through liver (arrows).
Fig. 3: A 18-year-old man with a history of acute myelogenous leukemia, who developed candidiasis infection of the liver. Hypoechoic, discrete and less than 1 cm multiple hepatic microabscesses are seen on sonographic examination (arrows).
**Fig. 4:** 57-year-old woman with sarcoidosis and hepatic involvement; Ultrasonographic image (A) shows predominantly hyperechoic heterogeneous areas on right lobe of liver (arrows). Contrast-enhanced CT images (B, C) show lobulated outline of liver, hypodense bands and septations in liver parenchyma (arrows).
**Fig. 5:** 39-year-old woman with hepatic sarcoidosis. Abdominopelvic ultrasonography (A, B) reveals a round, hypoechoic, well-defined nodular lesion in left lobe of liver. Contrast-enhanced CT scan shows a small hyperdense hepatic nodule located in left lobe of liver.
Fig. 6: 39-year-old woman with hepatic sarcoidosis (The same patient as in figure 5). The hepatic nodule is hypointense on T1-weighted image (A) and slightly hyperintense on T2-weighted fat-saturated image (B). Gadolinium-enhanced T1-weighted image (C) reveals mild enhancement within hepatic nodule.
**Fig. 7:** 38-year-old woman with hepatic tuberculosis. Axial contrast-enhanced CT scan demonstrates multiple non-uniform, low-attenuation lesions within the liver.
Fig. 8: 55-year-old woman with hepatic tuberculosis. Liver biopsy showed caseating granuloma consistent with tuberculosis. T2-weighted fat-saturated images (A, B), T1-weighted image (C), and early-phase gadolinium-enhanced T1-weighted image (D) depict innumerable small, round shaped hepatic nodules. Nodules are most clearly seen on T2-weighted images as markedly hyperintense. Unenhanced T1-weighted image does not show nodules well. Hepatic nodules appear as hypovascular lesions on early-phase gadolinium-enhanced T1-weighted image.
**Fig. 9:** 32-year-old man with Langerhans cell histiocytosis. US images (A, B) reveal distinct, hypoechoic hepatic nodules. CT images (C, D) show multiple hypodense nodular lesions within the liver, findings that are consistent with hepatic granulomas.
Fig. 10: 40-year-old woman presented with idiopathic GH. MR images show a well-defined lesion in right lobe of the liver; hyperintensity of lesion capsule and hypointensity of central of lesion seen on T2-weighted axial image (A); hypointensity of lesion seen on T1-weighted axial image (B). No enhancement is also seen within the lesion on post-contrast T1-weighted fat saturated axial image (C).
Conclusion

The radiologic findings of hepatic granulomatous diseases include multinodular lesions, heterogeneous parenchymal areas, branching tracts, solitary mass like lesions, and enlarged portal lymph nodes. Granulomas of liver may appear hypodense or hyperdense on CT, mixed signal on T1- and T2- weighted images. Post-contrast T1-weighted images reveal no enhancement in non-caseating granulomas and enhancement in caseating granulomas (1). The granulomas enhance diffusely. GH should be included in the differential diagnosis in the patients with nodular liver pathologies.

Personal information

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