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REVIEW

CT of splenic disease

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Introduction

The spleen is the largest collection of lymphoid tissue in the body. It has important haematological and immunological functions and may be involved in malignant disease. CT offers a simple, rapid way to assess the spleen in patients with cancer and here we review CT of splenic disease in such cases.

CT

The spleen on non-enhanced CT is homogeneous and has an attenuation of 35-55HU, that is 5-10HU less than that of liver. The spleen is optimally evaluated with the use of intravenous contrast material. The spleen normally demonstrates heterogeneous enhancement immediately after bolus injection of contrast material. Only after a minute or more does the splenic parenchyma achieve uniform homogeneous enhancement. This is thought to reflect the variable blood flow within different compartments of the spleen and should not be misinterpreted for pathology.

The shape and position of the normal spleen can vary considerably. The radiologist also needs to be aware that a number of normal variants and congenital anomalies affect the spleen. Residual clefts between adjacent lobulations may mimic lacerations and prominent lobes may mimic splenic mass lesions. Ectopic splenic tissue of congenital origin gives rise to accessory spleen. In autopsy series accessory spleens are present in 10–30% of the population. They are usually solitary and occur near the splenic hilum (75%), but may be found elsewhere in the abdomen. Accessory spleen varies in size from a few millimetres to several centimetres in diameter. After splenectomy, an accessory spleen can hypertrophy dramatically causing recurrence of problems in patients who have undergone splenectomy for hypersplenism. The typical accessory spleen has a smooth, round or ovoid shape and its blood supply is usually derived from the splenic artery with drainage into the splenic vein.

The normal adult spleen size measures approximately 12–15 cm in length, 4–8 cm in antero-posterior diameter and 3–4 cm in thickness. However the irregular shape and oblique orientation of the spleen means that these linear measurements are of limited use. Furthermore, splenic volume varies greatly from one individual to another. Normal in vivo adult splenic volume ranges from 107 to 314 cm^3. A quick quantitative assessment of splenic size can be made on imaging on CT using splenic index, i.e. the product of the length, width and thickness. The normal splenic index is between 120–480 cm^3.

Splenomegaly

There are many causes of splenomegaly, and it may occasionally be related to neoplastic disorders such as lymphoma, leukaemia, primary benign or malignant tumours and metastases. A clue to the underlying cause can sometimes be identified on imaging, e.g. abdominal lymph node enlargement may suggest lymphoma.

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Benign mass lesion

Splenic cystic lesions may be due to cystic neoplasm (lymphangioma or haemangioma), cystic metastasis or abscess (haematoma or pseudocyst). Non-neoplastic splenic cysts are true (primary) cysts, which possess a cellular lining or false (secondary) cyst which have no cellular lining. True cysts are either parasitic (echinococcal) or non-parasitic (i.e. epithelial also called epidermoid, mesothelial, or primary cyst). Epithelial cysts are congenital in origin while false cysts, i.e. pseudocysts are post traumatic in origin and thought to represent the final stage in the evolution of a splenic haematoma.

On CT, splenic cysts are well defined, of water density or signal, and show no enhancement after intravenous contrast. It is usually difficult to distinguish between true and false cysts on imaging, but certain characteristics may be useful in differentiating between them. CT demonstrates cyst wall calcification in 14% of true cysts and 50% of false cysts. Cyst wall trabeculation or peripheral septation occurs in 86% of true cysts and 17% of false cysts. High attenuation cysts may occur in up to one third of false cysts.

Haemangioma is the most common primary benign neoplasm of the spleen occurring in 0.03% to 14% of cases at autopsy. Most lesions are detected incidentally but in large haemangioma splenic rupture and anaemia, thrombocytopenia and coagulopathy (Kasabach–Merritt syndrome) has been reported. Splenic haemangiomas can be multiple and a part of a generalised angiomatosis as in Klippel–Trenauny–Weber syndrome. On CT, haemangiomas may appear either solid and/or cystic and may enhance in a similar pattern to hepatic haemangioma. Some lesions are relatively avascular or show slow filling of contrast material.

Lymphangioma can occur as single or multiple lesions and are usually asymptomatic and are categorised as capillary, cavernous or cystic depending on size of the abnormal lymphatic channels. In the spleen the cystic type is most common. CT shows multiple thin walled, well-marginated cysts often subcapsular in location. No enhancement is seen and the attenuation measurements vary from 15-35HU.

Splenic hamartomas (also called splenomas, or nodular hyperplasia of the spleen) are rare benign lesions composed of an anomalous mixture of normal splenic elements with red pulp predominating. The hamartoma occur singly or less commonly as mutiple nodules. On CT, they appear iso or hypodense on the precontrast images, with the occasional lesion showing cystic component.

Splenic malignancy

Splenic lymphoma is the most common splenic malignancy and is usually a manifestation of generalised lymphoma. It is estimated that at the time of diagnosis, splenic involvement is present in 25–35% of patients with lymphoma. In patients with NHL, splenic involvement is associated with para-aortic nodal involvement in approximately 70% of patients. On imaging, splenic involvement in lymphoma can take several forms: (1) homogeneous enlargement; (2) miliary nodules; (3) multifocal 1 to 10 cm lesions; (4) single solitary mass. In the majority of patients, the involvement is diffuse and difficult to identify on CT because splenomegaly does not necessarily indicate involvement. One third of patients have splenomegaly without infiltration; conversely one third of normal-sized spleen are found to have tumour following splenectomy. Necrosis of large lesion can give rise to an irregular cystic lesion. Radiologically visible calcification has been reported in aggressive lesions and after chemotherapy.

Primary splenic lymphoma, which is usually of the non-Hodgkin's type, is rare and comprises 1–2% of all lymphoma. Other primary tumours of the spleen are very rare and include angiosarcoma, fibrosarcoma, leiomyosarcoma, malignant teratoma and malignant fibrous histocytoma. Splenic angiosarcoma is very rare but is the most common non-lymphoid primary malignant tumour of the spleen. The prognosis is very poor (20% surviving months). About 70% of all angiosarcoma metastasise to the liver and approximately 30% undergo spontaneous rupture. Imaging reveals an enlarged spleen with a poorly defined mass and there may be areas of haemorrhage within it.

Metastatic disease

Metastatic deposits in the spleen are unusual, comprising 4–7% of patients with metastases in multiple organs. The most common primary sites for splenic metastases are the breast, lung and melanoma. Splenic metastases most frequently appear as multiple nodules. On CT, nodular metastases appear as rounded hypodense lesions. Cystic lesions may occur with metastases from ovary, breast, endometrium and melanoma. Calcification is uncommon but occurs in patients with mucinous adenocarcinoma primary. Peritoneal implants in patients with ovarian, GI or pancreatic cancer can cause scalloping of the splenic capsular surface.

Miscellaneous spleen lesions in oncology patients

Splenic infection may arise as a consequence of immunosuppression from chemotherapy especially fungal infection. The most common pathogens are Candida and Aspergillus. Fungal infection in the spleen is most likely to appear as a miliary or multifocal process.

Splenic infarcts may occur from mass lesion compressing splenic vasculature, e.g. pancreatic tumours.

Splenic infarction may be diffuse or focal. On CT, infarcts typically appear as sharply marginated, low-density wedge-shaped areas. Occasionally the infarct may be multiple, resulting in poorly defined hypodense lesions. When the entire spleen is infarcted only rim enhancement of the capsule occurs from capsular vessels.

Key points

(1) The early heterogeneous enhancement in the spleen should not be misinterpreted for pathology

(2) The commonest splenic malignancy is lymphoma. The spleen is involved as a part of the generalised lymphoma. An enlarged spleen is not a reliable indicator of lymphomatous involvement.

(3) Metastases to the spleen are very uncommon.

Further Reading

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