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Is magnetic resonance imaging of hepatic hemangioma any different in liver fibrosis and cirrhosis compared to normal liver?

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ABSTRACT

Purpose: To compare qualitative and quantitative magnetic resonance (MR) imaging characteristics of hepatic hemangiomas in patients with normal, fibrotic and cirrhotic livers.
Materials and methods: Retrospective, institutional review board approved study (waiver of informed consent). Eighty-nine consecutive patients with 231 hepatic hemangiomas who underwent liver MR imaging for lesion characterization were included. Lesions were classified into three groups according to the patients' liver condition: no underlying liver disease (group 1), fibrosis (group 2) and cirrhosis (group 3). Qualitative and quantitative characteristics (number, size, signal intensities on T1-, T2-, and DW MR images, T2 shine-through effect, enhancement patterns (classical, rapidly filling, delayed filling), and ADC values) were compared.
Results: There were 160 (69%), 45 (20%), and 26 (11%) hemangiomas in groups 1, 2 and 3, respectively. Lesions were larger in patients with normal liver (group 1 vs. groups 2 and 3; $P = .009$). No difference was found between the groups on T2-weighted images (fat-suppressed fast spin-echo ($P = .82$) and single-shot ($P = .25$)) and in enhancement patterns ($P = .56$). Mean ADC values of hemangiomas were similar between groups 1, 2 and 3 ($2.11 \pm .52 \times 10^{-3}$ mm^2/s, $2.1 \pm .53 \times 10^{-3}$ mm^2/s and $2.14 \pm .44 \times 10^{-3}$ mm^2/s, $P = 87$, respectively). T2 shine-through effect was less frequently observed in cirrhosis ($P = .02$).
Conclusion: MR imaging characteristics of hepatic hemangioma were similar in patients with normal compared to fibrotic and cirrhotic livers. Smaller lesion size was observed with liver disease and less T2 shine-through effect was seen in hemangiomas developed on cirrhosis, the latter being an important finding to highlight in these patients at risk of developing hepatocellular carcinoma.

1. Introduction

Hepatic hemangioma is the most common benign liver lesion [1]. Differentiation between hepatic hemangiomas and other liver lesions is a frequent clinically relevant situation. Precise focal liver lesion characterization is mandatory, particularly in patients with chronic liver disease and cirrhosis who have a much greater risk of developing primary liver malignancy [2]. Unfortunately, tumor characterization may be hampered by the distortion of the hepatic parenchyma due to the fibrotic process. Thus, a thorough understanding of imaging features of hepatic hemangiomas in fibrotic and/or cirrhotic livers is essential.

Hemangiomas have been shown to present different characteristics in patients with cirrhosis when compared to non-cirrhotic patients. Mastropasqua et al. [3] found a negative correlation between the number of hepatic hemangioma and the severity of liver disease. While hepatic hemangiomas are considered congenital lesions that do not demonstrate significant change over time [4], a decrease in lesion size with progression of liver disease has

Abbreviations: DW, diffusion-weighted; MR, magnetic resonance; ADC, apparent diffusion coefficient; CT, computed tomography; NASH, nonalcoholic steatohepatitis; HCC, hepatocellular carcinoma; ROI, region of interest.

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been reported [5]. Therefore these small lesions may potentially be difficult to differentiate from other hypervascular lesions such as hepatocellular carcinoma (HCC) [5,6].

The diagnostic of hepatic hemangioma relies on imaging characteristics that have been well documented at dynamic contrast material-enhanced computed tomography (CT) and magnetic resonance (MR) imaging, and are considered diagnostic when typical findings are present [6–8]. Typical hemangiomas show a strong hyperintensity on T2-weighted images together with a progressive centripetal filling at dynamic multiphase contrast-enhanced gradient-echo imaging. However, hepatic hemangioma may also display atypical features, such as rapid or delayed enhancement, making the diagnosis more difficult and uncertain [6,9–11]. Controversial data has been reported regarding the enhancement of hemangiomas in the setting of liver disease [3,12].

Recently, it has been shown that T2 shine-through effect was present in more than half of hepatic hemangiomas and was more frequent in lesions with typical features [13]. However, little is known about the diffusion-weighted (DW) MR imaging characteristics of hepatic hemangioma in chronic liver disease and cirrhosis.

Overall, it is unclear how imaging characteristics of hepatic hemangiomas are affected by the presence of an underlying liver disease or cirrhosis. Therefore, the purpose of this study was to compare qualitative and quantitative imaging features of hepatic hemangiomas in patients with normal, fibrotic or cirrhotic liver.

2. Materials and methods

This retrospective single-center study was conducted in a tertiary hospital for hepatobiliary and pancreatic diseases and was institutional review board approved with a waiver of informed consent.

2.1. Study population

Radiologic records of patients who underwent MR imaging of the liver with a DW sequence in the setting of lesion characterization found on ultrasound or CT from January 2011 to July 2012 were reviewed. Patients who had at least one hepatic hemangioma measuring at least 5 mm in minimum diameter and follow-up imaging of at least 12 months were included. Pathological reports including biopsies for characterization of focal liver lesion and liver surgery (resection and transplant) were also reviewed.

A total of 155 patients were identified. Thirty-two patients were excluded for the following reasons: hepatic hemangioma measuring less than 5 mm in diameter ($n = 7$), no DW sequences ($n = 8$), DW sequences with motion artifacts ($n = 8$), follow-up imaging of less than 12 months ($n = 9$), hemangioma on pathological specimen but without MR or DW imaging ($n = 8$). On the basis of these criteria, 115 patients were selected. The medical and pathological records of these patients were then thoroughly reviewed and patients were further classified in three groups: patients without underlying liver disease (group 1), patients with chronic liver disease (i.e. fibrosis without cirrhosis) (group 2) and patients with cirrhosis (group 3). In group 1, conditions that may have had a potential effect on liver parenchyma such as previous chemotherapy ($n = 11$), vascular liver disease ($n = 2$) or patients without known liver disease but who had morphologic changes of the liver on MR imaging ($n = 10$) or abnormal liver enzymes/function ($n = 3$) were excluded. Patients with liver steatosis on imaging as sole finding but without known hepatic disease or risk factors for hepatic disease, and with normal liver tests were deemed eligible. Thus, the final study population included a total of 89 patients with 231 hepatic hemangiomas (Fig. 1). Baseline patient characteristics are summarized in Table 1 (Supplementary material).

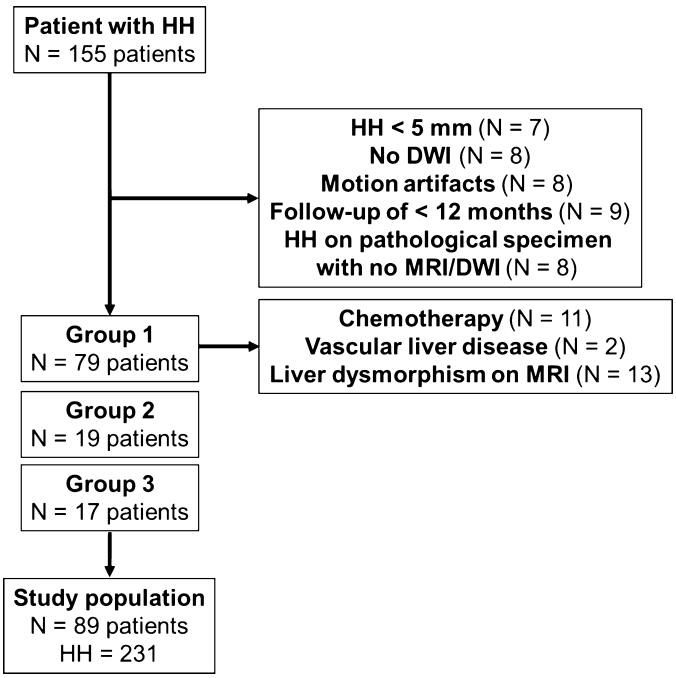

Fig. 1. Flowchart shows inclusion and exclusion criteria of the study group during the inclusion period. DWI = diffusion-weighted imaging, MRI = MR imaging, HH = hepatic hemangioma.

Aetiologies of chronic liver diseases (group 2) were hepatitis B ($n = 6$), hepatitis C ($n = 7$), excessive alcohol consumption ($n = 1$), nonalcoholic steatohepatitis (NASH) ($n = 2$), autoimmune hepatitis ($n = 1$), combined hepatitis B and D ($n = 1$), cardiac hepatopathy ($n = 1$). Chronic hepatitis was confirmed histologically in 8/19 patients (42.1%), whereas the diagnosis was made by a combination of clinical, biologically data (e.g. hepatitis test) and imaging (e.g. transient elastography) in 11/19 patients (57.9%). In histologically confirmed cases, the extent of fibrosis was graded using the METAVIR score [14]. The METAVIR score was assessed on a five points scale (0 = no fibrosis, 1 = portal fibrosis without septa, 2 = portal fibrosis with few septa, 3 = numerous septa without cirrhosis, 4 = cirrhosis). The activity score was graded according to the intensity of necrotic-inflammatory lesions (A0 = no activity, A1 = mild activity, A2 = moderate activity, A3 = severe activity). Two patients had a score of A1F1, 3 had a score of A1F2, 1 had a score of A1F3 and 2 of A2F3. Patients without histology had mean values of liver stiffness of 9.9 ± 2.1 kPa (normal values: 5.5 ± 1.6 kPa [15]).

Aetiologies of cirrhosis (group 3) were hepatitis B ($n = 3$), hepatitis C ($n = 3$), excessive alcohol consumption ($n = 6$), NASH ($n = 2$), autoimmune hepatitis ($n = 1$), combined hepatitis B and D ($n = 1$), combined hepatitis C and excessive alcohol consumption ($n = 1$). Cirrhosis was confirmed in all patients by means of percutaneous core needle biopsy.

2.2. Reference standard

Diagnoses of hemangiomas were established based on a combination of typical imaging features, follow-up and histological examination. On imaging, the diagnosis of hemangioma was established with a combination of the following findings [6–8]: well demarcated and strongly hyperintense on heavily T2-weighted images, and (a) peripheral globular discontinuous enhancement over time on contrast-enhanced dynamic MR images with progressive and centripetal enhancement; or (b) immediate homogeneous enhancement on the arterial phase and iso or hyperintensity compared with surrounding liver parenchyma at the equilibrium