CT characterization of focal spleen lesions

Poster No.: C-0144
Congress: ECR 2012
Type: Scientific Exhibit
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Keywords: Abdomen, Spleen, CT, Contrast agent-intravenous, Cysts, Neoplasia
DOI: 10.1594/ecr2012/C-0144

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Purpose

To review the most common focal lesions of the spleen as well as their appearance on CT, especially the key imaging features that allow a specific diagnosis.

Methods and Materials

We present a series of cases of most common focal lesions of the spleen as cyst (congenital, complicated, parasitic), infarction, inflammatory disease (bacterial abscess, tuberculosis), benign tumors (hamartoma, hemangioma), malignant tumors (lymphoma, metastases) and review their appearance on CT, especially the key imaging features that allow a specific diagnosis.

Results

There is a wide range of diseases that can produce splenic focal lesions. The imaging appearance of solitary focal lesions varies from cystic to solid masses. Cystic masses include congenital cyst, false cyst, hematoma, bacterial abscess, parasitic cyst and neoplasm (lymphangioma, metastases). On the other hand single solid masses include infarction, hemangioma, lymphoma, hamartoma, angiosarcoma and metastases. Differential diagnosis of multiple masses is very extensive and the most common disorders include fungal abscess, granulomatous infections (tuberculosis, sarcoidosis), Pneumocystis carinii infection, infarction, lymphangioma, lymphoma, litoral cell angioma and metastases. Other rare disease associated with multiple splenic lesions are extramedullary hematopoiesis, amyloidosis, Gaucher disease, phenytoin reaction and peliosis.

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SOLITARY CYSTIC LESIONS

NON NEOPLASTIC

The non neoplastic splenic cysts can be divided in two categories: primary (true) cyst, which possess a cellular lining, and secondary (false) cysts, which have no cellular lining. The primary cysts are either nonparasitic (epidermoid or congenital) or parasitic (echinococcal). Secondary or false cysts are presumed to result from either unrecognized trauma, previous infarction, or infection of the spleen. Posttraumatic cysts account for 80% of all splenic cysts.

1. CONGENITAL OR EPIDERMOID CYST

Imaging findings:

Spherical, well-defined cystic lesions with attenuation equal to that of water, a thin or imperceptible wall, and no rim enhancement.

2. POSTTRAUMATIC LESIONS

- Hematoma
Intrasplenic hematoma is a collection of extravasated blood within the splenic pulp. It is caused by blunt or penetrating abdominal trauma, splenic biopsy or anticoagulation therapy.

Imaging findings:

Low-attenuation, nonspecific, cystic lesion with clear-cut margins. No contrast uptake.

- **Posttraumatic or false cyst**

Posttraumatic or false cyst is believed to be the end stage of intrasplenic hematoma. CT appearance is similar to true cyst. Usually they are smaller than true splenic cysts and sometimes they show eggshell calcifications of the wall.

The diagnosis of a false cyst should be favored if there is a clear history of trauma, if the patient is older than the fourth decade, if there is a hematoma elsewhere in the spleen, or if the cyst wall is calcified.

(figure 1)

**3. INFLAMMATORY LESIONS**

- **Hydatid cyst**

Parasitic or hydatid cysts are almost always caused by *Echinococcus granulosus*. They are commonly seen in endemic areas. Concurrent liver cysts are frequently present.

Imaging findings:

Spherical or ovoid, well-defined cystic lesions with attenuation equal to that of water. They may show ring calcification or high CT values as a result of intracystic debris, hydatid sand and inflammatory cells. A cystic lesion with wall calcification in a patient from an endemic area who has positive serologic findings most likely represents hydatid disease.

(figures 2 and 3)
- Bacterial Abscess

A pyogenic abscess is a localized collection of pus that most commonly is caused by the hematogenous spread of infection (75% of cases). Other causes include penetrating trauma (15%) and prior splenic infarction (10%). They can be single or multiple.

Imaging findings:

CT is the most reliable technique. It show a more well-defined lesion than is typically shown on US images. No internal contrast enhancement is evident. Rim enhancement may be shown, although it is seen less often in these lesions than in hepatic abscesses. The presence of gas in an intrasplenic collection is diagnostic for an abscess, although the majority of splenic abscesses do not contain air.

(figure 4)

NEOPLASTIC

1. LYMPHANGIOMA

Lymphangioma is a vascular lesion filled with lymph. It is a relatively rare benign tumor with clinical manifestations that range from an asymptomatic incidental finding to a large multicentric, symptomatic mass requiring surgical intervention. Splenic lymphangiomas may be single or multiple (lymphangiomatosis).

Imaging findings:

Splenomegaly with single or multiple areas of low attenuation. Lymphangiomas are sharply marginated and are not enhanced on postcontrast images. Small, marginal, linear calcifications may be present.

2. METASTASES

Metastatic involvement of the spleen is relatively uncommon. It is seen in only 7% of patients with widespread malignancy. Fifty percent of all splenic metastases are due to
melanoma, and the remaining 50% are predominantly due to adenocarcinoma of the breast, lung, colon, ovary, endometrium, and prostate.

Many metastases in the spleen are cystic, secondary to rapid growth, resulting in autoinfarction, internal necrosis, or both. Melanoma commonly causes cystic splenic metastases.

Imaging findings:

They may appear as ill-defined low-attenuation foci or as well-delineated unilocular or septated lesions with the same attenuation as water. Enhancement may be present in the periphery and in viable internal septa.

(figure 5)

**SOLITARY SOLID LESIONS**

**NON NEOPLASTIC**

**INFARCTION**

Infarction can be either arterial or venous. Arterial infarction occurs secondary to occlusion of the splenic artery or its branches, and venous infarction is caused by thrombosis of the splenic sinusoids, which also occurs in patients with massive splenomegaly. The most common cause of splenic infarction is embolic, occurring in cardiovascular disease (eg endocarditis, atrial fibrillation, or left ventricular thrombus).

Imaging findings:

Classic CT findings are wedge-shaped, peripheral, hypoattenuating lesions. It is more common, however, for splenic infarcts to appear round or irregular. Contrast-enhanced CT markedly improves visualization of a splenic infarct.

(figure 6)

**NEOPLASTIC**


1. HEMANGIOMA

Hemangioma is the most common primary benign neoplasm of the spleen. They are usually small and asymptomatic lesions. Splenic hemangiomas may be multiple usually as part of a generalized angiomatosis (Klippel-Trenaunay-Weber syndrome). When the entire organ is replaced by hemangiomas, it is called hemangiomatosis.

Imaging findings:

- Unenhanced CT: well-defined hypodense lesions.
- Contrast-enhanced CT: centripetal contrast uptake. Isodense in late phases.

(figures 7, 8 and 9)

2. LYMPHOMA

Lymphoma is the most common malignant tumor of the spleen.

Splenic lymphoma can be classified as either primary lymphoma (rare) or lymphomatous splenic involvement as part of more systemic disease.

Non-Hodgkin lymphoma is the most common primary tumor of the spleen.

There are three different macroscopic patterns of splenic lymphoma:

- Infiltrative, without definite discrete masses
- Miliary, with small (< 2 cm) deposits of lymphomatous cells
- Massive, in which one or multiple large lymphomatous masses can be seen within the spleen

Lymphoma may become cystic secondary to massive internal necrosis.

Imaging findings:
- homogeneous enlargement without a discrete mass
- solitary mass
- miliary multifocal lesions

Areas of lymphoma larger than 1 cm in diameter are usually detectable with CT and usually appear as discrete, low-attenuation masses. These lesions are not enhanced on post contrast images.

(figure 10)

3. HAMARTOMA

Hamartoma of the spleen is a rare benign tumor without sex predilection, characteristically composed of anomalous mixtures of normal elements of splenic tissue. Hamartomas are usually single solid lesions that may contain a cystic or necrotic component. Most patients have no symptoms, and the discovery of a splenic hamartoma is an incidental finding. These lesions are commonly associated with tuberous sclerosis.

Imaging findings:

They usually appear nearly isoattenuating relative to normal spleen before and after intravenous administration of contrast material and, therefore, can be difficult to detect.

A contour abnormality may be the only finding present.

(figures 11 and 12)

4. ANGIOSARCOMA

Primary angiosarcoma of the spleen is a very rare vascular neoplasm with a very poor prognosis. These tumors are highly aggressive and manifest with widespread metastatic disease or splenic rupture.

Imaging findings:
Enlarged spleen with hypoattenuating lesions on non-enhanced scans. Areas of high CT attenuation may represent acute hemorrhage or hemosiderin deposits. Contrast enhancement of angiosarcomas may be similar to that of hepatic hemangioma, although the pattern of filling is variable.

5. METASTASES

See previous description.

MULTIPLE LESIONS

NON NEOPLASTIC

1. FUNGAL ABSCESS

Fungal abscesses are almost always multiple and occur most commonly in immunocompromised individuals. Candida fungus is most frequently encountered, followed by Aspergillus and Cryptococcus fungi.

Imaging findings:

Multiple small lesions of relatively low attenuation. Typical lesions are smaller than 2 cm in diameter and are usually 5-10 mm in size. Occasionally, a central focus of higher attenuation or a wheel-within-a-wheel pattern may be demonstrated.

2. GRANULOMATOUS INFECTIONS

Tuberculosis

Usually occurs in a miliary form by hematogenous dissemination of the infection.

Imaging findings:
Small focal splenic nodules of low attenuation. Often there is mild splenomegaly. Evolution toward calcification.

(figures 13 and 14)

**Sarcoidosis**

They are usually asymptomatic lesions.

Imaging findings:

Often there is mild splenomegaly with multiple small hypoattenuating nodules. These lesions are not enhanced on postcontrast images

**3. PNEUMOCYSTIS CARINII**

Often discovered incidentally in the patient with AIDS who is undergoing CT examination for a fever of unknown origin.

Imaging findings:

Enlarged spleen with focal low-attenuation splenic lesions, which may become progressively calcified either in rim-like or punctate fashion over a few months.

**4. INFARCTION**

See previous description

**NEOPLASTIC**

**1. LYMPHOMA**
2. LYMPHANGIOMA

See previous description.

3. LITORAL CELL ANGIOMA

Litoral cell angioma of the spleen is a rare vascular tumor that may occur at any age and have no gender predilection. Splenomegaly is almost always present.

Imaging findings:

Multiple hypoattenuating lesions on CT scans obtained with or without contrast material. On delayed contrast-enhanced images, litoral cell angiomas homogeneously enhance and become isoattenuating relative to the remaining splenic parenchyma, a finding that may help limit the differential diagnosis.

4. METASTASES

See previous description.

Other rare diseases associated with multiple splenic lesions are extramedullary hematopoiesis, amyloidosis, Gaucher disease, phenytoin reaction and peliosis.

Images for this section:
**Fig. 1:** FALSE CYST CT: spherical, well-defined cystic lesion with attenuation equal to that of water
Fig. 2: HYDATID CYST CT: cystic lesion with wall calcification and high CT values
Fig. 3: HYDATID CYST CT: cystic lesion with wall calcification and high CT values
**Fig. 4:** BACTERIAL ABSCESS CT: multiple hypodense lesions.
Fig. 5: METASTASES OF COLON CARCINOMA CT: multiple liver and spleen hypoattenuating nodules
Fig. 6: INFARCTION CT: wedge-shaped, peripheral, hypoattenuating lesion
**Fig. 7:** HEMANGIOMAS CT 40 seconds after contrast administration: multiple hypodense lesions in arterial phase mottled pattern of enhancement.
Fig. 8: HEMANGIOMAS CT 70 seconds after contrast administration: isodense lesions
Fig. 9: HEMANGIOMAS CT 180 seconds after contrast administration: homogeneous spleen
Fig. 10: LYMPHOMA CT: large splenic mass with central necrosis
Fig. 11: HAMARTOMA CT ARTERIAL PHASE: hypoattenuating lesion with central calcification
Fig. 12: HAMARTOMA CT PORTAL PHASE: slightly hypoattenuating relative to normal spleen. Central calcification.
Fig. 13: TUBERCULOSIS CT: small focal splenic lesion of low attenuation. Paratracheal enlarged necrotic lymph nodes.
Fig. 14: TUBERCULOSIS CT: multiple small focal splenic nodules of low attenuation
Conclusion

Radiologic findings often have substantial overlap which precludes the rendering of a specific diagnosis on the basis of imaging findings alone. Knowledge of the imaging features of the focal lesions of the spleen provides the criteria, with clinical information, for making a specific diagnosis or substantially narrowing the differential diagnosis.

References


Personal Information

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