

THE MANY FACES OF HEPATIC TUBERCULOSIS

Cross-sectional Imaging Manifestations

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Abstract

Hepatic tuberculosis is rare but its incidence is increasing. In imaging, it presents with different appearances and can mimic a variety of other conditions. A high degree of suspicion combined with appropriate diagnostic modalities greatly aid in the timely diagnosis of the disease. The aim of this review article is to illustrate and discuss the various patterns of hepatic TB on ultrasonography, computed tomography and magnetic resonance imaging.

Key Facts

Hepatic TB

- less than 1% of all TB cases
- may present in any age group, but is most common among young adults
- may occur primarily or as part of disseminated disease
- routes of propagation:
 - hepatic artery (miliary TB)
 - portal vein (localized hepatic TB)
 - lymphatic spread
- clinical presentations and imaging findings are often nonspecific
- biopsy is often needed to obtain definitive histological diagnosis

Introduction

Tuberculosis (TB) is an old disease presenting with new faces in the advent of more advanced cross-sectional imaging. It typically affects the lungs but can affect other organs of the body (extrapulmonary). During the latter half of the twentieth century, a dramatic decrease in the incidence of TB was seen in the world as a result of improved nutrition, reduced crowding, public health measures, and effective treatment. But in recent years, there has been an increase in incidence of TB due to several causes, including AIDS epidemic, intravenous drug abuse, increase in the number of immunocompromised patients, and emergence of drug-resistant strains of TB bacilli. Hepatic TB is one of the manifestations of extrapulmonary TB and its incidence has also been increasing [1, 2].

Hepatic Involvement in Tuberculosis

TB of the liver is uncommon and accounts for less than 1% of all tuberculous infections [3]. It is rare due to low tissue oxygen tension in the liver, which is unfavorable for mycobacterial growth. The disease may present at any age but is most commonly seen in young adults.

Hepatic TB can occur primarily or it can be secondary to a tubercular focus elsewhere in the body. Miliary disease of the liver results when TB bacilli reach the liver via the hepatic artery from a tuberculous infection of the lungs. In some cases, infection could reach the liver via the portal vein notably if there is concomitant involvement of the gastrointestinal tract. In localized hepatic TB, the route of propagation is usually through the portal vein. The TB bacilli may also reach the liver by lymphatic spread or due to rupture of a tuberculous lymph node along the portal tract. Irrespective of the mode of entry, the liver responds by granuloma formation. Both caseating and non-caseating granulomas are seen [4].

Clinical Manifestations and Nomenclature

The clinical presentation of hepatic TB is usually insidious and often nonspecific. Most frequently observed

Imaging Clues

Micronodular (Miliary) Type

- more common
- lesions measure 0.5 - 2 mm
- hepatomegaly may be the only imaging finding if lesions are below the resolution of US or CT

US

- tiny hypoechoic or calcified lesions

CT

- low attenuation lesions with central enhancement (acute stage)
- calcifications (chronic stage)

Macronodular Type (Tuberculoma, Pseudotumoral TB or Tuberculous abscess)

- less common
- multiple 1 - 3 cm lesions or large tumor-like mass

US

- hypoechoic or complex lesions
- calcifications

CT

- hypodense or calcified lesions
- with or without peripheral rim or central enhancement

MRI

- hypointense on T1WI
- hyperintense on T2WI
- with or without peripheral rim or central enhancement

Large mass-like lesions usually exhibit heterogeneous enhancement with areas of necrosis on CT and MRI

Mixed Type

- combination of micro and macronodules

Signs suggestive but not pathognomonic for TB:

"Target" sign

- central nidus of calcification or enhancement surrounded by an area of low attenuation or ring of enhancement on CT
- central and peripheral rim enhancement on MRI

"Cluster" sign

- multiple micronodular lesions fused into a macronodular mass
- may present as a multiloculated cystic mass

clinical findings include high-grade fever, upper abdominal pain, weight loss and hepatomegaly. Jaundice has been reported in 35% of cases and is usually obstructive in nature, simulating other conditions causing extrahepatic biliary obstruction and makes the diagnosis more challenging [5]. The diagnosis of TB depends on demonstration of caseating epithelioid granuloma or presence of acid-fast bacilli (AFB) in the aspirated pus or biopsy [6].

Hepatic TB has been described with a wide variety of terms and classifications. A review of literature in 1952 classified hepatic TB into miliary TB (part of generalized disease) and localized disease. Localized hepatic TB could be further divided into focal or nodular TB (including hepatic abscess or tuberculomas) and into the tubular form (intrahepatic duct involvement) [7]. Since then, isolated case reports or case series of localized hepatic TB have appeared in literature with varied nomenclature including atypical TB, tuberculous liver abscess, tuberculous pseudotumor, primary hepatic TB, tuberculous hepatitis, and serohepatic TB, which generated some confusion in classification and clinical significance of the disease [8-10].

Imaging Classification and Findings

On cross-sectional imaging, hepatic TB can be comprehensively classified into micronodular and macronodular forms [8, 9, 11-14]. Micronodular hepatic TB refers to miliary tuberculosis wherein the lesions measure 0.5 - 2 mm in diameter (Figure 1). The macronodular form may present either as multiple 1 - 3 cm lesions or as a large tumor-like mass (Figures 3 - 4). Mixed type of hepatic TB has also been described, which demonstrates both micronodular and macronodular features.

The micronodular form of hepatic TB is more common and is thought to result from hematogenous dissemination of TB bacilli. Concurrent pulmonary TB may or may not be seen. The only imaging finding in micronodular hepatic TB may be hepatomegaly if the lesions are below the resolution of ultrasonography (US) or computed tomography (CT). US may demonstrate lesions as tiny hypoechoic lesions with a "bright liver pattern." During acute stage, micronodular hepatic TB may present as low attenuation areas with central enhancement on CT imaging. Lesions may present with calcifications during the chronic stage (Figure 1). The differential diagnosis of micronodular hepatic tuberculosis includes metastases, lymphoma, leukemic cell infiltration, sarcoidosis, and fungal infection [11-14].

The macronodular form of hepatic TB is less frequent

and is probably secondary to conglomeration of miliary granulomas. Macronodular TB lesions have been referred to by a variety of names, including tuberculoma, pseudotumoral TB and tuberculous abscess. Macronodules on US appear as hypoechoic lesions (Figure 3A) or complex masses. Such lesions usually appear low attenuating with or without peripheral enhancement on CT (Figures 3B and 3C). The hypoenhancing or non-enhancing central region of the lesion represents the area of caseation necrosis while the peripherally enhancing rim corresponds to the outer granulation tissue. Low attenuating lesions with central enhancement may be demonstrated during the acute stage of the disease. On the other hand, during the chronic stage, fewer enhancements are observed at the central low density of caseation necrosis. Magnetic resonance imaging (MRI) demonstrates macronodular TB lesions as hypointense on T1-weighted sequences (Figures 3D and 4C) and hyperintense on T2-weighted sequences (Figures 3E and 4D) relative to the surrounding liver. Enhancement pattern of the lesions on post-gadolinium MRI varies from peripheral to heterogeneous patterns of enhancement. For larger mass-like lesions, enhancement pattern is commonly heterogeneous with areas of necrosis in post-contrast CT or MRI (Figures 4B and 4E) [1, 4, 8, 11, 13].

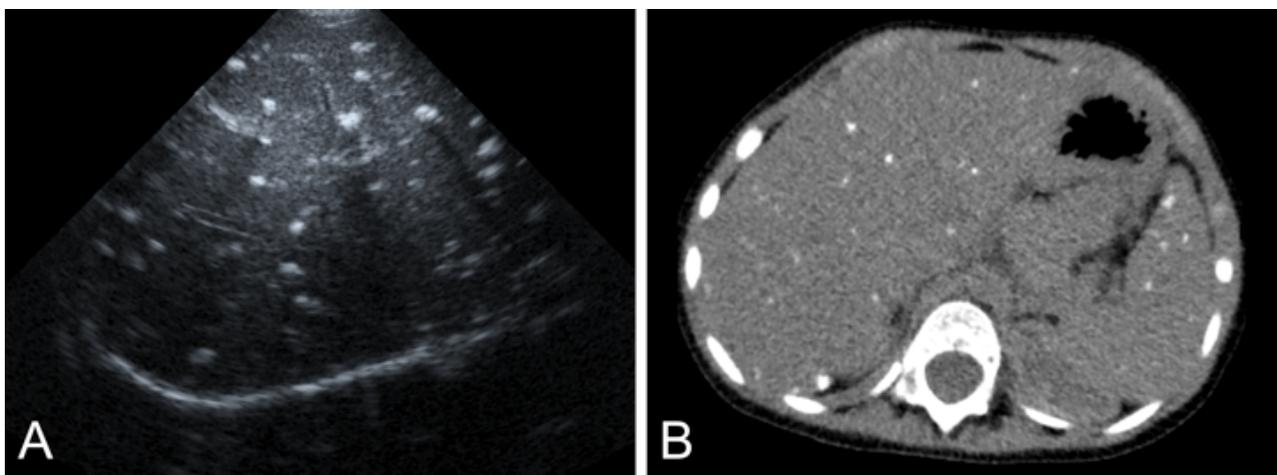


Figure 1. Hepatic involvement in a 2-year-old female with disseminated TB and Pott's disease. US (A) and CT scan (B) show hepatomegaly with multiple scattered punctate hepatic parenchymal calcifications. Punctate splenic calcifications (B) are also evident.

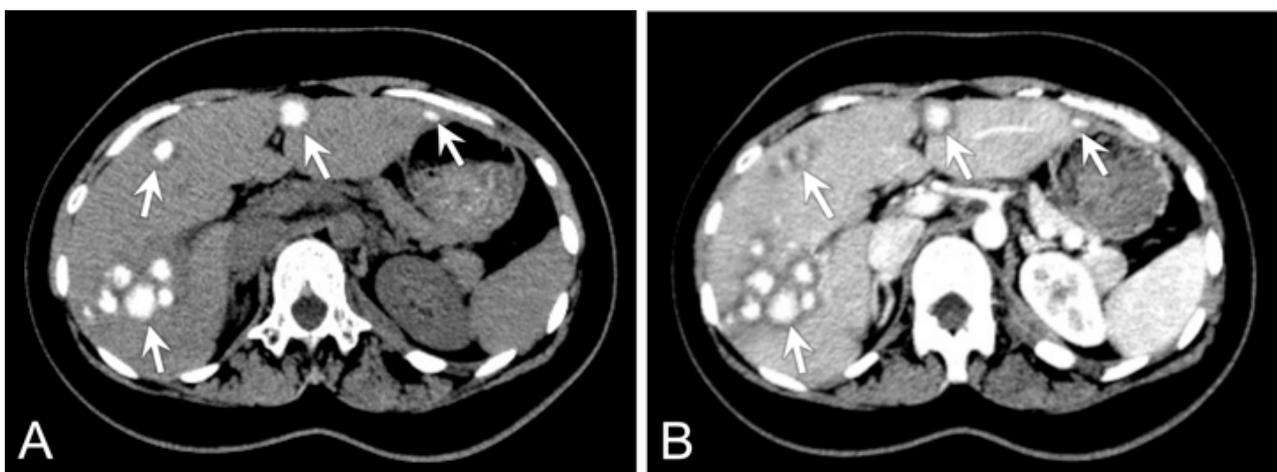


Figure 2. CT scan of an 18-year-old female with hepatic TB who presented with abdominal discomfort. Plain (A) and contrast-enhanced (B) images show hepatic nodules with peripheral areas of low attenuation and central calcifications (arrows). Biopsy of one of the hepatic lesions showed necrotizing granulomatous inflammation in keeping with TB.

Some macronodular lesions may exhibit a bull's-eye appearance ("Target" sign), which refers to the central nidus of calcification or central enhancement with surrounding area of low attenuation (Figure 2) or ring of enhancement on CT, or central enhancement accompanied by peripheral rim enhancement on post-contrast MRI (Figure 3F). This sign is suggestive of, but not pathognomonic for, TB [14].

When marked caseation necrosis occurs in the center of a tuberculoma, it means tuberculous abscess has formed, hence the CT or MRI manifestation would be a cystic lesion with slightly or no enhanced rim. Multiple micronodular lesions may coalesce into a macronodular lesion presenting as a multiloculated cystic mass or "cluster" sign, which could be considered as a suggestive feature of hepatic TB. Tuberculous abscesses are rare and share similar imaging characteristics with pyogenic or amoebic hepatic abscesses, which must first be ruled-out [1].

The imaging appearances of macronodular hepatic TB are nonspecific and may appear identical to pyogenic abscess, metastases, and primary liver tumors such as hepatocellular carcinoma and cholangiocarcinoma (Figures 3 and 4). Image-guided biopsy is often required to obtain a definitive

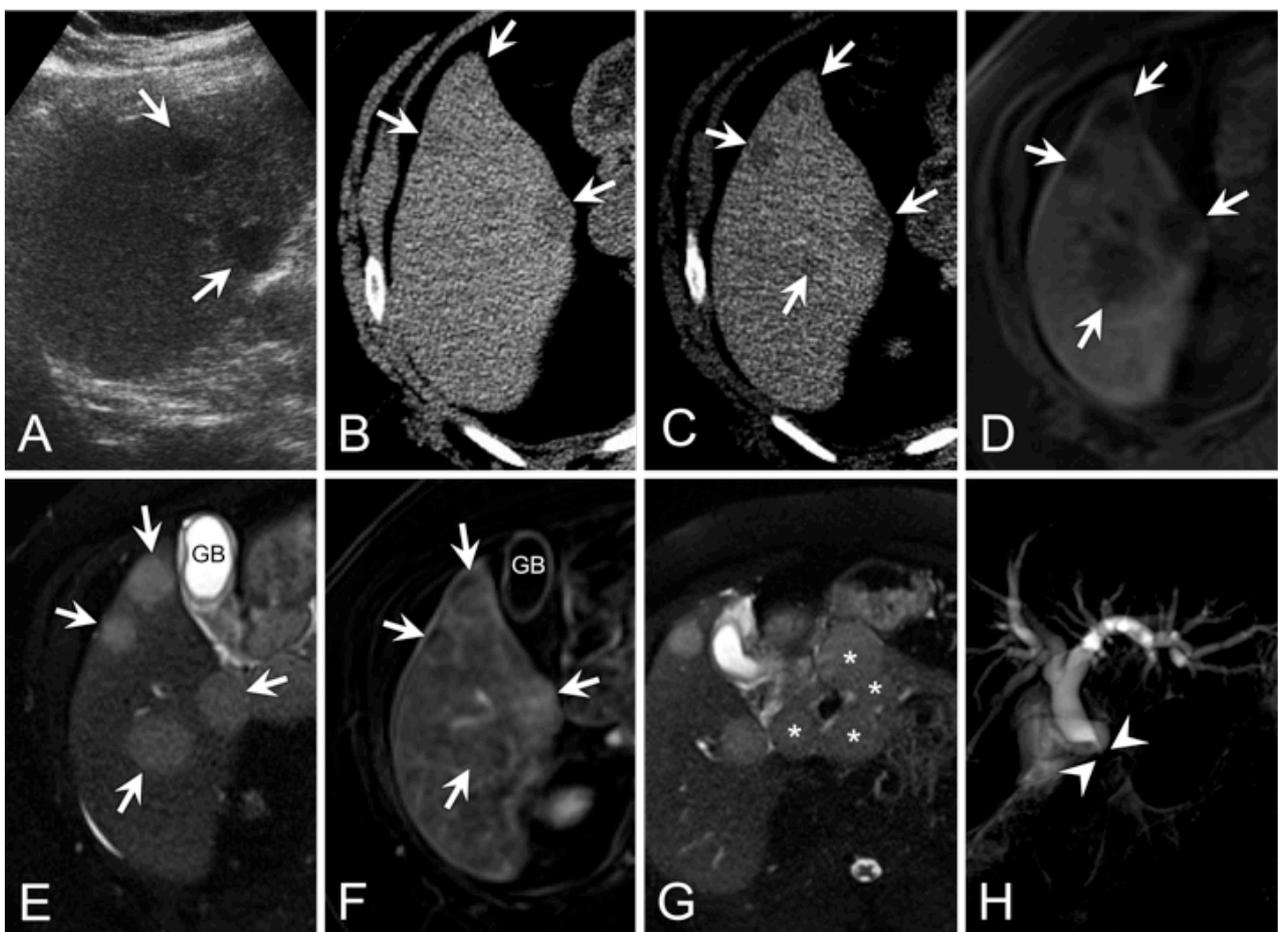


Figure 3. Hepatobiliary TB in a 44-year-old male with epigastric pain and jaundice. Initial US (A) shows hypoechoic hepatic nodules (arrows). Plain and contrasted-enhanced abdominal CT images (B and C, respectively) show the lesions as hypodense hepatic nodules. MRI better delineates the hepatic nodules, which exhibit low intensity signals on T1-weighted images (D) and high intensity signals on T2-weighted images (E). On post-gadolinium images (F), the nodules exhibit peripheral rim and central (target-like) enhancement. Multiple enlarged peripancreatic lymph nodes (asterisks in G) are demonstrated resulting to biliary obstruction (arrowheads in H). Fine needle aspiration biopsy (FNAB) of the peripancreatic lymph nodes revealed chronic granulomatous lymphadenitis consistent with TB. (GB - gallbladder)

histological diagnosis. Hepatic tuberculomas eventually tend to calcify, and the presence of calcified granulomas at CT in patients with known risk factors and in the absence of a known primary tumor should raise suspicion for TB [1, 4, 8, 11-14].

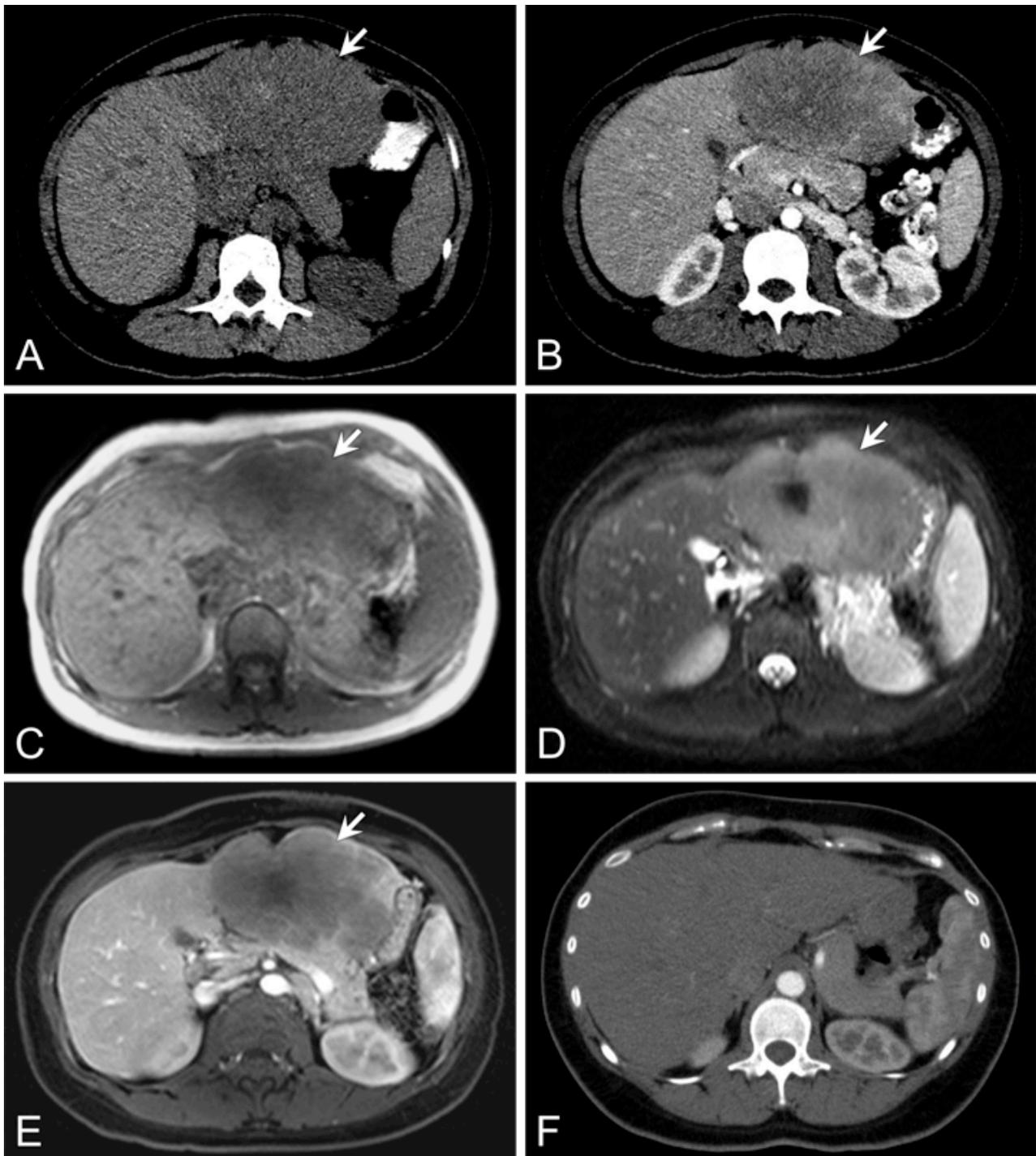


Figure 4. Hepatic TB presenting as a mass in a 29-year-old female. Initial CT scan (A and B) shows an enhancing hypodense mass involving the left hepatic lobe. The mass exhibits low intensity signals on T1-weighted images (C), high intensity signals on T2-weighted images (D), and heterogeneous enhancement with central area of low intensity on post-gadolinium images (E) on MRI examination. Histopathology of the lesion biopsy showed chronic necrotizing granulomatous inflammation consistent with TB. Follow-up CT scan (F) no longer demonstrates the mass after completion of anti-TB treatment.

Conclusion

Cross-sectional imaging with US, CT and MRI plays an important role in the diagnosis and post-treatment follow-up of hepatic TB. Although TB of the liver is uncommon, recognition of the imaging manifestations is important because of its increasing incidence and its propensity to mimic several varieties of intra-abdominal pathologies. Specific imaging features of hepatic TB are frequently related to caseous necrosis, which is the hallmark of this disease. However, hepatic lesions can appear similar to a variety of neoplastic and non-neoplastic conditions. Cross-sectional imaging alone may be insufficient in reaching a conclusive diagnosis, and image-guided tissue sampling is needed in most cases.

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