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Magnetic resonance imaging features varying by size in giant hemangioma of the liver

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Abstract

Different definitions are used for giant liver hemangiomas. When liver hemangiomas are larger than 4 cm, they are called cavernous hemangiomas (CHs). 6cm or higher thresholds have also been suggested in the literature. Mastering the magnetic resonance imaging (MRI) features that change as the size of CHs increases can prevent misdiagnoses. The aim of the study was to compare MRI features of CHs between 4-6cm and >6cm. The contrast-enhanced abdominal MRIs in the hospital image archiving system was retrospectively examined in the last two years. A total of 52 patients (39 females, 13 males) with CHs were detected by screening. MRI features of 30 patients in Group 1 (between 4-6cm) and 22 patients in Group 2 (>6cm) were analyzed and the two groups were compared in terms of imaging features. The presence of a central cleft-like area was found to be more in Group 2 (54.5%) than in Group 1 (6.7%) ($p<0.001$). Internal hemorrhage was not detected in Group 1, but it was seen in 3 (13.6%) patients in group 2 ($p=0.07$). The multiloculation-like appearance was significantly higher in Group 2 (86.4%) than in Group 1 (23.3%) ($p<0.001$). Delayed diffuse enhancement was observed at a rate of 30% in Group 1 patients, while it was not seen at all in Group 2 ($p=0.007$). In Apparent diffusion coefficient (ADC) mapping, the incidence of the hypointense rim in the periphery of CH was significantly higher in Group 2 (90.9%) than in Group 1 (66.7%) ($p=0.04$). ADC value was higher in Group 1 (1.76 ± 0.28) than Group 2 (1.55 ± 0.24) ($p=0.007$).

Keywords: Giant liver hemangioma, magnetic resonance imaging, apparent diffusion coefficient

Introduction

Liver hemangiomas are defined as non-cancerous lesions. In the literature, different sizes are used for the definition of giant hemangioma (>4, >5, >8, >10cm) [1,2]. In addition, different definitions such as extremely giant, super-giant or hypergiant have been reported in previous studies. This confusion in definition regarding hemangioma size still continues today. Liver hemangiomas, which are usually asymptomatic and detected incidentally, may become symptomatic depending on the increase in their size [3]. Typically abdominal pain is seen in 23–57% of patients [4]. Abdominal ultrasonography, contrast-enhanced computed tomography and magnetic resonance imaging are used in diagnosis and follow-up. Frequent follow-up of imaging is not recommended since changes in hemangioma size are rare [5]. However, as the size increases, the imaging features may also vary. Low signal intensity on T1-weighted images (T1WI) and high signal intensity on T2-weighted images

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(T2WI) defined as "cotton wool" appearance [6]. High signal intensity on T2WI and discontinuous peripheral enhancement are known as typical findings for giant hemangiomas of the liver [7]. The enhancement kinetics of giant hemangiomas is slow [8]. Small hemangiomas usually have a homogeneous appearance. As the size increases, the homogeneity of the lesions decreases, and they have a heterogeneous appearance. Cleft-like areas of low signal intensity on T1WI and internal septa are found more frequently [9]. The magnetic resonance imaging (MRI) can identify spontaneous hemorrhages well due to providing adequate better tissue characterization [10]. A peripheral low-signal-intensity rim may be found owing to the effect of the presence of pseudocapsule [10].

The unclear definition of giant hemangiomas and varying imaging findings with the increase in size of giant hemangiomas may cause difficulties for the correct diagnosis and treatment approach. In our study, it was aimed to define magnetic resonance imaging features varying by size in giant hemangioma of the liver.

Material and Methods

This retrospective study was approved by the local ethics committee (2018/0226) and performed according to the tenets of the Declaration of Helsinki Declaration. Informed consent was obtained from each patient before the MRI examination.

Patient Population

We retrospectively reviewed sixty-one patients diagnosed with CHs and treated or followed-up in our hospital between 2016 and 2018. Contrast-enhanced abdominal MRIs performed with a 1.5 Tesla MRI device in the last two years were evaluated. Patients with a history of liver surgery, liver trauma, additional hepatic pathologies on MRI and patients with incomplete data were excluded from the study. Fifty-two patients (39 females, 13 males) with CH who met the current criteria were enrolled in the study.

Radiological Evaluation

Contrast-enhanced abdominal MRI images of all patients performed with a 1.5 Tesla (General Electric) machine were evaluated by an 8-year-experienced abdominal radiologist.

The MRI scan protocol consists of contrast and non-contrast enhanced axial T1WI (section thickness:5mm; TR/TE, 170/2 ms; field of view, 420×420mm; scan time(sn): 20;), axial and coronal T2WI (section thickness:5 mm; TR/TE, 1100/82 ms; field of view, 420×420mm; scan time(sn): 180), axial and coronal dynamic gradient echo sequence (section thickness:3 mm; TR/TE, 4/2ms; field of view, 320×192mm; scan time(sn): 30; after intravenous contrast injection(sn): 0,25,45,90,120,180), DWI (TR/TE, 1500/86ms; field of view, 420×420 mm; section thickness: 5mm; matrix, 96×160; scan time (sn): 180; b value: 0 and 800 s/mm^2).

The diagnosis of CH was made according to characteristic imaging findings on MRI, such as hyperintense relative to liver parenchyma on T2WI and peripheral nodular discontinuous enhancement in post-contrast T1W1. The size of 6 cm and over was accepted as the threshold value for the definition of giant hemangioma.

Study Design

The patients were divided into two groups based on the size of the hemangioma.Patients diagnosed with hemangiomas between 4 - 6 cm were included in Group 1, and hemangiomas of 6 cm or over were included in Group 2.

Statistical Analysis

SPSS and Microsoft Excel computer programs were used to analyze the data obtained from the study. Descriptive statistics were obtained to represent data. Categorical variables were expressed as counts or percentages and continuous variables as mean and standard deviations. The chi-square test was used to compare categorical variables.Student-T test and Mann-Whitney U test were used according to the normal and abnormal distribution of the data in continuous variables. The results were evaluated at the 95% confidence interval and $p<0.05$ significance level.

Results

The mean age of patients in Group 1 and 2 were 51±10 and 50±13 years, respectively and were similar (p=0.77). The frequency of female gender was higher in Group 2 (90.9% vs. 63.3%, respectively, p=0.02). The average size of CH was 4.5±0.4cm in Group 1 and 8±2.3cm in Group 2.

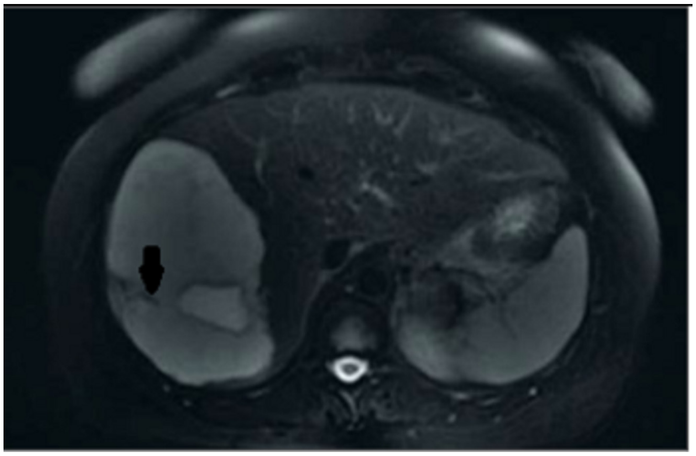

Figure 1. Central cleft(arrow) is observed in giant hemangioma on axial fat-saturated T2WI

The presence of a central cleft-like area was found to be more in Group 2 (54.5%) than in Group 1 (6.7%). ($p<0.001$). (Figure 1) Internal hemorrhage was not seen in group 1, but it was detected in three (13.6%) patients in group 2 (p=0.07). (Figure 2). Multiloculation-like appearance was higher in Group 2 (86.4%) than in Group 1 (23.3%) and it was statistically significant ($p<0.001$).(Figure 3) The incidence of concomitant hemangiomas in the liver was similar and was present in half of

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the patients in both groups. Delayed diffuse enhancement was observed at a rate of 30% in Group 1, while it was not seen at all in Group 2 (p=0.007).

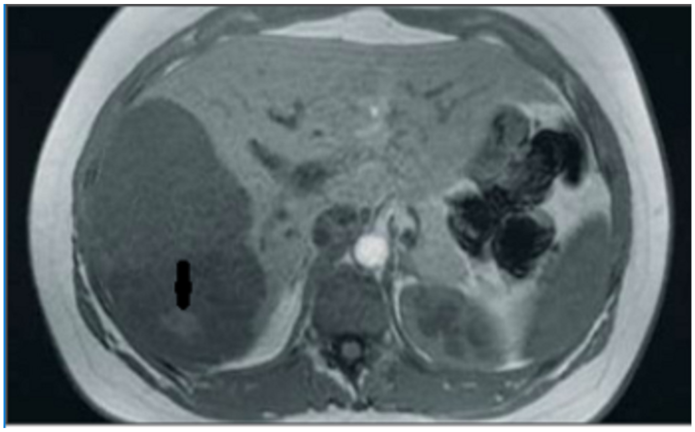

Figure 2. T1 hyperintense internal hemorrhage(arrow) is observed within the giant hemangioma

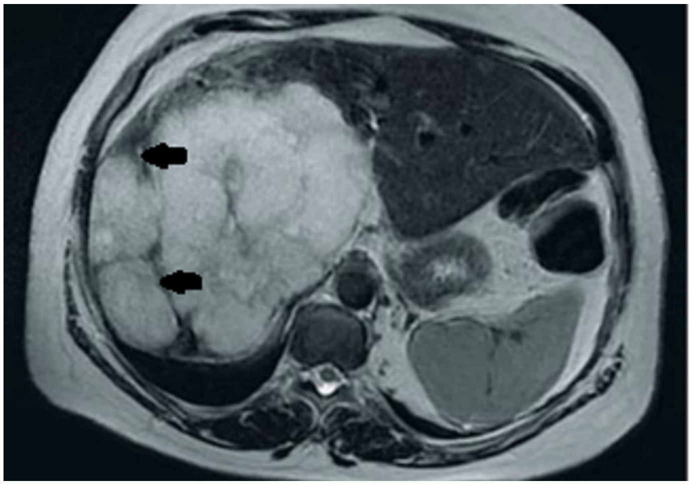

Figure 3. A giant hemangioma has a multilocular-like appearance due to internal septa and contour lobulation (arrows) on axial T2WI

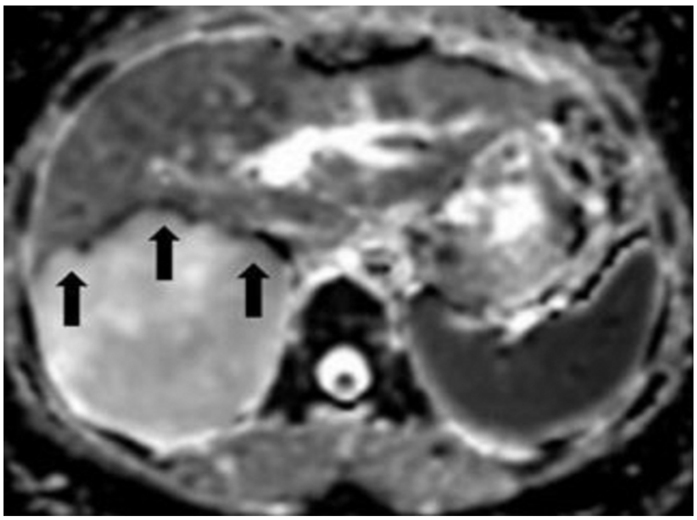

Figure 4. Axial ADC map image on MRI shows a hypointense rim (arrows) in the area where the giant hemangioma is adjacent to the liver parenchyma

In ADC mapping, the incidence of hypointense rim in the periphery of CH was higher in Group 2 (90.9%) than in Group 1 (66.7%) and it was statistically significant (p=0.04). (Figure 4) ADC value was higher in Group 1 (1.76±0.28) than in Group 2 (1.55±0.24) (p=0.007).

Discussion

The definition of giant hemangiomas varies in the literature [11]. In addition to its definition, clear lines in terms of disease management are not yet available. Furthermore, there is a lack of distinct guidelines about "when" and "how" to operate these lesions. In order to resolve of this confusion in disease management, additional information provided by imaging methods such as MRI may guide the planning of the treatment. In a review published in 2016, the need for a change in size categories for the definition of giant cavernous liver hemangiomas was emphasized. Additionally, the study reported that it would be appropriate to use 10cm as the threshold value for the definition of "giant" [12].

Depending on the increase in CH size, MRI findings change as mentioned our statistical results. Our results shows that if the CH size is >6 m, the entity of T2 hyperintense central cleft-like area, which shows the presence of necrotic-cystic patency increases with age, is seen more commonly. A multiloculation-like appearance occurs when peripheral lobulation accompanies the internal septa in CHs. As stated in the statistical results, frequent multiloculation-like appearance in group 2 might attributed to the increase in peripheral lobulation as the mass enlarged. Although it has been reported that there is no significant relationship between the size of typical hemangiomas and ADC values [12], the mean ADC value in Group 2 was lower than Group 1 in our study. Our results also revealed that peripheral hypointense rim is seen in ADC mapping and this finding is more common in Group 2. This may be due to the pressure effect of the mass.

The incidence of central cleft-like area is closely related to the size of the hemangioma. In the study of Ashida et al., the frequency of central cleft-like area was reported to be 78% in liver hemangiomas larger than 4 cm, and it was concluded that the frequency increases with increasing size [13]. In the study of Castrillon et al., in which they reported the data results of 21 patients diagnosed with liver hemangioma with a mean size of 10.4cm, the frequency of central cleft was reported as 100% [14]. In our study, this rate was found to be lower (54.5%) than the rates reported in the literature. Heterogeneity in mean hemangioma sizes in the studies also directly affects the frequency of central clefts.

Multiloculation-like appearance is another finding detected in liver hemangiomas. According to the results reported by Choi et al. [9], the frequency of this appearance increases with the increase in size in giant hemangiomas. However, according to the results of Castrillon et al. [14], internal septa was not detected in any case and multiloculation-like appearance was not reported. In our study, this rate was found to be 86.4%, which supports the

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results reported by Choi et al.

In recent years, the number of studies on ADC mapping on MRI in the diagnosis of hepatic hemangiomas has increased to learn "how" to differentiate to hepatic hemangiomas from malign lesions.In a study on ADC value in the evaluation and differential diagnosis of hemangiomas, Tokgöz et al. reported that the ADC values of hepatic hemangiomas were higher than those of malignant lesions of the liver, and they also reported that the defined "cut-off" ADC value (1.800×10(-3) mm (2)/s) [15]. In another study, the ADC value in the differential diagnosis was found to be 2.30×10-3mm²/ and it was reported to have 55% sensitivity and 100% specificity [16]. In the study by Hardie et al., hepatic hemangiomas and metastatic lesions of the liver were compared and the mean ADC value of hemangiomas was found to be significantly higher than metastatic lesions [17]. Differential diagnosis for giant hemangiomas can always involve difficulties. Misdiagnosis of liver hemangioma appears to be the foremost challenge [18]. The results in the literature show that; malignant lesions are found to have lower mean ADC values than hemangiomas. However in our study, the mean ADC values of giant hemangiomas were found to be lower than those of smaller hemangiomas. The results of our study can be evaluated as a warning in terms of omitting the differential diagnosis of giant hemangiomas and possible malignant lesion. Unfortunately, the number of studies on ADC features in MRI in the evaluation of giant hemangiomas in the literature is not sufficient.We think that focusing on this subject will contribute to the literature.

We have limitations in our study and the first of which is the retrospective design of the study. Secondary, the patient population's small size seem to be a problem. Prospective studies will allow us to define magnetic resonance imaging features varying by size in giant hemangioma of the liver better.

Conclusion

When a threshold value of 6cm is accepted for the definition of giant hemangioma, late diffuse enhancement is not frequently detected. However, central cleft-like area, multiloculation-like appearance, peripheral hypointense rim on ADC map, and internal bleeding are seen more common in MRI.

Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical approval
This retrospective study was approved by the local ethics committee (2018/0226) and performed according to the tenets of the Declaration of Helsinki Helsinki Declaration.

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