

## Ultrasound in the evaluation of aspergillosis liver abscess

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*The use of ultrasonogram in the evaluation of hepatic abscesses in a presumably immunocompetent patient with disseminated aspergillosis is discussed. Information on the appearance of the hepatic abscesses and a differential diagnosis of these lesions are presented along with sonographic features which could assist in diagnosis. We were indeed surprised to find that this is the first such case of aspergillosis liver abscess with sonographic features in the literature, so far. Sonographically guided needle aspiration with subsequent percutaneous drainage is suggested for providing a definitive diagnosis and a therapeutic approach for treating intrahepatic abscesses.*

*Key words: Aspergillosis, Liver abscess, Ultrasound, Computed tomography.*

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บทความนี้เป็นการวิจารณ์ลักษณะภาพอัลตราซาวด์ของฝีในตับในผู้ป่วยรายหนึ่ง ซึ่งได้รับวินิจฉัยว่าเป็นโรคคิสติซิเนทเทค แอสเปอร์จิลโลซิส และบรรยายลักษณะภาพฝีในตับที่พบบ่อย ๆ จากการตรวจพบด้วยอัลตราซาวด์ รวมทั้งการวินิจฉัยแยกจากโรคอื่น ๆ การใช้เข็มเจาะฝีในตับและการระบายหนองจากฝีผ่านทางผิวหนังโดยใช้อัลตราซาวด์บ่งบอกตำแหน่งของฝีจะช่วยให้การวินิจฉัยโรคและการรักษาได้ถูกต้องแน่นอนยิ่งขึ้น

The diagnosis and treatment of liver abscess continues to be a serious clinical problem because of the considerable morbidity and up to 50% mortality in such cases.<sup>(1,2)</sup> The basic requirements for effective therapy of intrahepatic abscess are early diagnosis and drainage.<sup>(3)</sup> Ultrasonography has proved to be extremely useful and accurate in the detection of intraabdominal abscesses.<sup>(4-7)</sup> Several centers have reported accuracy rates exceeding 90%.<sup>(8,9)</sup> Despite the high efficacy of this noninvasive method of investigation, the sonographic appearance of such abscesses has been shown to be nonspecific, with some producing varied and perhaps confusing patterns.<sup>(1,4)</sup> We present a case of multiple hepatic abscesses, which showed varying echogenicity from anechoic lesions to highly echogenic solid masses. An unusual "target" or "bull's-eye" appearance, that is usually associated with metastatic deposits, was also demonstrated. Percutaneous needle aspiration of such lesions allows early histologic and bacteriologic diagnosis and facilitates prompt therapy.<sup>(1,10-12)</sup>

## Case report

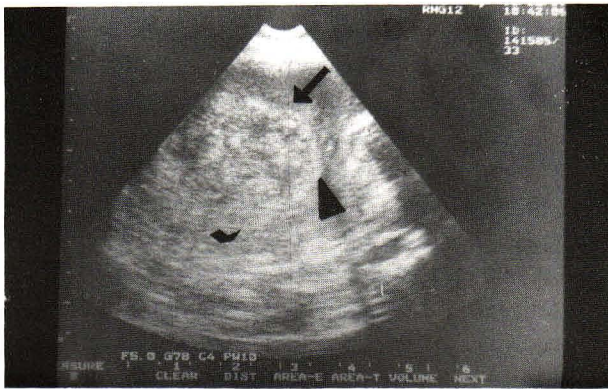
A three-year-old boy presented with a three-week history of fever, nonproductive cough and abdominal discomfort. He had been treated without improvement by a general practitioner in a provincial hospital. His mother noticed that his abdomen progressively distended during the illness. Thereafter he was referred to our hospital. There was a previous history of pneumonia, with G-6-PD deficiency diagnosed in another hospital six months previously.

On admission, the patient looked ill, mildly dehydrated and restless. His vital signs showed a body temperature of 39.2°C, rapid peripheral pulse rates and respiratory rates of about 130/min and 40/min, respectively, and blood pressure of 100/60 mmHg. He was moderately pale but not icterus. There were diminished breath sounds with evidence of rhonchi and crepitation in the right lung; heart sounds were normal. The abdomen was markedly distended; a large palpable 12 cm nonpulsatile mass was noted at the level of the epigastrium. It was of rubbery consistency, not tender and nonmovable. The liver was palpable 2 cm below the right costal margin. The spleen was not enlarged. The bowel sounds were normal. Other findings were unremarkable.

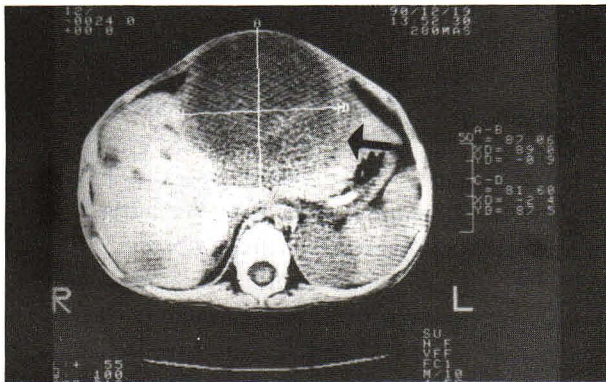
The hemoglobin value was 7.9 mg%. Red cell morphology showed slight hypochromia, moderate anisocytosis and poikilocytosis. The reticulocyte

count was 4.7%. The white blood cell count was 36,400/mm<sup>3</sup> with 54% neutrophils, 42% lymphocytes and 4% eosinophils. The platelet count was normal. The urine and stool examinations were also normal. Blood urea nitrogen was 6 mg/100 ml. Prothrombin time was prolonged. The albumin/globulin ratio was reversed, i.e. about 3.0/4.4. Total bilirubin was 1.1 mg/100 ml. SGOT and SGPT were 46 and 19 units/L, respectively. The alkaline phosphatase level was markedly increased, i.e. about 706 units/L. Tuberculin test, HBs Ag, alpha-fetoprotein, E. hist. titer and mellioidosis titer were all negative.

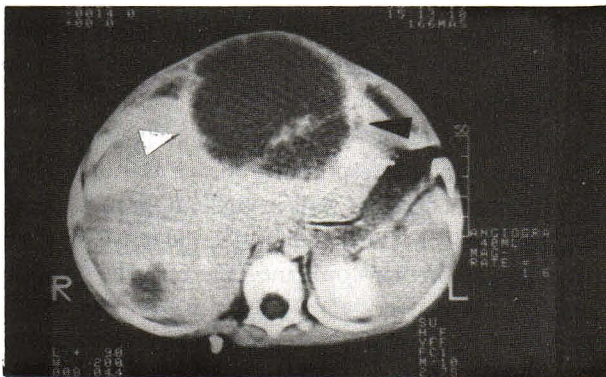
The chest roentgenogram revealed diffuse infiltration in the right lung with multiple cavity changes in the right upper lobe. There was right pleural effusion as well. Thoracocentesis was performed; only a small amount of clotted blood was obtained. There was a moderated number of neutrophils without a predominant organism in expectorated sputum. Upper abdominal ultrasonography revealed a large, inhomogeneous, mixed high and low echoic solid mass, with a well-defined thick echogenic wall, in the left lobe of the liver. There was a circumferential, thin, peripheral halo outside the echogenic wall of this large mass. Also noted was distal acoustic enhancement behind it (Fig. 1a). The latter findings were highly suggestive of hepatic abscess, although an echo pattern alone could indicate a tumour, such as hepatoblastoma, hematoma, sarcoma, or metastasis. Noncontrast CT scan of the liver revealed a large, inhomogeneous, low-density lesion (12-23 HU), with a circumferential low attenuation halo corresponding to the echo-free halo in the sonograph, occupying nearly the whole left lobe of the liver. Bulging of the anterior liver surface and the upper abdominal wall was also demonstrated (Fig. 1b). Contrast-enhanced CT scan showed a peripherally enhanced rim, corresponding to the echogenic wall in the sonograph, surrounding the large, low-density lesion in the left hepatic lobe (Fig. 1c). There were irregular septations inside this lesion. Also noted was a small, low-attenuation zone outside the peripherally enhanced rim, corresponding to the echo-free halo outside the echogenic wall in the sonograph. These CT findings provided a definite diagnosis of liver abscess and further confirmed the efficacy of sonography. Moreover, with CT scan we were able to find two more similar abscesses in the right lobe of the liver (Fig. 1c) associated with consolidation intermingling with multiple pockets of abscesses in the right lung (Fig. 2).



**Figure 1a.** An ultrasonogram reveals a large, mixed echoic mass, with a well-defined echogenic wall (arrow head) in the left lobe of the liver. Note the circumferential, thin, peripheral halo (straight arrow) outside the echogenic wall and distal acoustic enhancement (curved arrow).

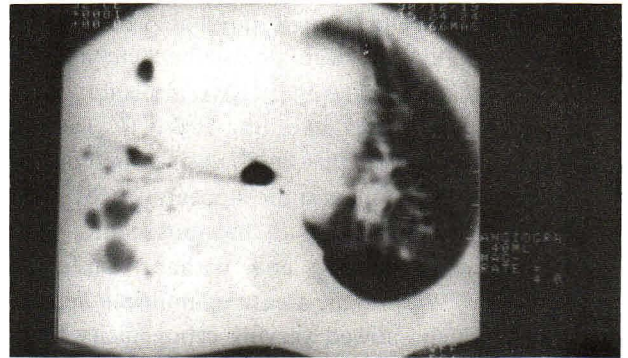


**b.** Noncontrast CT scan shows a large inhomogeneous low-density mass with a peripheral low-attenuation halo (straight arrow) corresponding to the decho-free halo in Fig. 1a.



**c.** Contrast CT scan shows rim-enhancement of the low-attenuation center (white arrow-head) corresponding to the echogenic

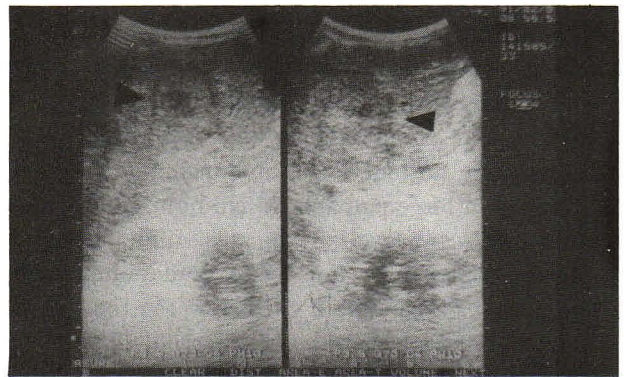
wall in Fig. 1a. The low-attenuation zone (black arrow-head) outside the wall in Fig. 1a. Note also another small, low-density lesion in the right lobe.



**Figure 2.** Lung window CT scan reveals consolidation associated with multiple pockets of fluid density in the right lung.

The patient underwent surgical drainage of the hepatic abscess in the left lobe and approximately 200 ml of odorless yellow pus was obtained. Gram stain of the pus showed no organism, but a culture of the pus grew *Spergillus fumigatus*. Therefore, we left that disseminated aspergillosis was presented in this patient, since by definition, two or more noncontiguous visceral organs were involved.<sup>(13)</sup>

During this hospital stay, follow-up sonographic studies of the hepatic abscesses were performed weekly. We noticed multiple “target” or “bull’s-eye” abscesses (Fig. 3), which could have been mistaken for metastatic deposits if there had been no definite diagnosis before hand. We also found various new mixed echoic lesions with and without a defined wall in these later studies.



**Figure 3.** A follow-up sonographic study reveals “target” or “bull’s-eye” abscesses in the left lobe of the liver (arrow-heads).

Despite amphotericin therapy, the pulmonary and hepatic abscesses progressed, and the fever and leukocytosis persisted. Persistent severe metabolic acidosis developed without improvement despite the administration of multiple doses of bicarbonate correction. The patient eventually died because of septic shock during the third month after admission.

## Discussion

The development of intrahepatic abscess is usually a complication of prior abdominal surgery, biliary disease, trauma, neoplasm, or bacteremia in a compromised host.<sup>(3)</sup> Our case is unique in that disseminated aspergillosis occurred in a young boy whose immune responses were not compromised. He was not granulocytopenic, hypogammaglobulinemic, receiving immunosuppressive drugs or corticosteroids. He had no underlying malignancy. Multiple specific tests for HMI, CMI and neutrophil function all showed no defect. Anti-HIV for AIDS screening was negative as well.

Patients presenting with hepatic abscesses may have abdominal pain and/or tenderness, fever, hepatomegaly or jaundice.<sup>(6)</sup> Our patient developed a large upper abdominal mass, which could hardly be differentiated from a neoplasm on clinical examination. In patients with disseminated aspergillosis, the lung is the most frequent target organ and the brain runs a close second. Kidneys, heart, thyroid and spleen are the next most frequently affected organs. It is surprising to learn that the liver is a less frequent target.<sup>(14)</sup> In all reported cases, hepatic involvement has been found during autopsy. This should further emphasized the unusual clinical features of our case.

Ultrasound is not yet at the stage of routinely providing tissue signatures and reliably accurated pathological diagnosis.<sup>(15)</sup> However, if attention is paid to certain features on the images, the diagnostic possibilities can usually be overcome. The sonographic spectrum of intrahepatic abscesses is varied. While the "typical" abscess has been described as a spherical, sonolucent structure which may have an irregular wall,<sup>(6,16)</sup> there are reports of increased echogenicity in some lesions with or without the presence of gas.<sup>(17-19)</sup>

Experimental studies have shown that sonographically examined fluid collections can be echogenic. This phenomenon occurs when a fluid collection contains cholesterol crystals,<sup>(20)</sup> suspensions of protein-macroaggregates,<sup>(21)</sup> protein-lipid,<sup>(22)</sup> fat,<sup>(23)</sup> and stable microbubbles in a protein-lipid solution.<sup>(24)</sup> Dissimilar liquids, when vigorously mixed, can be

echogenic, presumably due to a lack of homogeneity resulting in acoustic impedance mismatches.<sup>(25)</sup>

The variable sonographic appearance of abscesses is dependent on the morphology of the abscesses. Their contents are continuously changing during the phases of development, organization and repair.<sup>(7)</sup> Familiarization with the following sonographic features may help in making a precise diagnosis in most cases.

### 1. Echogenicity

There are variations in the echogenicity of abscesses ranging from totally anechoic to highly echogenic lesions, depending on the distribution of necrotic debris. Very intensely echogenic lesions are due to the presence of air within the abscess cavity.

### 2. Peripheral echo-free halo

A thin, circumferential echo-free zone, either inside or immediately outside the wall of the abscess, was demonstrated in 37% of the inflamed lesions.<sup>(7)</sup> This has been attributed to an inflammatory reaction and to the increased blood flow in the adjacent parenchyma.

### 3. Abscess wall

The wall of an abscess usually appears in the subacute and chronic stages and is generally not visualized in the acute inflamed lesion or in abscesses caused by amoebic infection.<sup>(7,15)</sup>

### 4. Distal acoustic enhancement

This sonographic feature presents the most consistent and reliable clue in the diagnosis of abscesses.<sup>(1,7,15)</sup> Every effort should be made to evaluate adequately the presence or absence of distal acoustic enhancement in a diffusely echogenic mass.

### 5. Secondary findings

Localized perihepatic fluid collections and an elevated hemidiaphragm with adjacent pleural reaction are important sonographic observations in determining the true nature of an echogenic mass.

The differential diagnosis of liver abscesses includes a simple cyst, hematoma, necrotic tumor, and primary or metastasis cystadenocarcinoma. On the basis of sonography alone, it may be difficult to distinguish among these possibilities. However, sonographically guided needle aspiration is an economic method for quickly and definitively establishing the diagnosis of an abscess.<sup>(1,10-12)</sup> Subsequent percutaneous catheter drainage of the abscess facilitates antibiotic therapy and prompt

clinical response,<sup>(12,26,27)</sup> and obviates the need for surgical intervention.

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