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Differentiation between hepatic alveolar echinococcosis and primary hepatic malignancy with diffusion-weighted magnetic resonance imaging

R. Sade[a], M. Kantarci[a,*], H. Ogul[a], B. Gundogdu[b], B. Aydınlı[c]

[a] *Ataturk University, School of Medicine, Department of Radiology, 200 Evler Mah. 14. Sok No 5, Dadaskent, Erzurum, Turkey*
[b] *Ataturk University, School of Medicine, Department of Pathology, Erzurum, Turkey*
[c] *Akdeniz University, School of Medicine, Department of General Surgery, Antalya, Turkey*

KEYWORDS
Diffusion magnetic resonance imaging;
Alveolar echinococcosis;
Apparent diffusion coefficient (ADC);
Hepatocellular carcinoma;
Intrahepatic cholangiocarcinoma

Abstract
Purpose: To determine the value of diffusion-weighted magnetic resonance imaging (DW-MRI) in discriminating between hepatic alveolar echinococcosis (AE) and hepatocellular carcinoma and intrahepatic cholangiocarcinoma.
Methods: We included 49 patients (27 men, 22 women; mean age: 52.02 ± 9.76 [SD] years; range: 25—72 years) with 57 histopathologically confirmed hepatic AE lesions. Fifty patients (18 men, 32 women; mean age: 58.93 ± 8.42 [SD] years; range: 42—71 years) with 61 histopathologically confirmed hepatocellular carcinoma and 50 patients (24 men, 26 women; mean age: 50.11 ± 7.70 [SD] years; range: 38—69 years) with 54 histopathologically confirmed intrahepatic cholangiocarcinoma lesions were used as control groups. All patients had MRI examination of the liver that included conventional MRI sequences and DW-MRI using *b* values of 50, 400 and 800 s/mm^2. Two radiologists evaluated conventional MRI and DW-MRI images and calculated ADC values of hepatic lesions.
Results: The mean ADC value of solid components of hepatic AE lesions was $1.34 \pm 0.41 \times 10^{-3}$ mm^2/s (range: $0.9—1.59 \times 10^{-3}$ mm^2/s) and was significantly higher than that of the solid components of hepatocellular carcinoma lesions (mean ADC value, $0.99 \pm 0.29 \times 10^{-3}$ mm^2/s; range: $0.7—1.15 \times 10^{-3}$ mm^2/s) and of intrahepatic cholangiocarcinoma lesions (mean ADC value, $1.05 \pm 0.22 \times 10^{-3}$ mm^2/s; range: $0.86—1.18 \times 10^{-3}$ mm^2/s) ($P < 0.001$).

* Corresponding author.
E-mail address: akkanrad@hotmail.com (M. Kantarci).

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Conclusion: In general ADC values can help discriminate between AE and hepatocellular carcinoma and intrahepatic cholangiocarcinoma. However, the use of ADC values cannot help differentiating Type 4 AE from hepatocellular carcinoma or intrahepatic cholangiocarcinoma.

Hepatic alveolar echinococcosis (AE) is a rare parasitic disease that mimics malignancy and may spread to distant organs, such as the brain and lungs, through a hematogenous route. Although AE is not rare, it is believed that it would be an emerging or re-emerging disease in many countries in the future. This disease is seen mostly in the northern hemisphere [1—3].

AE lesions had widely different imaging features. Although a great majority of AE lesions are localized in to the liver, they may invade the portal hilus, hepatic veins, biliary system, and inferior vena cava with a tumor-like infiltrative behavior [1,4,5]. Imaging findings of AE resemble variant type of hepatocellular carcinoma (HCC) and intrahepatic cholangiocarcinoma (ICC) due to a possible atypical magnetic resonance imaging (MRI) presentation of these tumors. The diagnosis of AE is generally based on serologic analysis and imaging findings [1,2]. Ultrasonography, computed tomography (CT), and MRI complement each other and provide valuable information for the detection and characterization of AE lesions as well as the determination of an appropriate treatment method. Ultrasonography is the initial screening method for regular follow-up imaging in AE [1,6]. Typical calcifications of AE are best detected on plain CT images whereas MRI depicts more accurately the multivesicular AE lesions, necrotic regions and invasion of intra- and extrahepatic structures [7].

Hepatic AE may be classified into different categories, which have different imaging presentations. Therefore, AE may have misleading appearance and this situation may cause misdiagnosis especially in non-endemic regions. At the same time, hepatic AE lesions may mimic hepatic malignancies. Nevertheless, MRI examination with standard sequences would be inadequate for the diagnosis of hepatic AE lesions [1,6,7].

Diffusion-weighted MRI (DW-MRI) uses the microscopic random movement of water [7—9]. DW-MRI is a non-invasive technique, which is being increasingly used in the abdomen [7,10,11]. DW-MRI is used to characterize focal liver lesions [12—14]. In this regard, DW-MRI helps discriminate between malignant and benign hepatic lesions. The apparent diffusion coefficient (ADC) may play a complementary role to conventional MRI for primary hepatic malignancy characterization [15,16]. Furthermore, ADC value can be used for monitoring response to therapy of HCC and liver metastasis [15]. It proves to be efficient in the prediction of recurrence after radiofrequency ablation [15]. A recent study has demonstrated DW-MRI findings and their potential role in the categorization of hepatic AE lesions [17].

The purpose of this study was to determine the value of DW-MRI in discriminating between hepatic AE and HCC and ICC.

Materials and methods

Patients

This study was performed between July 2013 and June 2016 and was approved by the institutional review board. AE patients with informed consent and control patients with waived informed consent (since retrospectively evaluated) were included. Fifty-seven consecutive patients with clinically suspected diagnosis of hepatic AE referred from our general surgery, liver transplantation and gastroenterology clinics were admitted for liver MRI. The inclusion criteria were:

- nucleic acid of *Echinococcus multilocularis* detected in a clinical specimen;
- *Echinococcus* species-specific serum antibodies detected in blood tests;
- histopathological features suggestive of echinococcosis.

Eight patients were excluded due to following causes: initial MRI examinations did not include DW images ($n=2$), totally calcified hepatic AE lesion on unenhanced CT images ($n=2$), chronic renal failure ($n=2$), claustrophobia ($n=1$) and previous hypersensitivity to intravenous administration of a gadolinium chelate ($n=1$).

Finally, the study included 49 patients. There were 27 men and 27 women with a mean age of 52.02 ± 9.76 [SD] years (range: 25—72 years), who met the selection criteria and constituted the study group. All participants underwent preoperatively MRI examinations of the liver including DW-MRI.

A control group was made by querying the radiological database of our radiology department from August 2012 to June 2016 using the following search terms: HCC, ICC, liver, diffusion, and MRI. Thus, the control group consisted of 50 consecutive patients (18 men, 32 women; mean age: 58.9 ± 8.4 [SD] years; range: 42—71 years) with histologically confirmed HCC and 50 consecutive patients (24 men, 26 women; mean age: 50.11 ± 7.70 [SD] years; range: 38—69 years) with histologically confirmed ICC. We considered only AE, HCC and ICC lesions with a maximum diameter ≥ 1 cm. The histopathological diagnosis of HCC and ICC was obtained after surgery or percutaneous biopsy using a 16G Tru-Cut® needle (TSK Laboratory, Tochigi-Ken, Japan). All patients of the HCC and ICC groups underwent conventional and DW-MRI examinations concurrently with the AE group.

MRI protocol

MRI was performed with a 3-T Skyra® (Siemens Healthineers, Erlangen, Germany) using an 18-element body matrix coil.

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