

Case Report

Liver Sarcoidosis with Unique MRI Images Using Gadolinium Ethoxybenzyl Diethylenetriamine Pentaacetic Acid

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Sarcoidosis is a systemic disease characterized by the formation of non-caseating granulomas in multiple organs. In the diagnosis of sarcoidosis, imaging modalities such as ultrasonography, computed tomography (CT) and magnetic resonance imaging (MRI) are useful; however, there are few reports of MRI imaging using gadolinium ethoxybenzyl diethylenetriamine pentaacetic acid (Gd-EOB) MRI. A 46-year-old Japanese female with suspected pulmonary sarcoidosis was admitted to our hospital because low-density mottles in the liver were observed incidentally by chest CT. The low-density mottles were not enhanced at the arterial phase or portal phase by abdominal CT and MRI, and decreased uptake was observed in the hepatobiliary phase of Gd-EOB MRI. No hematological disorder was observed except for a slight increase of biliary enzymes. The lesion was diagnosed as liver sarcoidosis by the liver biopsy. Since the patient refused steroid therapy, we prescribed ursodeoxycholic acid (UDCA). 600 mg/day. The serum levels of biliary enzymes were normalized and the abdominal CT findings gradually improved after the initiation of UDCA medication. Gd-EOB MRI showed unique hypointense areas in the liver at the hepatobiliary phase, which might be useful in the diagnosis of liver sarcoidosis.

Key words: liver sarcoidosis, ursodeoxycholic acid (UDCA), gadolinium ethoxybenzyl diethylenetriamine pentaacetic acid (Gd-EOB)

Sarcoidosis is a systemic disease characterized by the formation of non-caseating granulomas in multiple organs. The exact cause of sarcoidosis is unknown. Sarcoidosis generally affects the hilar lymph nodes, lungs, and eyes [1]; most cases involve the enlargement of bilateral hilar lymph nodes and the development of lung lesions that are detectable by thoracic radiography. Numerous asymptomatic cases are incidentally identified on examination, whereas symptomatic cases are often concomitantly detected

based on eye, respiratory, and skin symptoms. Observation without any treatment (*i.e.*, "wait and see") is used in most sarcoidosis cases, but individuals with severe visual disorder and cardiac dysfunction are treated with steroids.

Here we report the incidental identification of a liver lesion during a thoracic computed tomography (CT) examination of a lung sarcoidosis patient who was under observation. Unique images were observed by gadolinium ethoxybenzyl diethylenetriamine pentaacetic acid (Gd-EOB) MRI, and treatment using oral

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ursodeoxycholic acid (UDCA) resulted in improved blood test and imaging results.

Case Presentation

A patient was a 46-year-old Japanese female. Her medical history and family history revealed no remarkable information. In June 2006, she underwent an examination by thoracic radiography, which detected granular shadows in her thorax; she was admitted to our hospital for further examination. A chest X-ray suggested sarcoidosis, and a bronchoscopy was planned. However, the examination was terminated because of suspected xylocaine shock. No significant findings were observed by fundoscopy, echocardiography, and abdominal CT. We then decided to monitor the patient using periodic thoracic radiography and CT examinations at an outpatient clinic.

No subjective symptoms were found. However, in June 2010 an intrahepatic patchy pattern shadow emerged during a thoracic CT examination, and she was therefore admitted again to our hospital for further examination. In the blood test at the time of admission, her alkaline phosphatase (ALP) and gamma-glutamyl transpeptidase (γ -GTP) levels were

410IU/L and 62IU/L, respectively, which suggested a mild increase in hepatobiliary enzymes. However, her transaminase level was normal, and her AST and ALT levels were 28IU/L and 19IU/L, respectively. The angiotensin-converting enzyme (ACE) level was elevated to 35.3IU/L. The hepatic tumor marker level was also normal; alpha-fetoprotein (AFP) was 3.3ng/mL.

In a thoracic radiogram, a nodular shadow was observed in the middle zone of the right lung. No undisputable hilar lymph node enlargement was observed. In abdominal ultrasonography, a low echoic area was observed in the hepatic border which corresponded to the map-like low-density area observed during the CT examination. An intrahepatic diffuse map-like low-density area was also detected, but no early- or late-contrast effects were observed in abdominal dynamic CT examination (Fig. 1). In addition, the low-density area detected by CT appeared slightly hypointense on T1-weighted imaging, and slightly hyperintense on T2-weighted imaging in abdominal Gd-EOB MRI (Fig. 2).

The intensity of the liver was lower than that of the spleen in T2-weighted imaging. Similar to the CT results, MRI did not show any contrast effects. In addition, hepatobiliary-phase contrast MRI showed

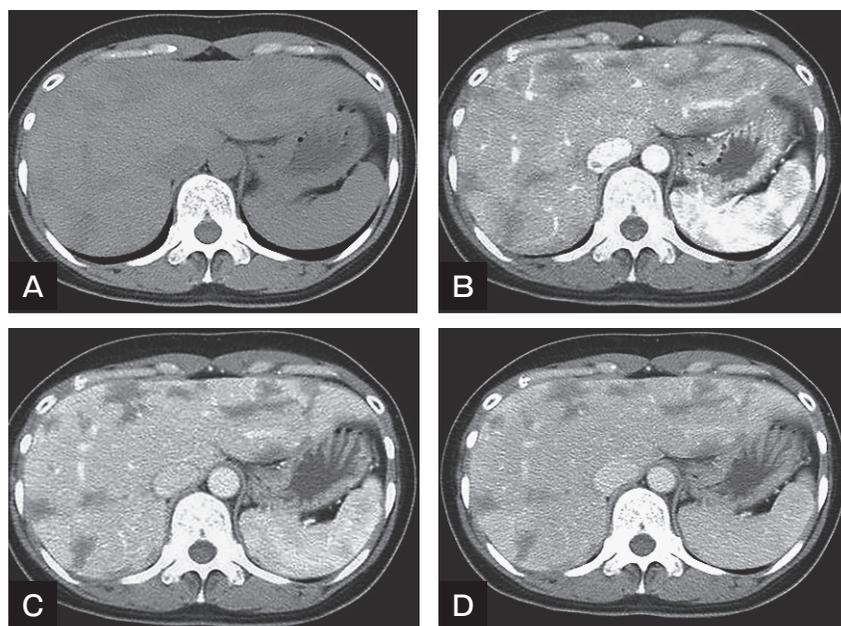


Fig. 1 Dynamic CT: The low-density mottles in the liver were observed at the precontrast phase (A), and were not enhanced at the arterial phase (B), portal phase (C) or delayed phase (D).

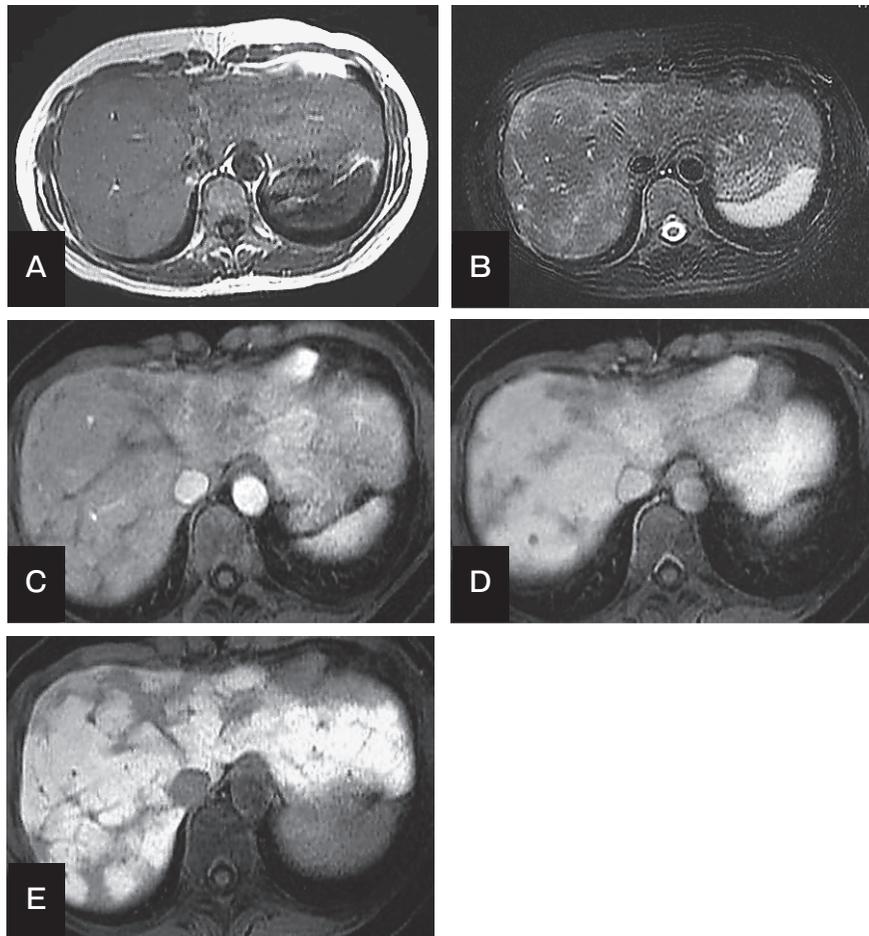


Fig. 2 Gd-EOB MRI: The low intensity mottles were observed on a T1-weighted image (A), and the high-intensity mottles were observed on a T2-weighted image (B). The mottles were not enhanced at the arterial phase (C) or portal phase (D). Decreased uptake was observed in the hepatobiliary phase (E).

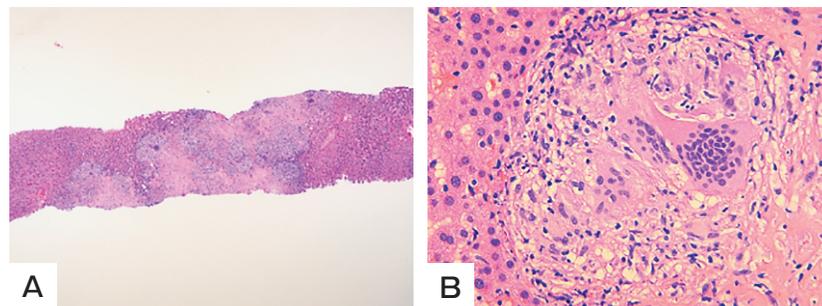


Fig. 3 Histological findings of the liver needle biopsy (hematoxylin and eosin staining). From the portal region to the liver parenchyma, multiplication of the epithelioid cells containing a multinuclear giant cell was observed.

hypointense lesions. The hypointense area on the hepatobiliary phase in Gd-EOB MRI was slightly larger than the low-density area in dynamic CT.

A liver biopsy was performed in June 2010 to establish a definitive diagnosis. In the pathology investigation, the lobular structure of the liver was

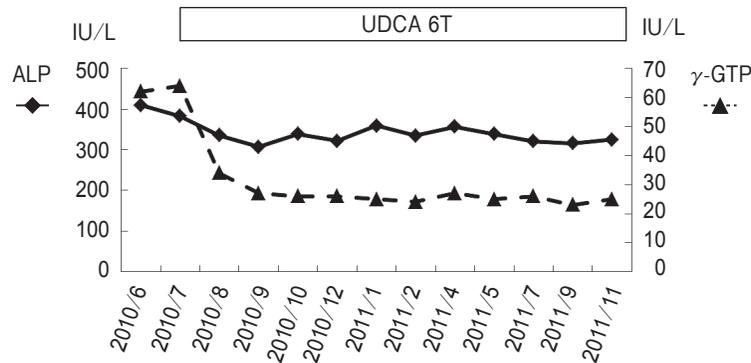


Fig. 4 The patient's clinical course. Her γ -GTP and ALP levels improved after UDCA treatment was initiated.

intact, but multinucleated giant cells were detected in the portal area-peripheral liver parenchyma; multiplication of epithelioid cells was observed (Fig. 3). We made the diagnosis of liver sarcoidosis with the pathology findings. Subjective symptoms were not found; however, pathological changes in the liver and abnormal levels for biliary enzymes were observed, and thus steroid treatment was recommended. The patient expressed a strong preference for taking oral medications, and thus, oral UDCA 600 mg/day was initiated.

After the introduction of UDCA, a gradual improvement was observed in the patient's blood tests (Fig. 4). Although an intrahepatic low-density area was constantly observed during abdominal CT imaging, the patient continued to show improvement. After 1 year and 7 months of treatment with UDCA, the patient has not experienced any general health problems and has been given a good prognosis.

Discussion

Liver sarcoidosis accounts for approx. 20–30% of all sarcoidosis cases. In Japan, approx. 40–60% of sarcoidosis cases are detected during autopsy, and the cases commonly involve the lungs, lymph nodes, and heart [2]. Most sarcoidosis cases, including our patient, are asymptomatic, anorexia, general malaise, and fever are also infrequently reported. Rare sarcoidosis cases may be associated with portal hypertension, jaundice, and liver cirrhosis because of vascular pressure attributable to a granuloma [3, 4].

Imaging findings for liver sarcoidosis generally involve multiple nodules; however, a few cases,

including our patient, have shown diffuse map-like lesions. The fusion of nodules has also been reported in some cases, in which multiple nodular lesions combine into a larger map-like lesion. Hypoechoic nodules detected during abdominal ultrasonography have also been reported, although some cases show internal coarse echo and hyperechoic nodules [5]. Low-density areas may sometimes be observed in the affected area during CT imaging without contrast effect, making it difficult to differentiate between metastatic liver cancer and liver abscess [4, 6]. No patterns in T1- and T2-weighted MRI imaging have been established for liver sarcoidosis. However, superparamagnetic iron oxide particle (SPIO) contrast reduces the intake of the lesion, which results in a hyperintense image that may be useful for diagnosis.

In our patient, CT imaging demonstrated a low-density area, whereas in her MRI examination, T2-weighted images showed hyperintense lesions and T1-weighted imaging showed hypointense lesions. These findings suggested an increase in cell density, which reflects an increase in the amount of water. The decreased intensity of the liver on T2-weighted images was emphasized by comparing the intensity of the spleen. A difference in intensity between the liver area and spleen was also reported by Chundru *et al.* [7], and this finding might be ubiquitous in liver sarcoidosis. In our patient, the intensity of liver sarcoidosis was similarly lower than that of the spleen on T2-weighted images. We speculate that the sarcoid nodules destroyed normal liver tissue, and thus the blood flow to the liver was reduced. The reduction in blood flow in the sarcoid nodules might thus have affected the contrast of the sarcoid lesion and the

spleen.

A reduction in blood flow in the lesion has also inhibited the contrast effect of imaging. A reduction in the intake of the contrast dye, which is attributable to the destruction of normal liver tissue, resulted in the generation of hypointensity on the hepatobiliary phase. In our patient's case, we observed that the hypointense area on the hepatobiliary phase in Gd-EOB MRI was slightly larger than the low-density area in dynamic CT, suggesting that the liver cell function was deteriorated without the reduction of blood flow at the boundary of the lesion. There are few reports showing the intake of Gd-EOB by hepatocytes, which might shed light on the liver function of sarcoidosis.

In the absence of imaging results or in cases of undetectable impairment of liver function, approx. 80% of liver sarcoidosis cases are diagnosed using laparoscopic liver biopsy [8]. A clinicopathological report of 100 cases of liver sarcoidosis [9] included findings such as cholestatic disorder, a mix of cholestatic disorder and hepatocyte damage, and hepatitis; all cases showed varying degrees of non-caseating granuloma, as well as multinucleated giant cells and asteroid bodies.

In the present case, UDCA was effective. The mechanism of action of UDCA involves immunoregulation. It was reported that UDCA modulates the action of nuclear glucocorticoid receptors [10–12], thus suggesting that its effect may be attributable to its steroid-like action.

Conclusion

Our patient's case involved sarcoidosis of the liver with unique Gd-EOB MRI findings and successful treatment with oral UDCA.

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