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(Article begins on next page)

# Hemolymphangiomas of the Spleen

## Imaging Features

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**Summary:** Hemolymphangiomas are an extremely rare entity that has never been described in the diffuse form. Its main pathologic feature is proliferation of lymphatic and vascular cells inducing interstitial and hematic lakes and then splenomegaly. We report a complete imaging study, including magnetic resonance (MR) imaging, after administration of a superparamagnetic contrast agent. Ultrasonography (US), basal MR imaging, and late computed tomography (CT) contrastographic features are quite similar to those of other diffuse benign vascular neoplasms, without real hemangioma-like enhancement during the vascular phase. Its late contrastographic pattern could be considered specific if CT and iron oxide-enhanced MR imaging are applied as complementary diagnostic tools, however.

**Key Words:** angiomas, spleen, splenomegaly, superparamagnetic contrast agents, vascular neoplasms

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**H**emolymphangioma is a tumor characterized by proliferation of lymphatic and vascular cells. Such neoplasms can be localized in the orbit, tongue, neck, mediastinum, or abdomen. Splenic localization is rare, however, and its imaging has been reported only some decades ago;<sup>1,2</sup> features of the diffuse form were never described. We describe a case of hemolymphangiomas, which was also analyzed at magnetic resonance (MR) imaging after administration of a superparamagnetic contrast agent, otherwise rarely used in the study of splenic pathologic findings.<sup>3</sup>

Iron oxide contrast agent, when hydrated, has a strong T1 relaxation property, allowing enhancement of the vessels, and thus of angiomas. Its small particles are phagocytosed by

the cells of the reticuloendothelial system. This offers the possibility to distinguish malignant tissues, in which there are no phagocytic Kupffer cells and, consequently, no signal intensity (SI) change, from normal tissue and benign tumors, in which there is SI loss in T2-weighted images.<sup>4</sup>

### CASE REPORT

A 38-year-old woman in excellent physical condition was referred to a hematologist for asymptomatic moderately gravescent thrombocytopenia (platelet count = 102,000 cells/mm<sup>3</sup>). The patient's medical history was negative, except for a surgical intervention in childhood for unclarified angioma of the thymus. The patient had 2 uncomplicated pregnancies. Physical examination revealed only huge splenomegaly. Antiplatelet antibodies were absent, and the results of peripheral blood tests were negative. Bone marrow biopsy and aspiration indicated normal hemopoiesis with stimulated megakaryocytes. Cardiac ultrasonography (US) and electrocardiography revealed a marked axial cardiac deviation. Transabdominal US, performed with an Astro MP (Esa Ote-Ansaldo, Genoa, Italy) with a 3.5-MHz convex probe, confirmed inhomogeneous splenomegaly (Fig. 1A). A spiral computed tomography (CT) examination was performed using a Somatom Plus (Siemens, Erlangen, Germany) single-row scanner. After a direct scan and intravenous administration of 100 mL iodinated contrast agent (Ultravist 370; Schering, Berlin, Germany) at rate of 3 mL/s, 4 acquisitions were obtained (8-mm thickness, pitch = 1). Computed tomography further confirmed splenomegaly (diameter of 24 cm) with inhomogeneous density attributable to multiple hypodense masses (diameters from 1 mm to 4–5 cm), more evident at the arterial (see Fig. 1B), portal venous, and equilibrium phases because of enhancement of the surrounding parenchyma. At the 60-minute scan performed to demonstrate possible delayed enhancement of the lacunae, the resultant spleen density was quite homogeneous for slow enhancement of the masses (see Fig. 1C).

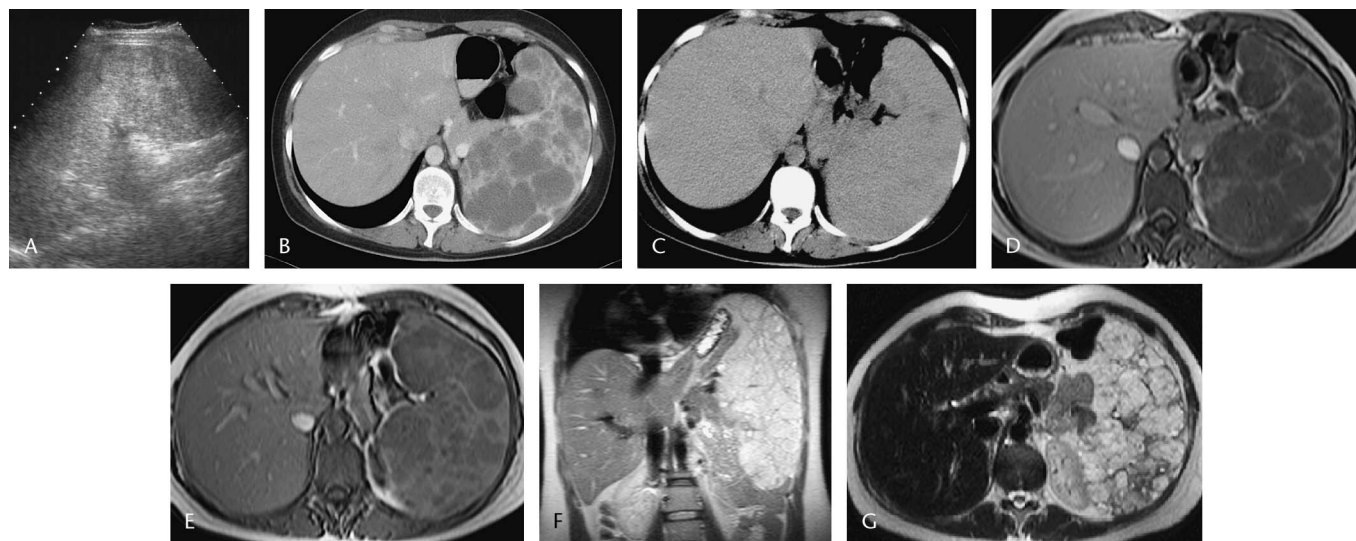
The patient underwent an MR imaging examination on a 1.5-T unit (Gyrosan ACS NT; Philips, Eindhoven, The Netherlands) with a body phased-array coil. Direct axial breath-hold, fast field echo, T1-weighted (repetition time = 110 milliseconds, echo time = 1.8 milliseconds, flip angle = 80°, 7-mm slice thickness) and respiratory-gated free-breath, turbo spin echo, single-shot, T2-weighted (repetition time = 810–870 milliseconds, echo time = 80–210 milliseconds, turbo factor of 91–97, 4-mm slice thickness) sequences were performed; T2 sequences were also acquired with fat suppression. T1-weighted sequences were repeated 25, 70, and 180 seconds after administration of 1.4 mL Resovist (SHU-555 A; Schering), followed by a 20-mL saline solution flush; T1- and T2-weighted sequences were performed again after 10 and 60 minutes. In direct T2-weighted images (see Fig. 1F), the spleen appeared hyperintense because of the presence of multiple coalescent masses, whereas the T1-weighted scan showed only inhomogeneous SI without well-defined nodules. The early contrast-enhanced T1-weighted images (see Fig. 1D)

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**FIGURE 1.** Imaging findings of a 38-year-old woman with splenomegaly. (A), Sonogram shows mottled echo texture of the spleen. Early contrast-enhanced CT scan (B) shows an enlarged spleen containing innumerable, focal, low-density lesions with almost homogeneous fill-in on a 60-minute contrast-enhanced CT scan (C). Early contrast-enhanced MR imaging T1-weighted image (D) shows an enlarged spleen containing innumerable, focal, low-intensity lesions without significant fill-in on a 60-minute contrast-enhanced MR imaging T1-weighted scan (E). T2-weighted precontrast image (F) shows innumerable, focal, hyperintense lesions with no loss of SI after Resovist administration on a 60-minute T2-weighted image (G); such focal areas are better defined because of negative enhancement of the surrounding parenchyma.

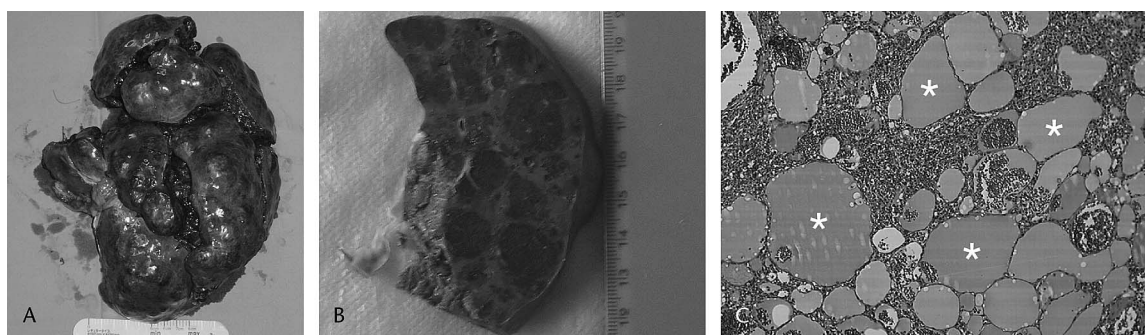
showed a pattern similar to that described at CT examination. Conversely, 10- and 60-minute T1-weighted images (see Fig. 1E) showed only minimum enhancement, whereas T2-weighted scans (see Fig. 1G) demonstrated no SI loss of lesions, which appeared hyperintense and surrounded by a thin layer of markedly hypointense enhanced parenchyma.

The 1600-g laparoscopically resected spleen had an even surface (Fig. 2A) and contained several lacunae containing hematic or serous liquid (see Figs. 2B, C); the latter were larger and more numerous (approximately 60%–70%) than the former. Microscopically, lacunae walls were lined by flat (and sometimes cuboid) endothelial cells, which were anti-CD34 antibody- and anti-Factor VIII positive and anti-pancytokeratin AE1/AE3 antibody-negative. The cells detected in the lumen of the lacunae and in the intervascular spaces were histiocytes (anti-CD68 antibody-positive) with increased iron deposits (Perls positive). Small residues of normal spleen tissue were still identifiable.

Evaluation of the sample and the anamnestic data on the childhood angioma directed us to the diagnosis of hemolymphangiomatosis of the spleen, associated with previous hemolymphangiomatosis of the thymus. The spleen angioma, although probably present for many years or even since birth, had undergone rapid enlargement. Indeed, at US for pregnancy follow-up, performed 4 years before the current diagnosis, no pathologic findings were evident.

## DISCUSSION

In our reported case, the spleen, removed to prevent the onset of hypersplenism and further enlargement, showed altered architecture attributable to the presence of multiple cavities in a limited residual normal parenchyma. Lacunae contained blood or pink proteinaceous material conferring a “spongy” appearance to the spleen (see Figs. 2B, C). Macroscopic and histologic



**FIGURE 2.** Pathologic findings of a 38-year-old woman with splenic lesions. A, Photograph of the surgically removed enlarged spleen shows a deformed and markedly nodular exterior surface. B, Photograph of the cut surface demonstrates round dark areas attributable to lakes filled with serous liquid. C, Photomicrograph (hematoxylin-eosin stain) of the histologic specimen shows vascular lacunae containing blood and interstitial lakes filled with serous liquid (\*).

findings were consistent with US, CT, and basal MR imaging: multiple sharply defined nodular areas, low SI on T1-weighted images (see Fig. 1D) and high SI on strongly T2-weighted images (see Fig. 1F), and homogeneous enhancement on the CT scan at 60 minutes (see Fig. 1C).

Vascular neoplasms are the most common primary tumors of the spleen and represent most nonlymphoid splenic tumors. Of these, 2 are the most common: lymphangiomatosis and hemangiomas. Lymphangiomatosis is usually composed of endothelium-lined cystic avascular spaces containing eosinophilic homogeneous material, which confer a characteristic "Swiss cheese" US and CT appearance to the spleen with liquid SI at MR imaging.<sup>5</sup> Hemangiomas presents an MR imaging and US appearance similar to that of liver hemangiomas: round, low-T1, and high-T2 masses; echogenic; and occasionally with hypoanechoic vascular lacunae (cavernous forms) or echoic areas (hemorrhagic foci). On CT scans, multiple, usually homogeneous, lesions are demonstrated. These lesions are hypodense with peripheral contrastographic enhancement ("fill-in") and are sometimes hyperdense compared with surrounding normal parenchyma in the late phase.<sup>6</sup>

A similar contrastographic pattern is found in 2 other types of splenic diffuse vascular neoplasms: littoral cell angioma and hemangioendothelioma. The former is characterized by a specific immunohistochemical phenotype and is composed of anastomosing vascular channels resembling splenic sinuses. Ultrasonography shows a diffuse heterogeneous echo texture of the spleen. On CT, the usual contrastographic pattern of hemangiomas can be demonstrated. Hemangioendothelioma is an intermediate type of vascular endothelial neoplasm, thought to be potentially more aggressive than hemangioma but still not full-fledged angiosarcoma. The US appearance is variable, and the contrastographic pattern may be similar to that of benign forms.<sup>7</sup> Both types may have T1/T2 hypointense areas because of the presence of hemosiderin.<sup>8</sup> Other vascular neoplasms such as hamartomas, hemangiopericytomas, and angiosarcomas have a variable nonpathognomonic US/MR imaging appearance; in contrast to benign types, they show inhomogeneous enhancement during late-phase CT. Moreover, hemangiopericytoma shows intense enhancement of its solid portions, whereas angiosarcoma usually includes areas of necrosis, has extra-splenic tumor extension, and exuberates from spleen.

Malignancy and phlogosis usually show different radiologic patterns.<sup>7</sup> In particular, with the exception of diffuse infiltration of lymphoma, in both cases, there is no homogeneous enhancement during late-phase CT; therefore, such diagnostic hypotheses were not formulated after imaging.

The case described here presents some of the characteristics of angiomatosis (high SI on T2-weighted images and late

homogeneous enhancement) but not the typical marked centripetal enhancement typical of liver hemangiomas.<sup>9</sup> Moreover, late-phase images showed only minimum T1 enhancement (see Fig. 1E) without any T2 signal loss (see Fig. 1G).

A possible explanation for this late contrastographic pattern may be related to the molecular dimensions and kinetics of iodinated and iron oxide contrast agent (1.5 vs. 62 nm). On CT, by 1 hour, the iodinated contrast could be equilibrated through the extracellular fluid compartment (see Fig. 1C), including the serous liquid lakes, which were apparently not in connection with the vascular system and did not contain phagocytic cells. Conversely, Resovist, whose uptake is exclusively by phagocytosis, did not leave the vascular compartment and provoked scarce enhancement of vessels and hematic lacunae on T1-weighted images, was not equilibrated through the extracellular fluid compartment (see Fig. 1E), and did not demonstrate any negative enhancement of interstitial lakes on T2 images (see Fig. 1G).

In conclusion, splenic hemolymphangiomas is an extremely rare entity whose US, basal MR imaging, and late CT contrastographic features are quite similar to those of other diffuse benign vascular neoplasms described previously, without real hemangioma-like enhancement during the vascular phase. Its late contrastographic pattern could be considered specific if CT and iron oxide-enhanced MR imaging are applied as complementary diagnostic tools.

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