

GIANT HEPATIC CAVERNOUS HEMANGIOMAS: SPIRAL COMPUTED TOMOGRAPHY FINDINGS IN 21 PATIENTS

HEMANGIOMA CAVERNOSO HEPÁTICO GIGANTE: HALLAZGOS EN TOMOGRAFÍA COMPUTARIZADA HELICOIDAL DE 21 PACIENTES

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Liver neoplasms
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SUMMARY

Objective: To describe the features of the giant hepatic cavernous hemangioma on spiral CT. **Method:** During five years, we evaluated 21 patients with 21 giant hepatic cavernous hemangiomas using computed spiral tomography, and 16 and 64 channel multi-slice tomography. The series included 18 women (86%) and 3 men (14%) with a mean age of 45 years. **Results:** The mean average size of the hemangiomas was 10.4 cm. Non-enhanced computed tomography showed 21 hemangiomas with lower density than the adjacent hepatic parenchyma, all of them containing a low-density central cleft area. No calcifications or internal septations were observed. On the enhanced multi-slice spiral tomography, all lesions demonstrated a globular, peripheral enhancing pattern with centripetal filling beginning in the arterial phase and continuing into the portal and delayed phases. None of the lesions showed complete filling. The degree of enhancement was the same as that of the aorta in all phases. **Conclusion:** Giant hepatic cavernous hemangiomas show low attenuation on non-enhanced computed tomography. Central cleft areas are seen very frequently. The enhancement pattern is characteristic, starting at the periphery with centripetal filling, but never complete.

Introduction

Cavernous hemangiomas are benign tumors, found most frequently in the liver, with a prevalence of 7% and a frequency of 20% on autopsy (1). These tumors may be found at any age, and they are more common in women (70%) (2). They are usually solitary, but they may also be multiple in 10% of cases (3).

Giant hemangiomas are rare, and for this reason there are few specific reports about this tumor in the radiological literature (4,5). Moreover, there is a controversy regarding the accurate description of giant hemangiomas. Edmondson and Peters gave the name of *giant hemangiomas* to tumors larger than 10 cm in diameter (6). Adams *et al.* defined them as tumors of more than 4 cm in di-

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ameter, given that none of the patients included in their series with small tumors were symptomatic (7).

The tomographic features of a typical cavernous hemangioma are well known (8,9). Diagnostic criteria include the following: an attenuation coefficient lower than that of the liver parenchyma in studies with no intravenous contrast, and a classical enhancement pattern after the injection of intravenous contrast, with progressive opacification, starting on the periphery of the lesion in the form of one or more globular enhancement areas that continue to the center until the area is filled, usually within 3 to 20 minutes (9).

There are few studies of the characteristics of giant hemangiomas on computed tomography (CT). The most important one published so far is the one by Choi *et al.* (10), who studied 10 giant cavernous hemangiomas in 8 patients using incremental CT and magnetic resonance imaging (MRI) over a two-year period. However, there are no studies describing the characteristics of this unusual hepatic lesion on spiral CT. The purpose of this study is to describe the findings of giant cavernous hemangiomas on spiral CT.

Materials and method

Patients

This is a five-year (July 2002 – June 2007) retrospective study that included 21 patients who underwent spiral CT (the first 8 patients) and multi-slice CT (the other 13 patients) with 16 and 64-channel detectors. The study was carried out in two institutions and included all patients whose final diagnosis was giant hemangioma. Giant hemangioma was defined as a lesion at least 4 cm in diameter, using the description by Adams *et al.* (7). During the study period, 21 giant hemangiomas in 21 patients were assessed using spiral and multi-slice CT.

The definitive diagnosis of a giant cavernous hemangioma was established by pathology in four cases, through MRI imaging in five, and through clinical follow-up and imaging for a period of 6 to 24 months in twelve. The series included 18 women (86%) and 3 men (14%), with a mean age of 45 (range: 33 to 60 years of age). Eleven patients had right upper quadrant abdominal pain, six patients had a palpable abdominal mass, and in four patients the mass was an incidental finding on ultrasound.

Spiral and multi-slice computed tomography technique

Spiral CT scans were obtained with a ProSpeed SX (GE Medical Systems Milwaukee, WI) tomographer. In the first eight patients, the study was performed with single 10 mm collimation and interval sections in the upper hemiabdomen. The study used 10 mm collimation, a pitch of 1.5, a tube current of 120 KvP, and 200-250 mAs. In the other 13 patients, the multi-slice scans were performed in a 16-detector tomographer (Lightspeed, GE Medical Systems, Milwaukee, WI). Images were acquired with a 5mm slice thickness, a 2.5 mm reconstruction interval, a pitch of 1.2, a tube current of 120 kVp, and 200-300 mAs.

Intravenous iopamidol 100 cm³ was administered (300 mgI/mL) using an automatic injector, at an infusion rate of

3.5 cm³/sec, and an 18G needle in the antecubital fossa. The delay between the administration of the contrast medium and image acquisition was 30 seconds for the arterial phase and 60 seconds for the portal phase. Delayed scans were also done in all patients after 5 to 20 minutes. The scans were interpreted on an Avantage 4.1 workstation.

Image analysis and interpretation

The spiral and multi-slice CT images were interpreted by two radiologists who made their final decisions by consensus. The criteria assessed in the non-enhanced CT images were the following: localization of the hepatic mass (right or left hepatic lobe), size (larger diameter in centimeters), morphology (oval or rounded), presence of a cleft area (defined in general terms as a central region with an attenuation coefficient lower than the rest of the tumor and variable morphology), and presence of calcifications and internal septations.

On the other hand, the following were the criteria assessed in the enhanced spiral CT images: type of peripheral enhancement (globular or circumferential), enhancement intensity (subjective assessment comparing the enhanced area of the hemangioma with the aorta on the same CT image, and classified as lower, equal or greater than the aortic enhancement), and enhancement progression with the contrast inside the hemangioma (classified as centripetal or centrifugal). Moreover, the presence or not of complete filling was assessed in the late acquisitions (5 to 20 minutes).

Results

Size and location of the hemangiomas

The size of the hemangiomas ranged between 4 and 24 cm, with a mean of 10.4 cm in their larger diameter (Fig. 1a). Fifteen (71%) hemangiomas were localized in the right hepatic lobe and 6 (29%) in the left. Nine (42%) were round and 12 (58%) were oval in shape.

Characteristics on spiral and multi-slice computed tomography

On single-phase imaging, the 21 hemangiomas appeared as low-attenuation masses when compared with the liver parenchyma (Fig. 1). The 21 hemangiomas showed cleft areas with lower attenuation than the rest of the tumor (Figs. 1b and 2a). The cleft areas were oval or round in 10 (47.6%) cases and irregular in 11 (53.4%) (Fig. 4). No calcifications, hemorrhagic areas or internal septations were observed.

On contrast CT, all the tumors showed globular peripheral enhancement that started in the arterial phase (Figs. 2 and 3) and continued towards the center of the mass in the portal phase and in the delayed images obtained within 5 to 20 minutes (Figs. 2b and 3). None of the tumors showed complete filling in that period of time. The subjective assessment of the degree of enhancement of the hemangioma, compared to the aorta in the same CT section and in any of the phases after the administration of the contrast medium, revealed that, in all the hemangiomas, the degree of enhancement was the same as that of the aorta in all phases.

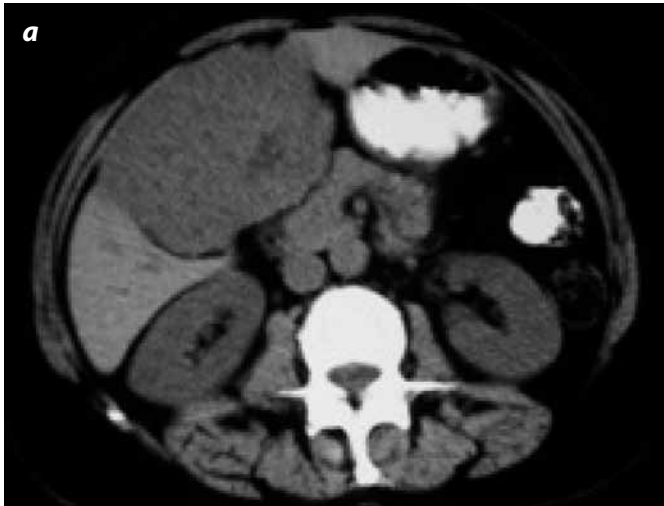


Fig. 1a. Single phase CT. Low-attenuation mass of approximately 6 cm in its larger diameter localized in the right hepatic lobe, with a central cleft area showing a stellate morphology.



Fig. 1b. Arterial phase CT showing peripheral and globular contrast medium uptake.



Fig. 2a. Portal-phase CT showing a hemangioma with peripheral and globular uptake, and centripetal distribution of the contrast medium.



Fig. 2b. Delayed-phase CT. Image acquired 10 minutes after intravenous contrast administration. The hemangioma shows centripetal distribution of the contrast medium without complete filling of the lesion.

Discussion

Hemangiomas are considered benign congenital hamartomas, although some authors have suggested that they may arise in areas of necrosis and focal hepatic regeneration (11). Hemangiomas are made of vascular spaces filled with blood, lined by a single endothelial layer. These spaces are separated by fibrous septa that proliferate centrally and extend towards the periphery (1). Malignant transformation has never been described, and spontaneous rupture is a rare complication (12).

When hemangiomas grow to a significant size, they are called giant hemangiomas. The associated symptoms are non-specific: pain, sensation of heaviness and a palpable mass, which were the main forms of presentation in our series. When hemangiomas grow, they may cause recurrent fever or jaundice

(12,13). The Kasabach-Merritt syndrome (thrombocytopenia and localized intravascular coagulation) may be another rare form of presentation (14).

The tomographic characteristics of hemangiomas are well known (9). The diagnostic criteria of hepatic hemangioma include: a lower attenuation coefficient than that of the adjacent liver parenchyma in images without intravenous contrast, with equal attenuation as that of the blood vessels, and a classical enhancement pattern after contrast administration characterized by progressive opacification starting in the periphery of the lesion, with one or more globular areas of enhancement, and continuing towards the center until it is complete, usually within a period ranging between 3 and 20 minutes (9).



Fig. 3. Isoaortic enhancement. There is centripetal filling of the hemangioma showing the enhanced region with an attenuation coefficient equal to that of the aorta in this slice.

Scatarige *et al.* (4) applied these tomographic criteria to eight giant hemangiomas and found that in the non-enhanced images, seven out of eight had an attenuation coefficient lower than that of the liver parenchyma, and all eight of them had low attenuation coefficient areas in a central location and in the shape of a cleft. After contrast injection, there was early peripheral enhancement in all the lesions, although there was no complete filling in any of them. The average time between the end of the injection and maximum filling of the tumor with contrast ranged between 10 and 120 minutes (with a mean of 32 minutes).

Choi *et al.* (10) obtained similar results in a series of 10 giant hemangiomas. The findings in our series are similar to those of these two papers (4,10), although the authors did not use the spiral technique.

In our patients, single-phase images showed all 21 hemangiomas as low-attenuation masses compared with the surrounding liver parenchyma. Seventy-one per cent were found in the right lobe, and 29% in the left lobe. Cleft areas were observed in all 21 hemangiomas, with lower attenuation than the rest of the tumor, oval or round in 10 (47.6%) cases, and irregular in 11 (53%).

None of the tumors presented calcifications or internal septations, and there were no complications like bleeding or rupture. On contrast CT, all tumors (100%) showed peripheral globular enhancement starting in the arterial phase and continuing towards the center of the mass in the portal phase, and in the delayed scans at 5 and 20 minutes. No complete filling was observed in any of the lesions and there was persistence of a central low-attenuation area, corresponding to the cleft. The subjective assessment of the degree of enhancement of the hemangioma, compared with the aorta in the same CT slice and in any other phase after the administration of the

contrast medium, showed that the degree of enhancement was the same as the aortic enhancement, in all the hemangiomas and in all phases.

The differential diagnosis of hepatic hemangioma has to be made with hypervascularized metastatic lesions, with hepatocellular carcinoma and angiosarcoma (15,16). The globular enhancement pattern has an 88% sensitivity, and a specificity ranging between 84% and 100%, in terms of differentiating hepatic hemangioma from hypervascular metastases (16). The attenuation of the enhanced vascular space in the hemangioma comes close to the attenuation of the aorta, regardless of the phase.

Although some hepatic vascular neoplasms may enhance during the early phase of contrast administration, the attenuation coefficient drops more rapidly than in the aorta (16,17). Another helpful sign for differentiating a hemangioma from a malignant lesion is a ring of hypoattenuation that surrounds malignant masses (16). Angiosarcoma is a very rare malignant hepatic tumor, more frequent in men, often appearing in the seventh decade of life and associated with Thorotrast®, steroids, arsenic and phenol. It may show a pattern very similar to that of a hemangioma on CT, MRI, ultrasound and nuclear medicine studies. When associated with Thorotrast®, the presence of this material in the liver, the spleen and the lymph nodes helps to guide the diagnosis (18).

Our study describes well-known characteristics of giant hepatic hemangiomas. However, this is one of the series with the largest number of patients in the era of spiral CT and multislice detectors, with a finding of very similar characteristics to those already described in the literature.

One of the limitations of the study was the initial acquisition with 10 mm collimation on spiral CT. However, considering the size of the lesions, greater than 4 cm in diameter, this limitation did not affect the interpretation of the images given that the characteristics described are mainly those related to the attenuation coefficient of the hemangioma and its behavior with the contrast medium, and these are not altered with the collimation obtained.

Another limitation of the study was the subjective assessment of the degree of enhancement of the hemangioma when compared to the aorta. However, considering the diameter of the lesions and the type of globular, peripheral, discontinuous enhancement with centripetal non-homogenous filling, it is difficult to measure attenuation objectively because of the need to obtain too many values that would change with the diameter of the hemangioma.

Conclusion

In summary, giant hepatic cavernous hemangiomas show low attenuation on CT images without intravenous contrast. Cleft areas are very frequent, considering that they were present in 100% of the hemangiomas in our series. The enhancement pattern is characteristic: it starts at the periphery in a globular form and progresses centripetally. However, complete filling on delayed images is unusual.

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