



What is Your Radiologic Diagnosis?

Radyolojik Tanınız Nedir?

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A five-year-old male patient was admitted to the pediatric oncology outpatient clinic with fever, abdominal pain and malaise. The history revealed that the patient had undergone right hemicolectomy eight months ago due to intussusception, had been diagnosed with Burkitt lymphoma and received the last chemotherapy was given 10 days ago. Physical examination revealed no significant findings. Laboratory tests revealed neutropenia, thrombocytopenia and mild increase in liver enzymes. A focus of infection was investigated with a preliminary diagnosis of neutropenic fever. Abdominal ultrasonography (US) showed several hypoechoic lesions in the liver. For characterization of the lesions, upper abdomen magnetic resonance imaging (MRI) with intravenous contrast was performed. Multiple nodular lesions were seen in the liver (Figures 1,2).

What is your diagnosis according to the patient's history and MRI findings?

DIAGNOSIS: Fungal Infection

MRI showed T2W hyperintense lesions with indistinct borders distributed in both lobes of the liver, showing diffusion restriction and homogeneous contrast enhancement (Figures 1,2). Lymphoma involvement and fungal infection should be considered in the differential diagnosis of these lesions. Percutaneous biopsy was taken from the lesions for diagnosis. Fungal hyphae were detected on pathological examination, and the patient was diagnosed with invasive fungal infection. After one month of antibiotic and amphotericin-B treatment, the lesions regressed almost completely.

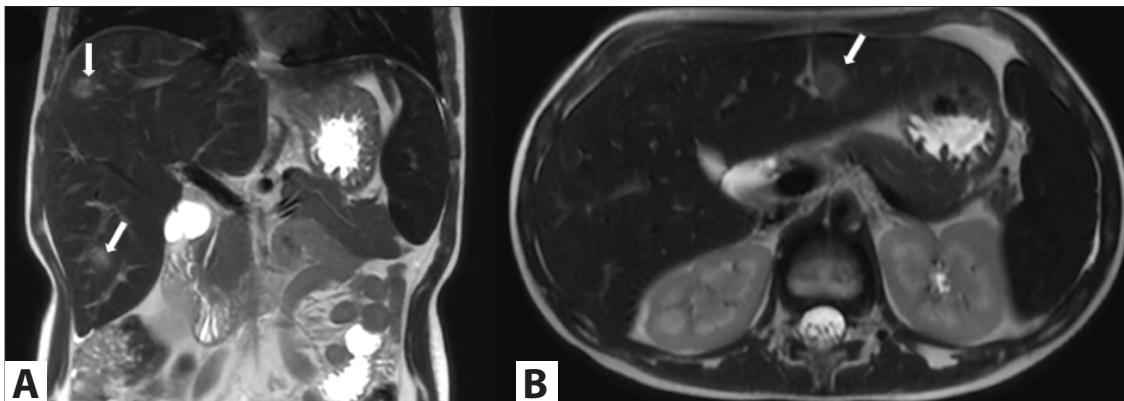


Figure 1. Without fat suppression, coronal (A) and axial (B) T2-weighted images show hyperintense lesions with indistinct borders in the liver (white arrows).

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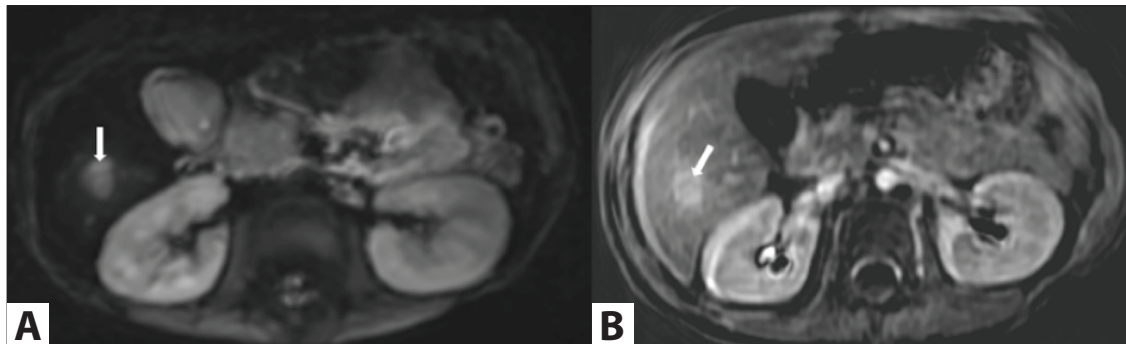


Figure 2. In diffusion-weighted imaging ($b=800 \text{ sec/mm}^2$) (A), the lesion in the segment 6 of the liver demonstrates diffusion restriction, and subtraction imaging (B) shows that this lesion homogeneously enhances (white arrow).

Short discussion

Burkitt lymphoma is one of the subtypes of non-Hodgkin lymphomas and has an aggressive course. It is usually sensitive to chemotherapy. It may also frequently develop from extranodal areas (1). It may cause lymphadenopathy and masses in the head-neck, thoracic and abdominal regions. The most common site of involvement in the abdomen is the ileocecal region. In case of abdominal involvement, abdominal pain, palpable mass, constipation, obstruction and intussusception may be observed (2).

Possible foci of infection should be investigated in patients with diagnosis of neutropenic fever. The most common infection in these patients is pneumonia. Infections in the early period of neutropenia are 90% bacterial. In cases of severe neutropenia lasting longer than 10-14 days, the risk of invasive fungal infection increases. Invasive fungal infections especially affect the lung, liver, kidney and spleen (3).

The most common fungal agents infecting the liver and spleen are *Candida* species. *Histoplasmosis*, *Cryptococcus neoformans* and *Mucormycosis* are other fungal agents. Invasive systemic candidiasis is an important cause of morbidity and mortality in immunocompromised patients. Blood culture is positive in 50% of patients (4).

Hepatic candidiasis lesions can be seen in four different forms on US examination. The first type of lesions is the wheel-in-wheel appearance consisting of hypoechoic nidus in the center, a hyperechoic halo in the middle layer and a hypoechoic rim in the outermost layer. The second type of lesions is called bull's eye. These lesions have a central echogenic nidus and hypoechoic rim. The third type of lesions are hypoechoic nodular lesions which are the most common but have the least specificity. The fourth type of lesions is echogenic scar or calcification focus forming a posterior acoustic shadowing. This type of lesion occurs in the late stages of infection (4).

Computerized tomography (CT) examination usually shows hypodense nodular lesions distributed in both lobes. MRI examination is superior to CT and US in detecting fungal lesions. In patients who do not respond to antibacterial

antibiotics, MRI examination can demonstrate hepatic fungal infection with 100% sensitivity and 96% specificity (4). The lesions appear slightly hypointense on T1-weighted images and markedly hyperintense on T2-weighted images. Moderate contrast enhancement is observed in the lesions. Sometimes there may be peripheral rim enhancement. Fungal abscesses may show diffusion restriction. Diffusion weighted imaging is useful in the diagnosis of fungal infections and can also be used in the evaluation of response to treatment. It was found that apparent diffusion coefficient (ADC) values of the lesions gradually increased with antifungal treatment. Imaging findings are similar in liver infections due to other fungi (4,5).

If a liver lesion is found in a patient with neutropenic fever who has been treated for lymphoma, other differential diagnoses to be considered are tumoral infiltration of the liver, bacterial abscess, tuberculosis and sarcoidosis. Tumoral infiltration may be accompanied by supra- and infradiaphragmatic lymphadenopathies. Oedema is expected around bacterial abscesses. Clinical and laboratory findings along with chest X-ray may be useful in the exclusion of tuberculosis and sarcoidosis. In some patients, definitive diagnosis cannot be made with clinical and imaging findings. In these cases, percutaneous liver biopsy is necessary (6).

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