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A Case of Mass-Forming Splenic Tuberculosis: MRI Findings with Emphasis of Diffusion-Weighted Imaging Characteristics

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Tuberculosis remains one of the most prevalent and fatal infectious diseases in spite of considerable improvements in medical science. The diagnosis and treatment of extrapulmonary tuberculosis involving the abdomen is still complicated owing to vague or non-specific clinical features. Although rare, isolated splenic involvement is one of the important manifestations of extrapulmonary tuberculosis, and imaging suspicion of the disease is essential. We report a case of surgically confirmed mass-forming splenic tuberculosis showing a layered pattern consisting of caseous necrosis with profound restriction of water molecules surrounded by an irregular rind of granulation tissue with less diffusion restriction on diffusion-weighted magnetic resonance imaging (DWI). In the differential diagnosis of neoplastic or non-neoplastic mass-forming lesions involving the spleen, this unique DWI feature could be helpful in characterizing splenic tuberculosis. The patient has been in clinically disease free status for nearly 20 months after splenectomy.

Key Words: Tuberculosis; Spleen; Magnetic Resonance Imaging; Diffusion

INTRODUCTION

Despite medical improvements in the diagnosis and treatment of infectious diseases over the decades, tuberculosis is still a major health problem in developing countries, especially with the increasing prevalence of human immunodeficiency virus (HIV) infection and immunocompromised patients. Because diagnosis of abdominal tuberculosis is often delayed due to a lack of specific symptoms and laboratory findings, radiologic detection is important (1, 2). Abdominal tuberculosis often shares manifestations with other clinical entities such as lymphoproliferative disease, inflammatory bowel disease, tumorous conditions or other infectious diseases (3). Without other disseminated lesions, splenic tuberculosis in immunocompetent individuals is very uncommon, and little information about the magnetic resonance imaging (MRI) findings exists (1, 4). Here we present the MRI features of a case of surgically confirmed isolated splenic tuberculosis, with emphasis on the diffusion-weighted MRI (DWI) findings, in an immunocompetent patient.

CASE DESCRIPTION

A 45-yr-old female who had previously been diagnosed with neck lymph node tuberculosis in June 2007, revisited our institution to confirm complete remission of the disease two months after cessation of anti-tuberculosis medication. She complained of no specific symptoms including weight loss, which she had experienced at the time of her initial diagnosis. There were no abnormal signs observed, and her physical examination was unremarkable. Peripheral blood laboratory tests including complete blood cell count, routine serum chemistry and C-reactive protein were within normal limits. Sputum acid-fast bacillus fluorescent smear and serum polymerase chain reaction were negative, and mycobacterium culture showed no growth for 8 weeks. She did not have an HIV antibody test but an absolute count of T-cell lymphocyte and percentage of CD4 and CD8 T-cell subsets were within normal range in the peripheral whole blood.

Chest computed tomography showed no lung lesion but a 3.8 cm conglomerated low attenuation density lesion was incidentally found in the non-enlarged spleen without calcification. For further characterization, abdominal MRI was performed using a 1.5-T scanner (MAGNETOM Avanto, Siemens, Berlin, Germany). On T2-weighted images with fat suppression, an irregular, conglomerated, internally hyperintense and peripherally hypointense lesion was distinguished from the background parenchyma (Fig. 1A). Fat-suppressed precontrast T1-weighted images showed slightly high signal intensity for the entire lesion. On the IV gadopentate dimeglumine-enhanced dynamic images, the lesion showed a gradual enhancement for the peripheral portion of the lesion with internally non-enhancing contents (Fig. 1B). DWI using a respiratory-triggered single-shot spin-echo echo-planar sequence (TR/TE = 6,036/72 msec; number of av-

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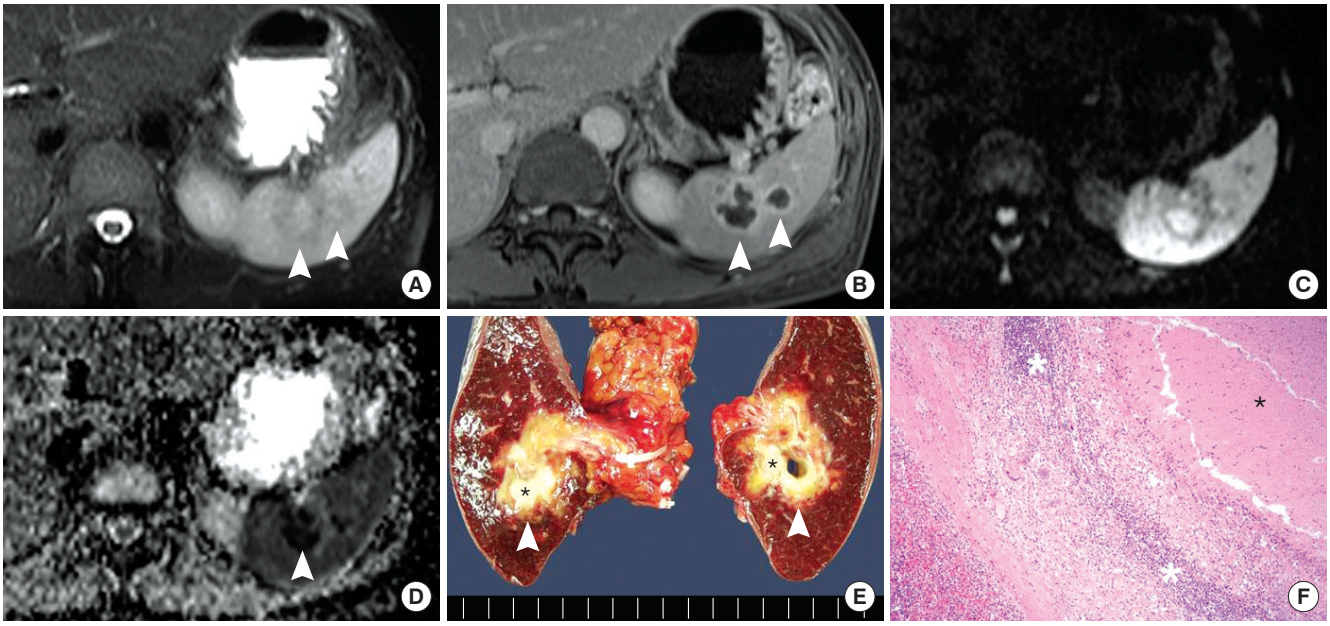

Fig. 1. Abdominal MRI of a 45 yr-old female shows an isolated splenic lesion. (**A**) Irregular conglomerated splenic lesion shows internal hyperintensity with peripheral hypointensity (arrowheads) on fat-suppressed T2-weighted image. (**B**) Contrast enhancement of peripheral rim (arrowheads) with non-enhancing central portion is noted on the gadolinium-enhanced T1-weighted image. (**C**) Diffusion-weighted MRI (b=800 sec/mm^2) shows a prominent internal hyperintensity surrounded by rather hypointense rind. (**D**) Profound diffusion restriction is demonstrated in the internal component (arrowhead) with low ADC value (0.580×10^{-3} mm^2/sec). (**E**) Gross specimen shows an irregularly marginated yellowish mass (arrowheads) filled with cheesy necrotic material (asterisks). (**F**) Corresponding outer granulomatous component (white asterisks) with internal caseous necrosis (black asterisk) is confirmed on high power field microscopy with hematoxylin and eosin stain.

erage = 2; b-values = 50, 400 and 800 sec/mm^2) revealed the sustaining hyperintensity for the internally non-enhancing component (apparent diffusion coefficient [ADC] = 0.580×10^{-3} mm^2/sec) surrounded by the relatively hypointense rind (ADC = 1.040×10^{-3} mm^2/sec) distinguished from background parenchyma (ADC = 0.797×10^{-3} mm^2/sec) (Fig. 1C, D).

The patient underwent sonography-guided gun biopsy, and the finding of chronic granulomatous inflammation with multinucleated giant cells and focal necrosis were suggestive of tuberculosis. This splenic lesion was new in spite of long-term anti-tuberculosis medication treatment, and surgical intervention was indicated to eradicate the singular tuberculosis lesion. After laparoscopic total splenectomy, the dissected gross specimen showed an irregularly marginated yellowish mass filled with necrotic material of the consistency of cheese (Fig. 1E). The histopathologic result confirmed chronic granulomatous inflammation with internal caseous necrosis, consistent with tuberculosis (Fig. 1F). The patient underwent additional anti-tuberculosis medication after splenectomy and stopped medication after 12 months. No other newly developed lesion was detected on follow-up imaging studies and laboratory result were all within normal limits since the operation suggesting disease-free status.

DISCUSSION

Extra-pulmonary tuberculosis without evidence of pulmonary infection is not rare and accounts for up to 15% of all tuberculosis cases (5). Abdominal tuberculosis is one of the common presentations of extrapulmonary tuberculosis affecting the gastrointestinal tract, peritoneum, mesentery, abdominal lymph nodes, liver, spleen and pancreas (1). Isolated splenic involvement as a manifestation of extra-pulmonary tuberculosis, however, is very unusual with only a few case reports and studies mentioning this presentation (3, 6-10). There are two types of splenic tuberculosis clinically. The more frequent form is the disseminated or miliary type involving the spleen which often is related to immunosuppressed condition but also is observed in immunocompetent patients (5, 11). The isolated type is rare and has been reported to be more associated with HIV infection (5, 12). Our patient did not have a specific HIV antibody test, but with regard to the normal laboratory results listed previously, the possibility of concurrent HIV infection is less likely.

Radiologically, splenic tuberculosis has been categorized into micronodular or macronodular forms, depending on whether it is smaller or larger than 10 mm (2, 13, 14). Micronodular tuberculosis is more common and tends to have multiple nodules, usually seen in disseminated systemic tuberculosis. If the nodules are below the resolution capability of imaging techniques, they could manifest as simple splenomegaly (10). Macronodular splenic tuberculosis is rare and could manifest as a singular abscess or multiple large nodules (12). If it does manifest as a localized mass as in our case, differentiation from other solid mass lesions is not always easy (12, 15).

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Even though imaging features could vary depending on the route of involvement, lesion size or the stage of disease process, Backer et al. (11) described enhancement patterns on dynamic MRI of splenic tuberculosis as a centrally unenhancing lesion with peripheral enhancement as one of their typical features. This is similar to our case, which consisted of centrally unenhancing caseous necrosis surrounded by an irregular wall of granulation tissue with contrast enhancement.

For the T2-weighted imaging characteristics, the hypointense area in the lesion has been felt to represent the presence of free radicals produced by macrophages during active phagocytosis associated with increased fibrosis and granulomatous tissue (4), and such findings could be distinguished from other neoplastic or inflammatory lesions in other intra-abdominal organs. In our case, the area of irregular granulation tissue with contrast enhancement was well matched with the T2-weighted hypointense area. For the centrally unenhancing area, caseous necrosis could show hyper- or hypointensity on T2-weighted images (13). The reason for the variety on T2-weighted imaging has not been clearly understood; however, internal hypointensity on T2-weighted images could suggest more solid caseation (16).

Upon DWI, the profound restriction of molecular diffusion in the centrally necrotic portion that was observed in our case could be interpreted in the same context as thick caseous necrosis, inflammatory cells, and cellular debris confined within a small area and restricting water diffusion (16). Compared with the background parenchyma of the spleen showing inherently low ADC values (17), the area of active inflammation with increased perfusion and water content in the granulation tissue could show relatively higher ADC values, as in our case.

In addition to the T2-weighted hypointense portion of the lesion, such profound diffusion restriction in the area of caseous necrosis in splenic tuberculosis could be distinguished from cystic or necrotic area of neoplastic lesions with higher ADC values, as in other organs (18). However, the restriction feature of water diffusion could potentially overlap with other pyogenic or fungal abscesses (19) or intratumoral hemorrhage, and tissue confirmation by percuteneous biopsy would still be necessary, depending on a different clinical setting.

To our knowledge, this is the first case report about isolated splenic tuberculosis recurred in an immunocompetent patient in Korean population. There is none but one case report mentioning about tubercular splenic abscess occurred in an immunocompetent individual who had gone full term anti-tubercular therapy for previous pulmonary tuberculosis (20). That case also underwent splenectomy and additive chemotherapy for complete remission like our case.

In conclusion, we report a case of isolated mass-forming splenic tuberculosis showing a profound restriction of water molecules on DWI. Low ADC values in necrotic tissue are not specific for caseous necrosis of tuberculosis. Even so, noticing a stratified pattern consisting of non-enhancing internal necrosis with restricted diffusion surrounded by a well-enhancing irregular rind of granulomatous inflammation with T2-weighted hypointensity could be helpful in characterizing splenic tuberculosis.

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