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CT and MR Features of Splenic Disease

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1. Learning Objectives

To review the CT imaging features of splenic congenital and acquired diseases, as seen on CT and MR.

2. Background

Although CT or MR are only occasionally performed to image the spleen, it is included in practically all sectional imaging evaluations of the abdomen, so it is very important to recognize splenic pathology which we may encounter incidentally.

Incidental or not, the spleen may be affected by various pathologic conditions, including congenital diseases; trauma; inflammation; vascular disorders hematologic disorders; benign tumors; malignant tumors; and other disease processes that affect the spleen diffusely or focally. Although CT is still performed more often, MR imaging has been increasing it´s role in the detection and characterization of splenic diseases.

3. Imaging Findings/Procedure Details

Based on cases diagnosed at their institutions, the authors intend to present examples of the several categories of splenic lesions, discussing their CT and MR imaging features.

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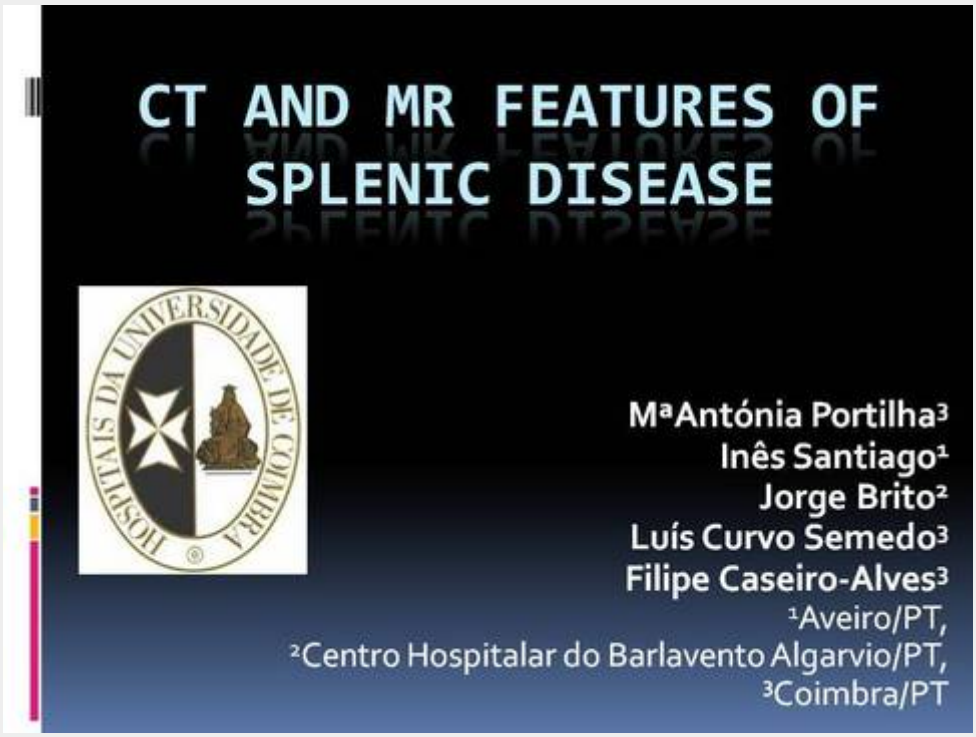

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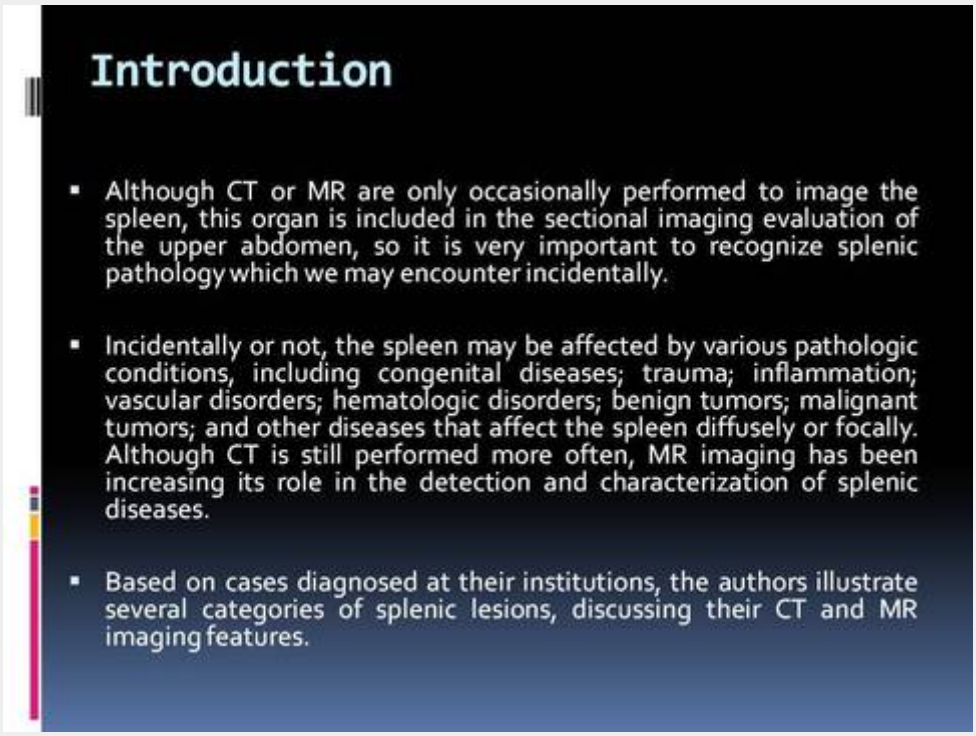

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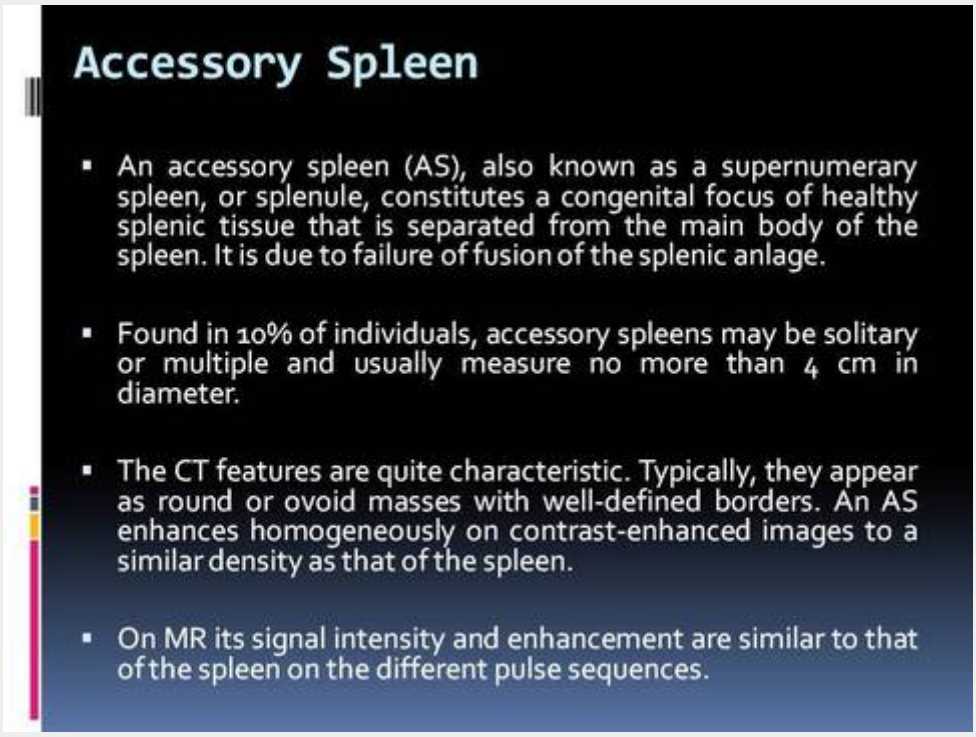

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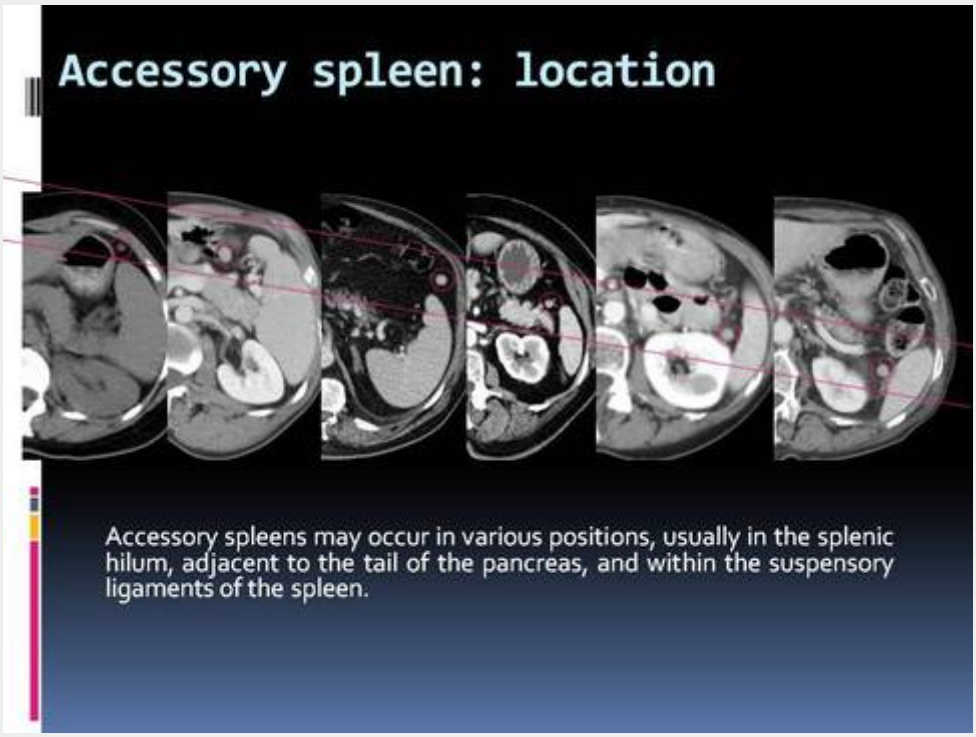

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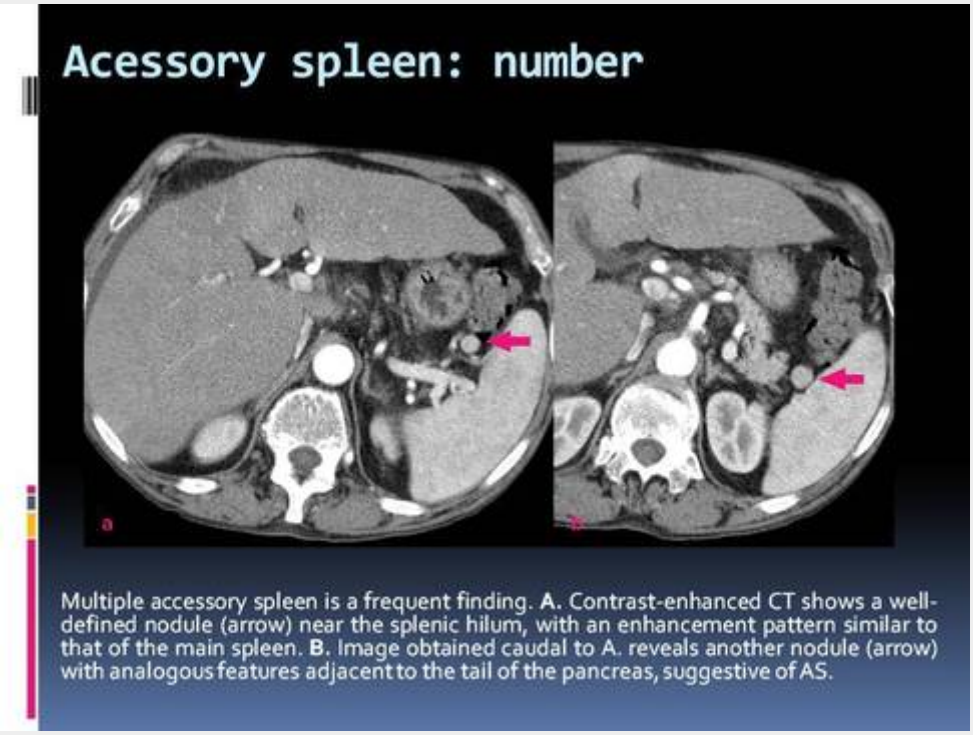

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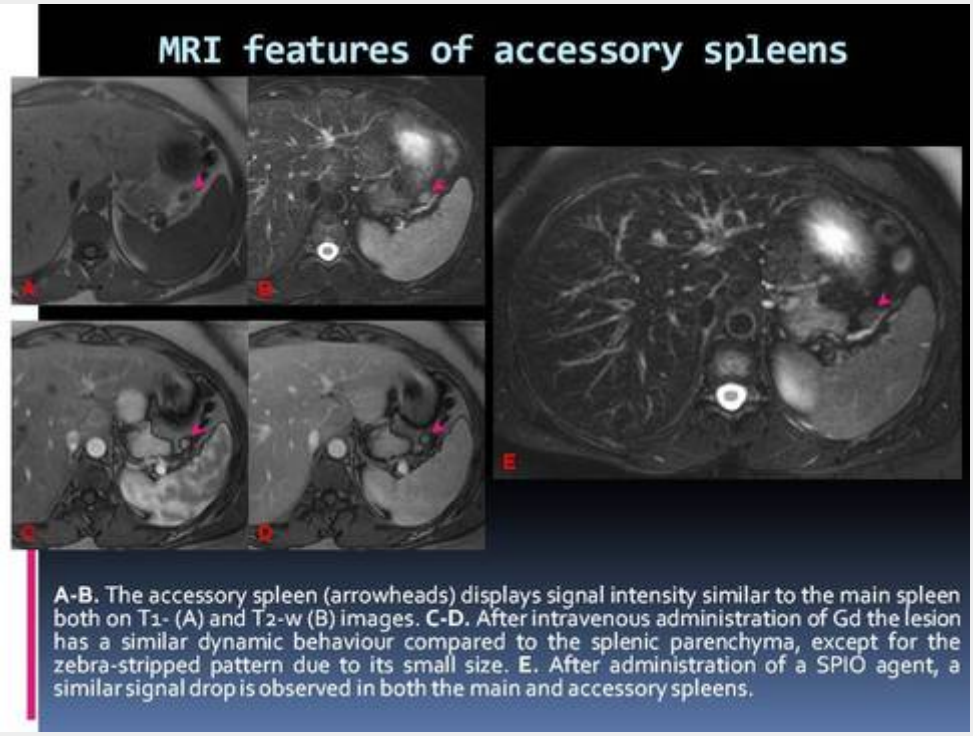

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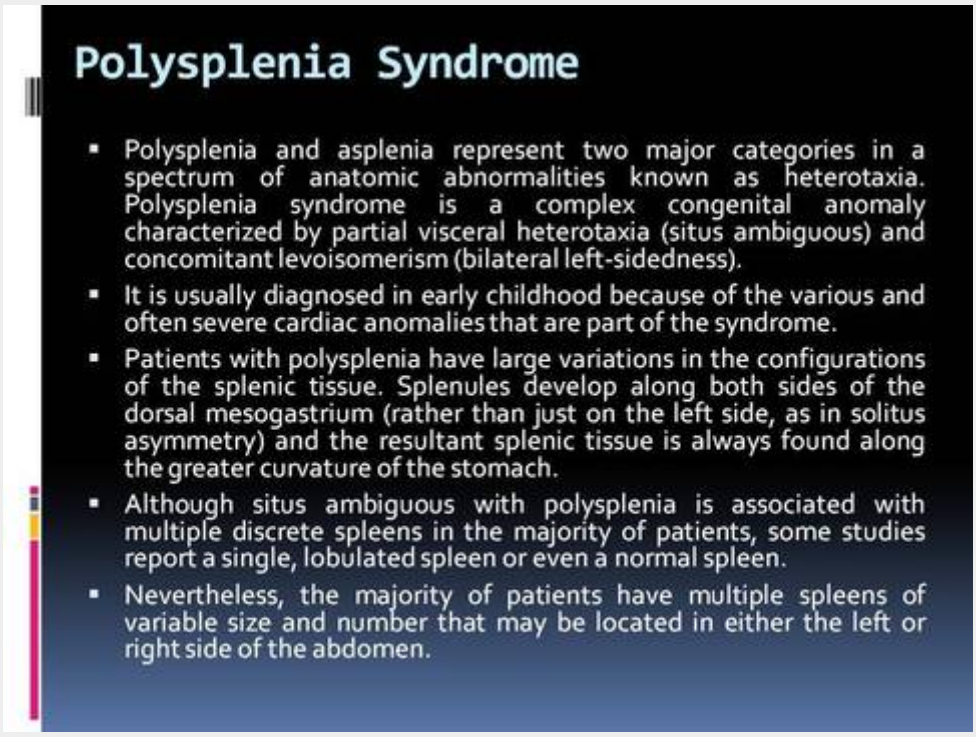

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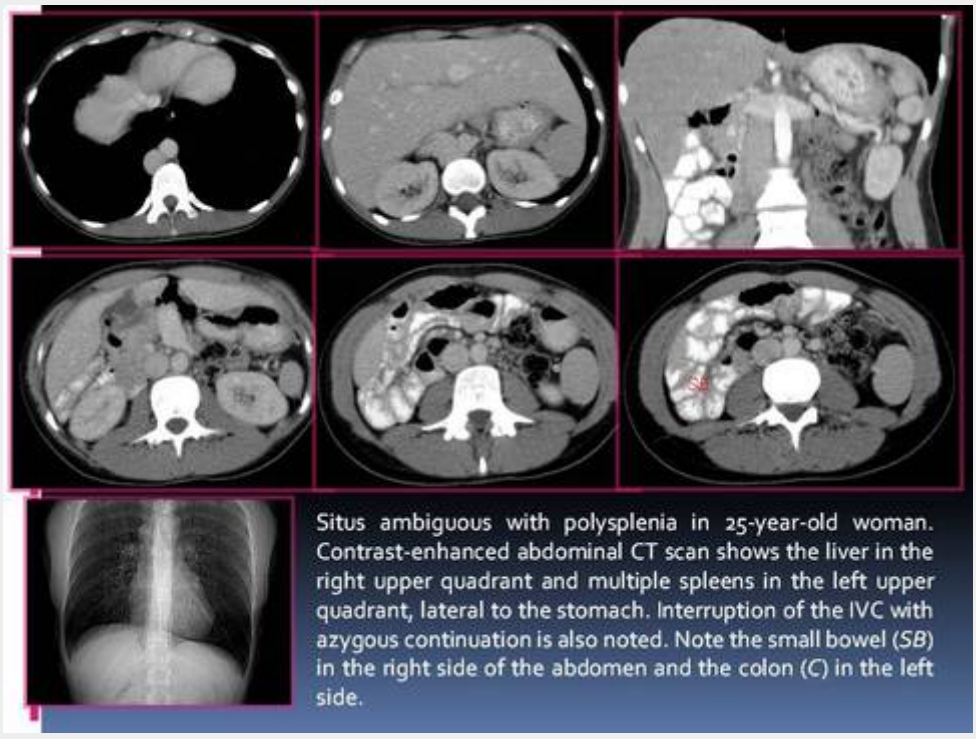

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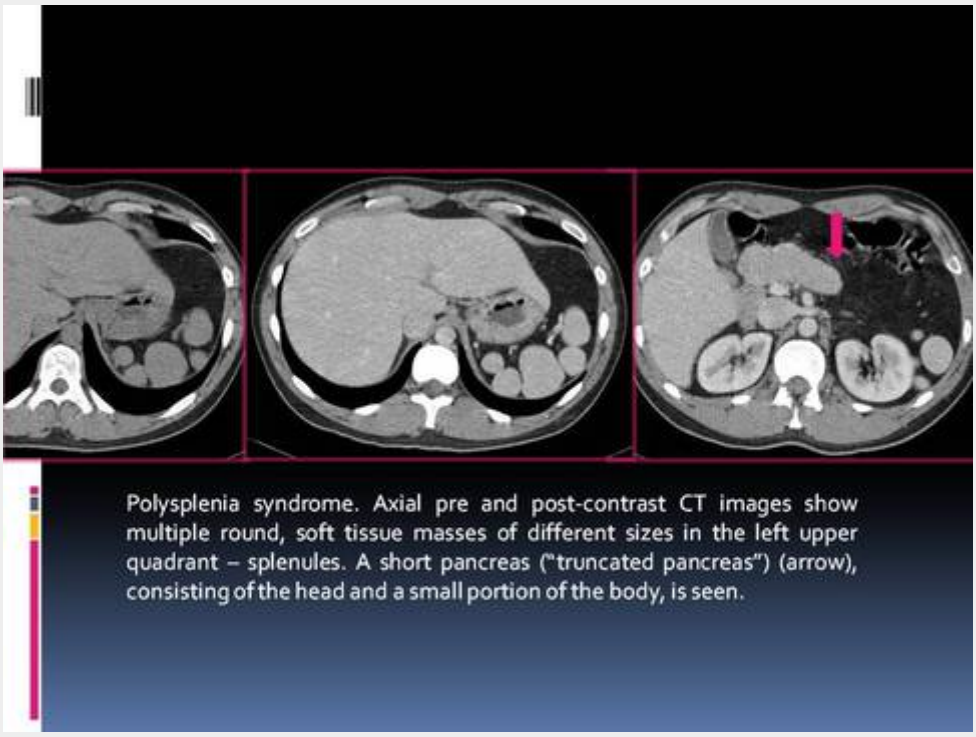

Polysplenia syndrome. Axial pre and post-contrast CT images show multiple round, soft tissue masses of different sizes in the left upper quadrant – splenules. A short pancreas ("truncated pancreas") (arrow), consisting of the head and a small portion of the body, is seen.

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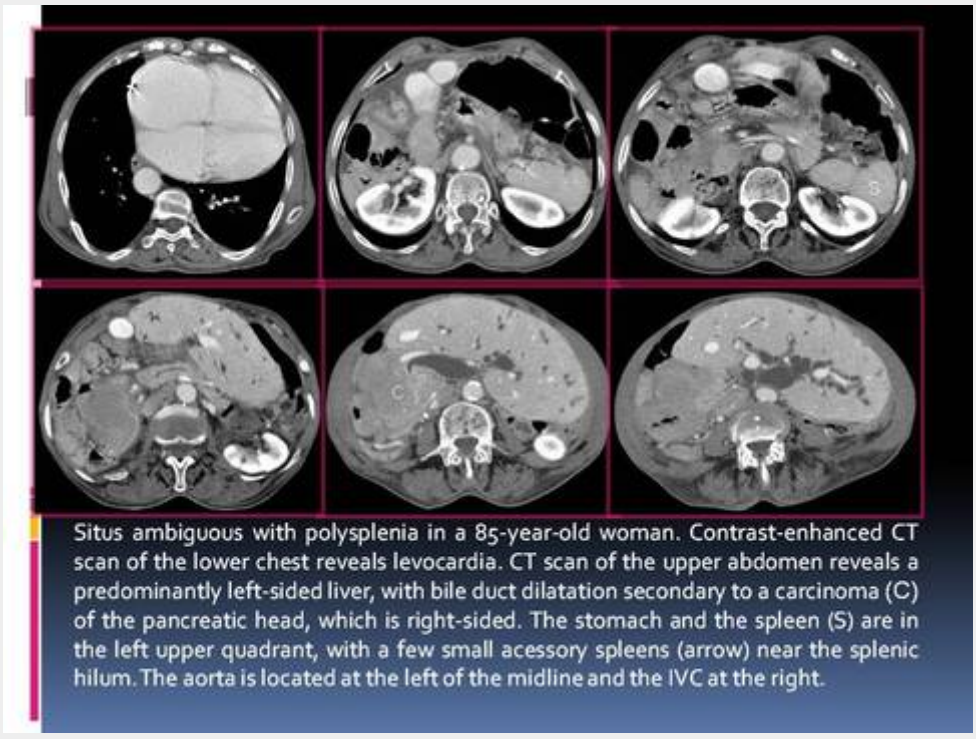

Situs ambiguous with polysplenia in a 85-year-old woman. Contrast-enhanced CT scan of the lower chest reveals levocardia. CT scan of the upper abdomen reveals a predominantly left-sided liver, with bile duct dilatation secondary to a carcinoma (C) of the pancreatic head, which is right-sided. The stomach and the spleen (S) are in the left upper quadrant, with a few small acessory spleens (arrow) near the splenic hilum. The aorta is located at the left of the midline and the IVC at the right.

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Wandering spleen

- Wandering or ectopic spleen refers to migration of the spleen from its normally fixed location in the left upper quadrant. Absence or laxity of the splenic suspensory ligaments results in increased splenic mobility thereby allowing it to rotate axially on its long pedicle.
- This anomaly is quite rare, with a reported incidence in several large series of splenectomies of less than 0.5%. Wandering spleens are mainly found in children and in women aged 20–40 years.
- The wandering spleen may be incidentally detected as an abdominal or pelvic mass. CT findings of a wandering spleen are absence of the spleen in its normal position with a location somewhere else in the abdomen or pelvis.
- The major complication of a wandering spleen is acute, chronic or intermittent torsion caused by its increased mobility. Early recognition of the condition and timely surgical intervention are highlighted to prevent complications.

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Wandering spleen. Ultrasound images show the spleen in an abnormal position, in the pelvis, adjacent to the uterus and left ovary.

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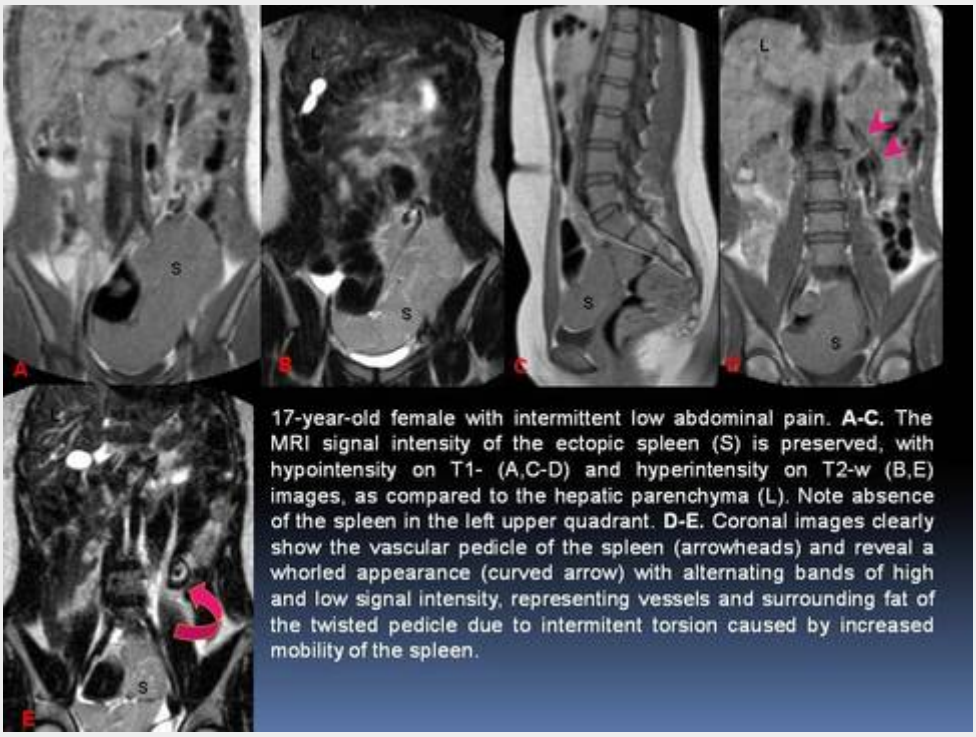

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Trauma

- The spleen is the most frequently injured intraperitoneal organ in blunt abdominal trauma.
- The extent of the injury can range from subcapsular hemorrhage and parenchymal contusion, to a parenchymal laceration (with or without capsular injury), or a complete splenic rupture. Injury to the vascular pedicle leads to splenic infarction of variable extent.
- CT provides the best evaluation of the spleen, being the imaging modality of choice to diagnose and to follow splenic traumatic lesions. An additional advantage of CT is the ability to image all of the abdominal organs simultaneously in excluding a secondary injury.

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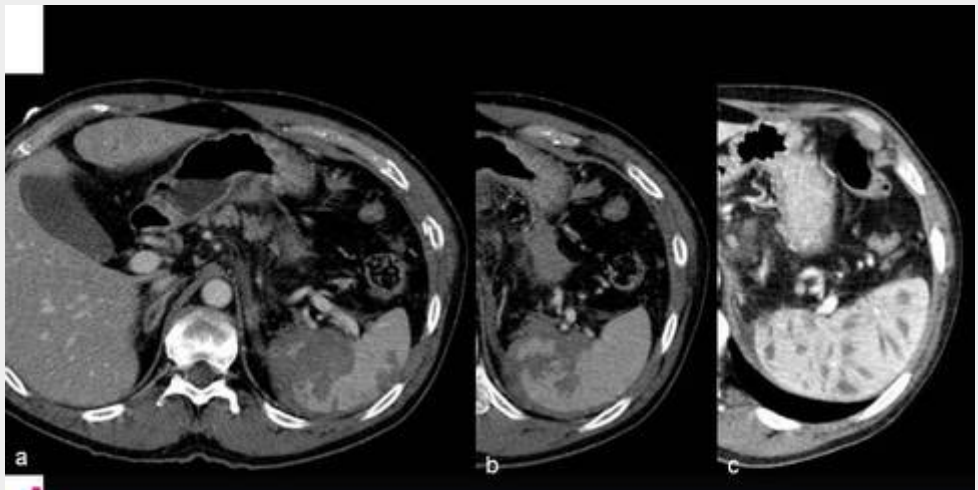

Splenic trauma. (a,b) Contrast-enhanced CT scans show traumatic splenic laceration with disruption of the capsule and small amount of perisplenic fluid. The patient was treated conservatively. The CT performed one month after, revealed remarkable improvement, showing only small hypoattenuating areas (c).

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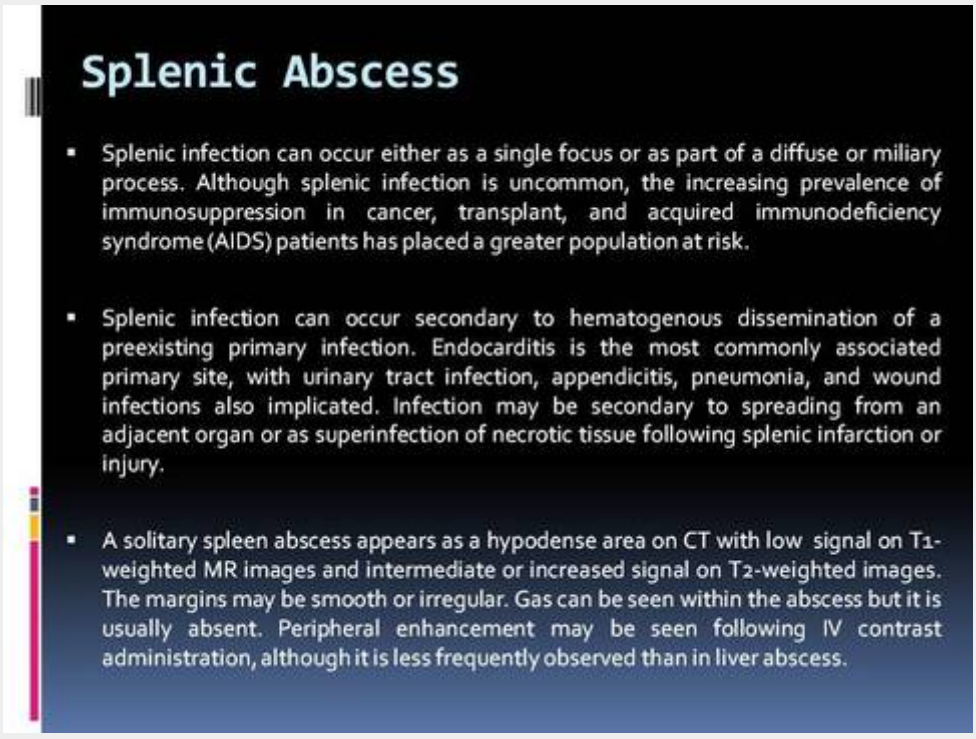

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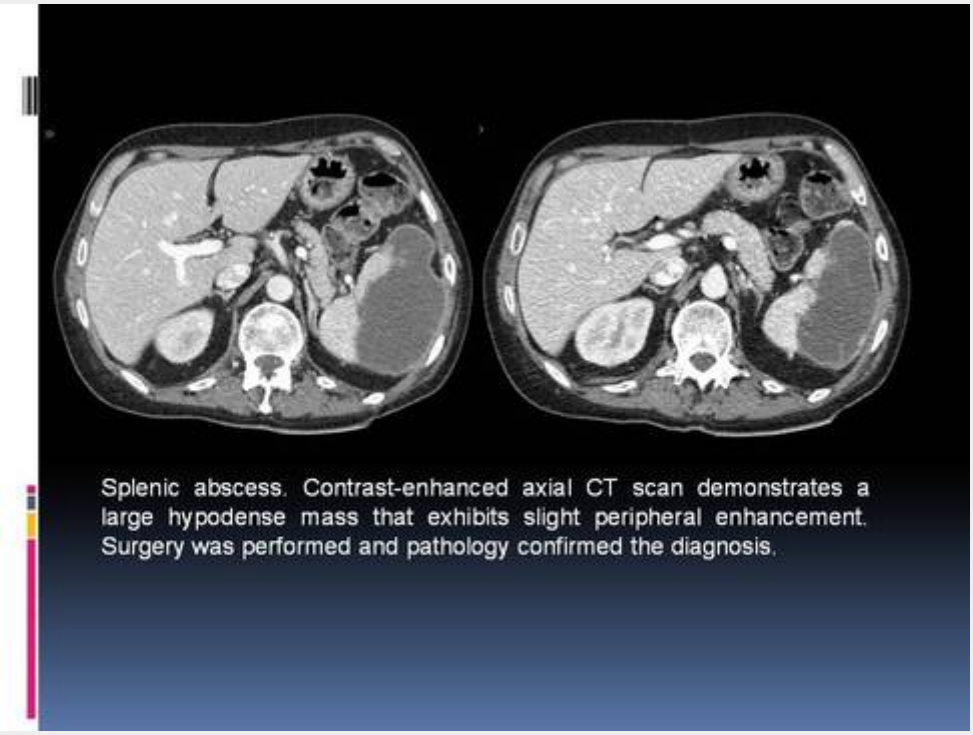

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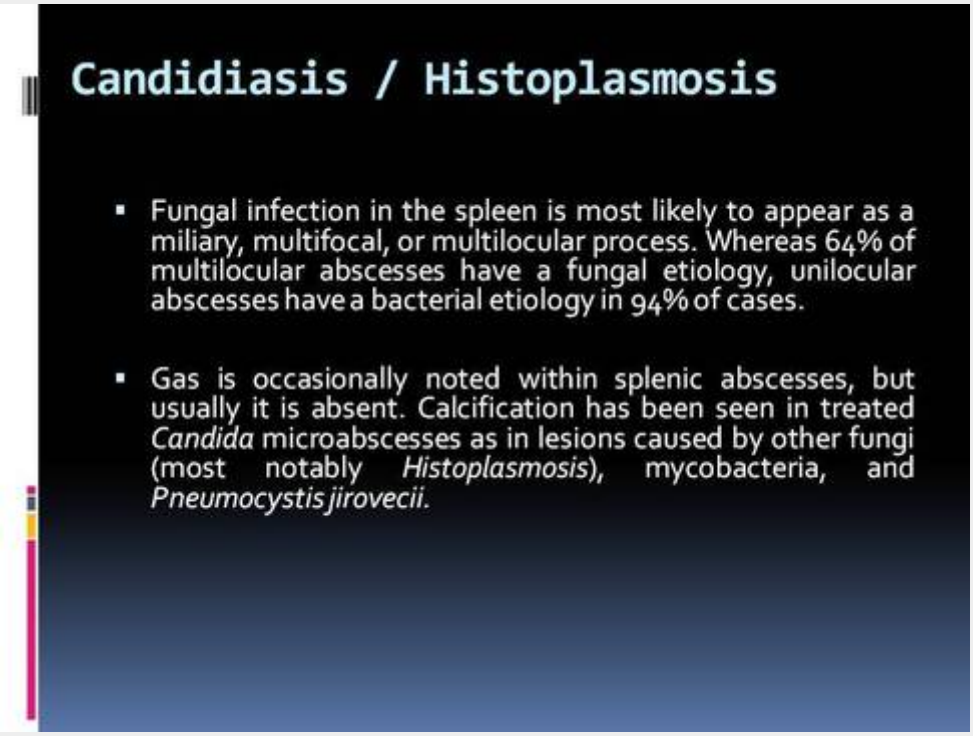

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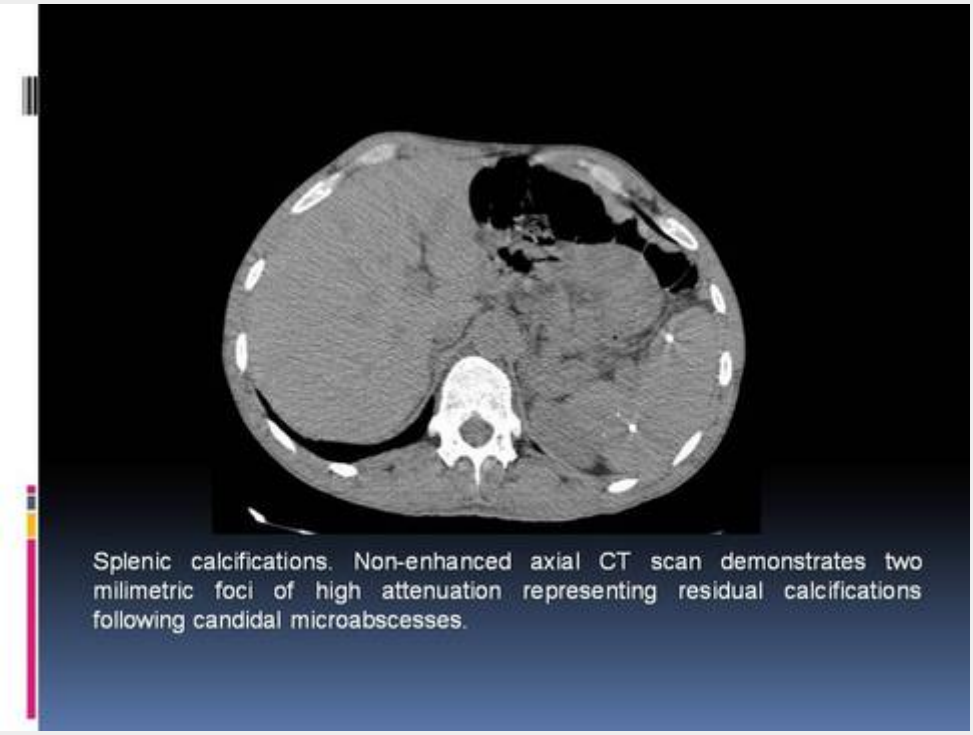

Splenic calcifications. Non-enhanced axial CT scan demonstrates two milimetric foci of high attenuation representing residual calcifications following candidal microabscesses.

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Sarcoidosis

- Sarcoidosis is a systemic disease of unknown cause, characterized by non-caseating granulomas with proliferation of epithelioid cells.
- Bilateral pulmonary hilar lymphadenopathy is the most common radiologic finding, frequently with associated parenchymal infiltrates.
- Splenic sarcoidosis usually is asymptomatic. However, with marked involvement, abdominal tenderness, fever, malaise, hyperesplenism, and even rupture may occur.
- At CT and MR imaging, splenic sarcoidosis may manifest with organomegaly. In only 5%-15% of patients, coalescing granulomas become apparent as multiple hypointense or hypoattenuating nodules. No peripheral enhancement is usually seen with sarcoid nodules.
- On MRI, splenic nodules are typically hypointense in all sequences and hypoenhancing relatively to normal spleen. Lesions are best visualized on T2-weighted fat-supressed or early T1-weighted gadolinium-enhanced images.

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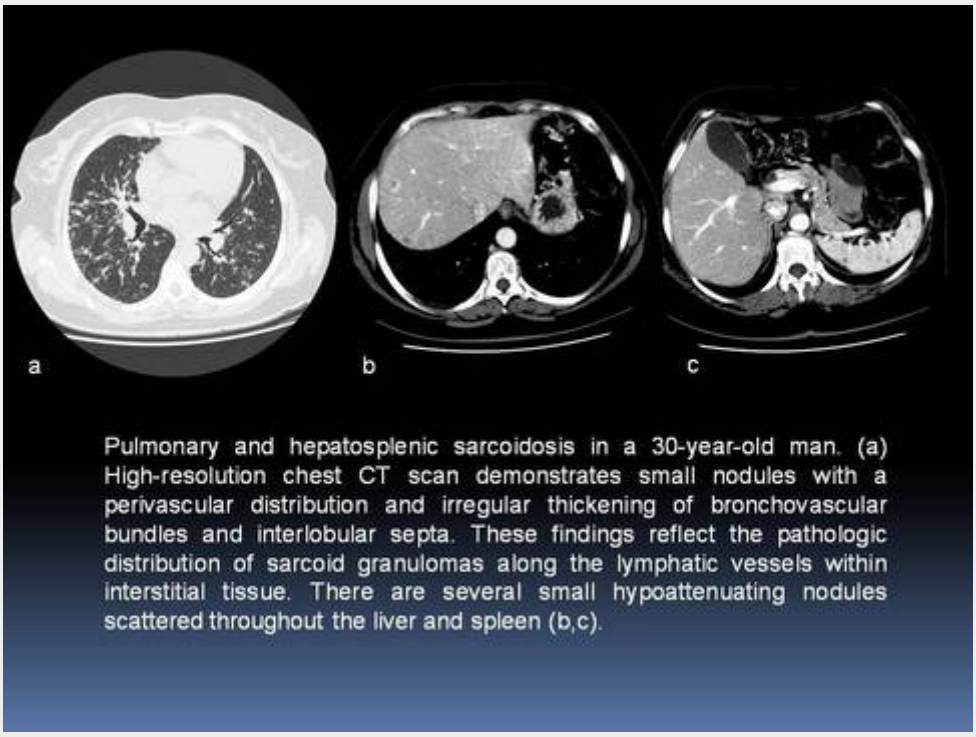

Pulmonary and hepatosplenic sarcoidosis in a 30-year-old man. (a) High-resolution chest CT scan demonstrates small nodules with a perivascular distribution and irregular thickening of bronchovascular bundles and interlobular septa. These findings reflect the pathologic distribution of sarcoid granulomas along the lymphatic vessels within interstitial tissue. There are several small hypoattenuating nodules scattered throughout the liver and spleen (b,c).

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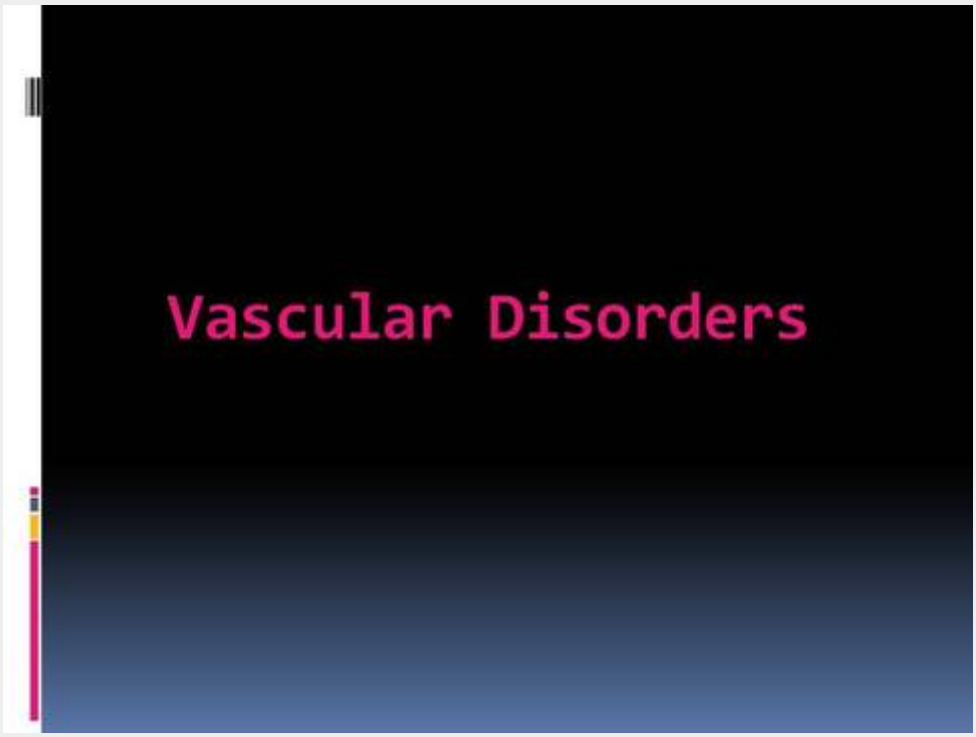

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Infarction

- Splenic arterial branches are end arteries that do not intercommunicate; therefore, occlusion leads to infarction.
- Causes of splenic artery occlusion include embolic disease (eg, cardiac emboli), atherosclerosis, arteritis, splenic artery aneurysm, sickle cell disease (thrombosis), splenic torsion, and mass lesions such as pancreatic carcinoma.
- On CT, infarcts classically appear as sharply marginated, low-density regions that are wedge-shaped, with the base at the splenic capsule, and the apex directed towards the hilum. Not uncommonly, however, infarcts appear as multiple, poorly marginated, hypodense lesions, indistinguishable from other forms of focal splenic pathology.
- Splenic infarction also can be seen in MRI. It exhibits decreased signal intensity on both T1- and T2-weighted MR images and does not enhance after injection of intravenous contrast material.

diapositivo27.jpg

Focal infarctions in two different patients. Contrast-enhanced axial CT scans shows non-enhancing wedge-shaped areas of infarction in the spleen. There is a pseudocyst secondary to pancreatitis anteriorly to the body and tail of pancreas (a).

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Splenic Artery Aneurysm

- Splenic artery aneurysm is the most common abdominal visceral artery aneurysm.
- Predisposing conditions include pregnancy and multiparity, systemic and portal hypertension, and atherosclerotic disease.
- Occasionally, a specific cause can be cited for the development of splenic artery pseudoaneurysms. Acute and chronic pancreatitis, penetrating gastric ulcer, trauma and septic emboli have all been implicated. Mycotic aneurysms involving the intrasplenic branches of the splenic artery have also been reported.
- On unenhanced CT, a low-density lesion with peripheral calcification is observed along the course of the splenic artery. When large, there may be significant areas of heterogeneous attenuation corresponding to clot and hemorrhage. On unenhanced MRI, heterogeneous signal can be observed on T1- and T2-weighted sequences, representing areas of clotting. Following IV administration of contrast material, on both MRI and CT, bright enhancement is observed unless the lesion is thrombosed.

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Splenic artery aneurysm. Contrast-enhanced MDCT images, with VR and MIP reformations, show aneurysmal dilatation of the distal end of the splenic artery.

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Splenic Vein Thrombosis

- Splenic vein thrombosis has multiple causes but it is most commonly secondary to pancreatitis. It may result in gastric varices and at times either esophageal or colonic varices.
- Splenic vein thrombosis is usually recognized as an intraluminal filling defect after intravenous contrast material administration.

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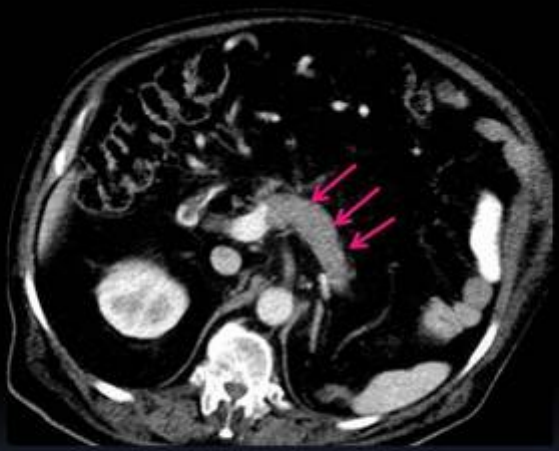

Acute occlusion of the splenic vein. Marked enlargement and absent enhancement of splenic vein (arrows), corresponding to acute thrombosis.

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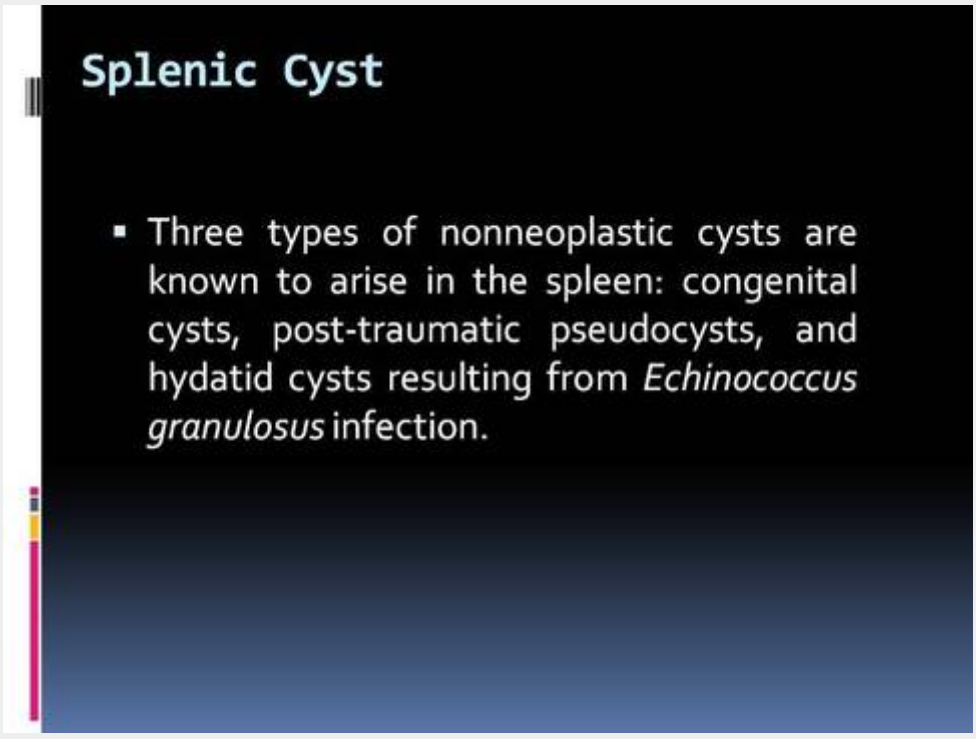

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Echinococcal cysts

- Splenic involvement with *Echinococcus granulosus* is unusual, occurring in only 1 to 3% of cases.
- At histology, the cyst wall is composed of an inner germinal layer with an outer acellular laminated membrane, all surrounded by the host reaction comprising variable amounts of fibrosis and inflammatory tissue (pericyst layer). Daughter cysts are formed off of the germinal layer.
- Echinococcal cysts appear as well-circunscribed low-density lesions. On MRI the cysts are hyperintense on T2-weighted images. Lesions are often large and can be unilocular or contain daughter cysts distributed either peripherally or throughout the lesions giving them a multilocular appearance. Daughter cysts are typically slightly less dense on CT and hypointense on T1-weighted images relative to fluid in the parent cyst. Cyst wall calcification is frequently seen, and, when extensive, suggests that the cyst is inactive. Typically, no enhancement is noted following IV contrast administration.

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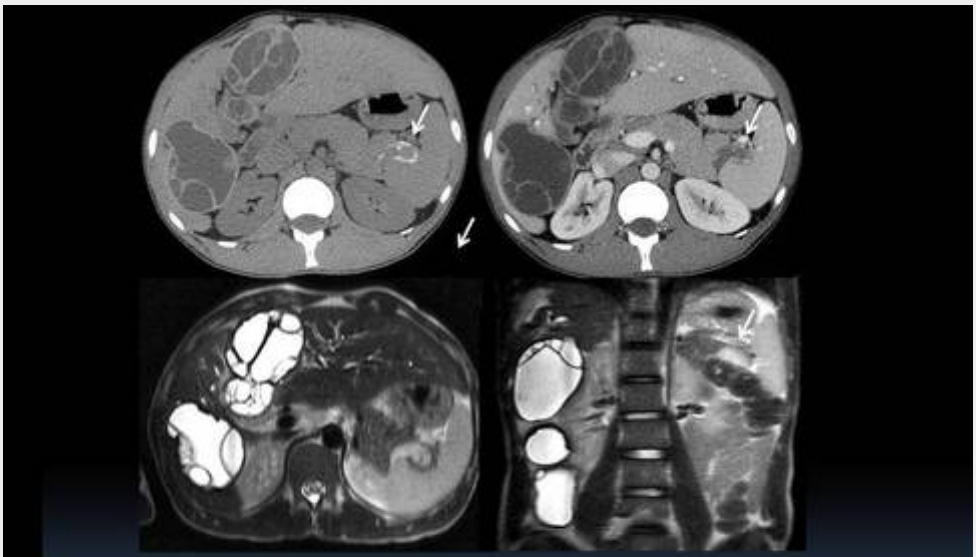

Disseminated hydatid disease in 27-year-old man. Pre and post-contrast CT, and axial and coronal T2-weighted MR images, show large intraperitoneal and hepatic multiloculated cysts containing multiple daughter cysts. There is also a lesion near the splenic hilum with peripheral calcifications, moderately hyperintense on T2-weighted images.

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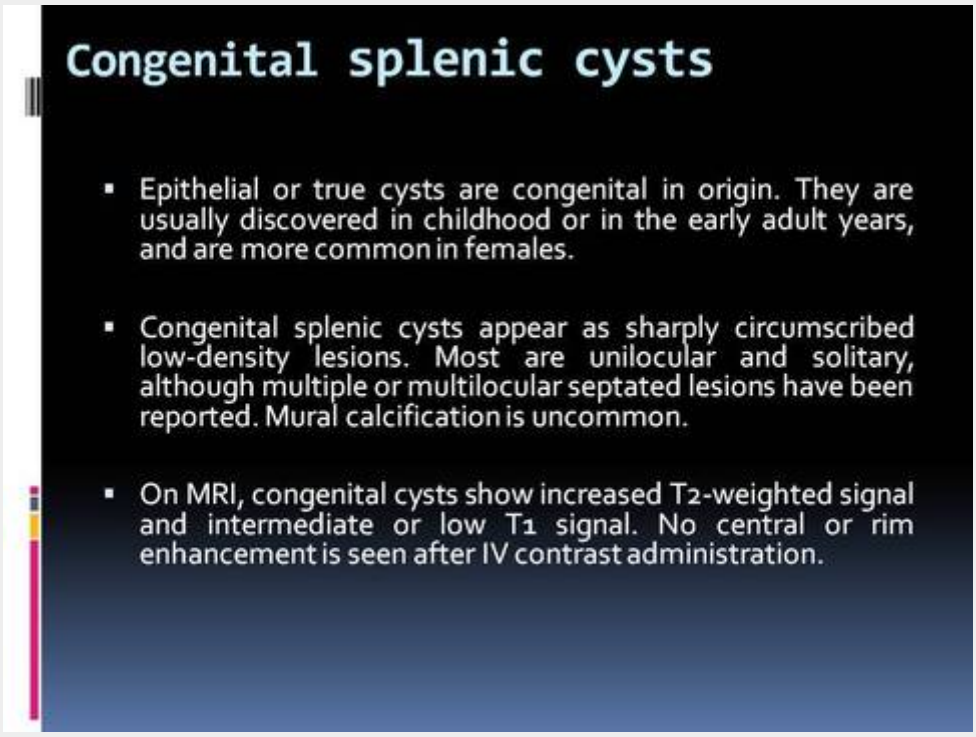

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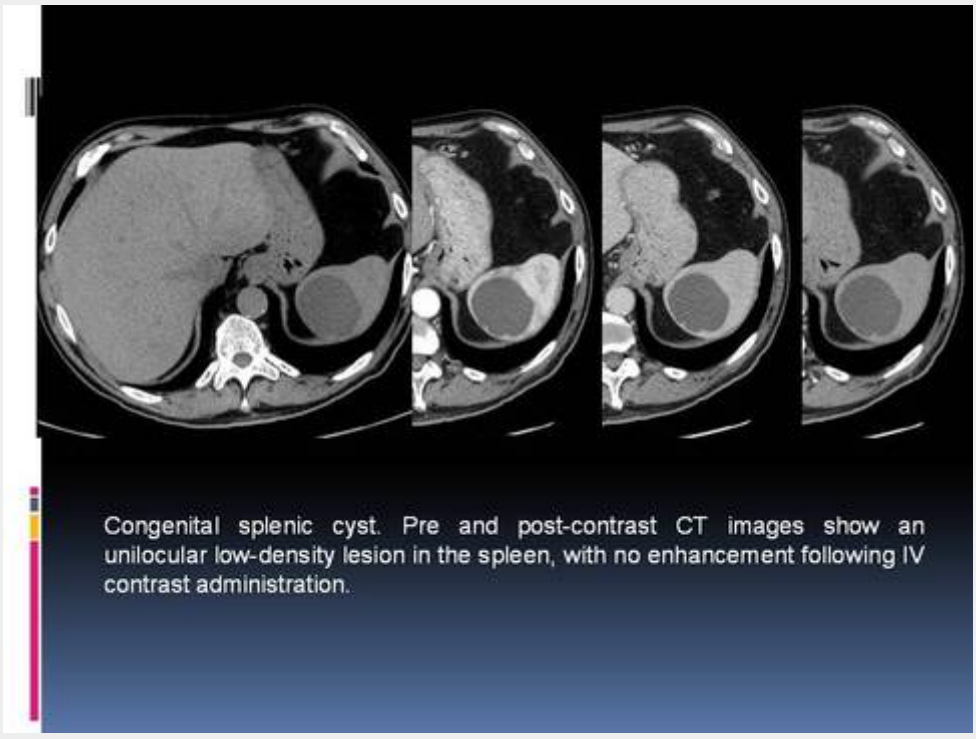

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Post-traumatic pseudocysts

- Post-traumatic pseudocysts are thought to represent the final stage in evolution of a splenic hematoma, although some have suggested that acute necrosis secondary to infarction or infection may also lead to pseudocysts. The wall is composed of dense fibrous tissue and lacks a true cellular lining.
- On CT, post-traumatic cysts appear as sharply demarcated, unilocular, low-density regions. No peripheral enhancement is evident. Peripheral septation or cyst wall trabeculation is more common in congenital cysts. Mural calcification, however, is more common in cysts of traumatic etiology.

diapositivo39.jpg

Post-traumatic cyst. Post-contrast CT image shows an unilocular lobulated low-density lesion in the spleen, with no enhancement following IV contrast administration, in a patient with history of previous trauma.

diapositivo40.jpg

Hemangioma

- Although rare, hemangioma is the most common primary neoplasm of the spleen. Pathologically, the lesion is similar to hemangiomas in other organs.
- Most commonly, it is a single asymptomatic lesion unless splenomegaly or rupture develops. Anemia, thrombocytopenia, and coagulopathy (Kasabach-Merrit syndrome) have been reported with large hemangiomas. Splenic hemangiomas may also be multiple and part of a generalized angiomatosis, as in Kippel-Trenaunay-Weber syndrome.
- The imaging findings of splenic hemangiomas are similar to those of the liver. On unenhanced CT, they appear as a well-defined hypodense masses that may contain cystic components. With contrast administration, most enhance from the periphery with gradual fill-in and persistence of contrast enhancement on delayed images. Some lesions, however, may remain hypodense, show diffuse enhancement , or show discrete mottled areas of density. Calcification can occur as scattered, punctate, curvilinear densities, or as dense rays radiating from a central point.
- On MR, these lesions are hypointense to the spleen on T_1-weighted images and hyperintense on T_2-weighted images. Heterogeneous signal is sometimes noted on T_2-weighted images, reflecting the presence of cystic and solid components with various amounts of fibrosis, necrosis, and hemorrhage. Injection of IV Gd-DTPA causes enhancement similar to that observed with iodinated contrast material on CT.

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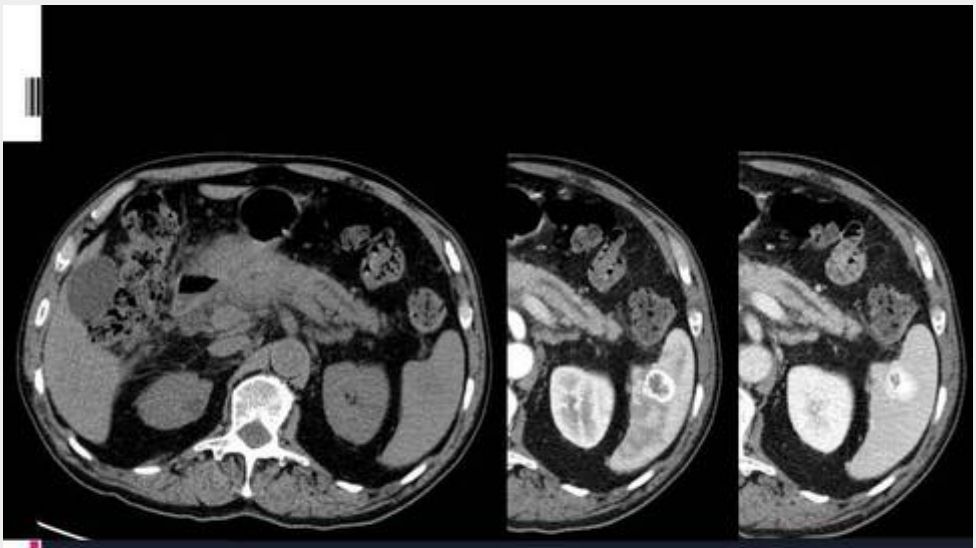

Hemangioma. Pre and post-contrast CT images show the typical CT features of a splenic hemangioma.

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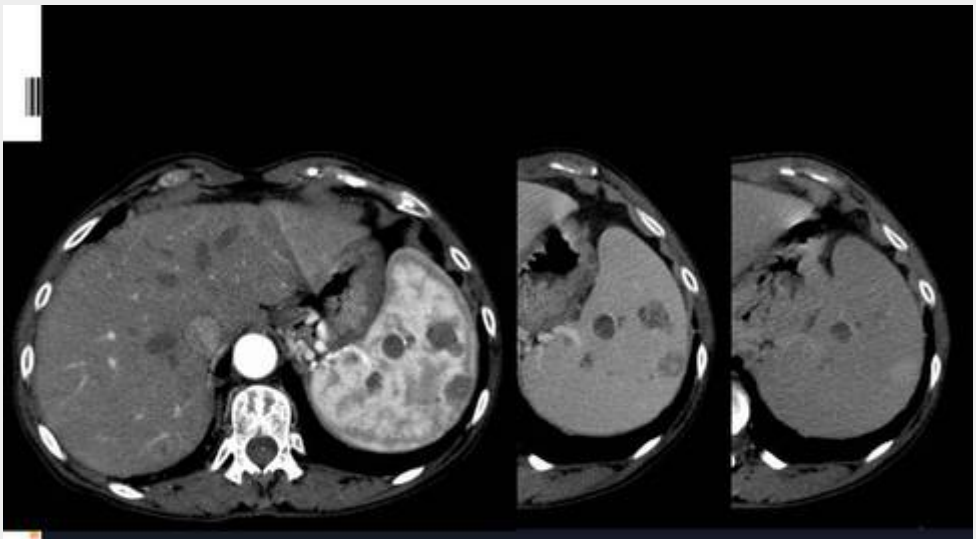

Splenic hemangiomatosis. Post contrast CT images show several hypodense focal lesions, that enhance from the periphery with gradual filling and persistence of contrast enhancement on delayed images.

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Hamartoma

- Hamartomas are rare benign asymptomatic lesions, composed of a mixture of normal splenic structures such as white and red pulp.
- Splenic hamartomas are usually solitary and may be solid or cystic. The solid lesion may reveal a nearly equal attenuation to that of spleen on contrast-enhanced CT scans.
- On CT, they appear as well-circunscribed, iso- to hypodense masses on pre-contrast images, with occasional lesions showing cystic components. Calcification can be observed. They usually show slow enhancement and fill in after IV administration of contrast material. Prolonged enhancement similar to that seen with hemangiomas is often noted and can help to differentiate hamartomas from lymphoma.
- On unenhanced MR images, the lesions are usually isointense on T1-weighted images and heterogeneously hyperintense on T2-weighted images relative to the spleen. Slow, diffuse, heterogeneous enhancement is noted following gadolinium injection. On delayed images, more uniform and persistent enhancement is seen, often greater than that of the normal spleen.

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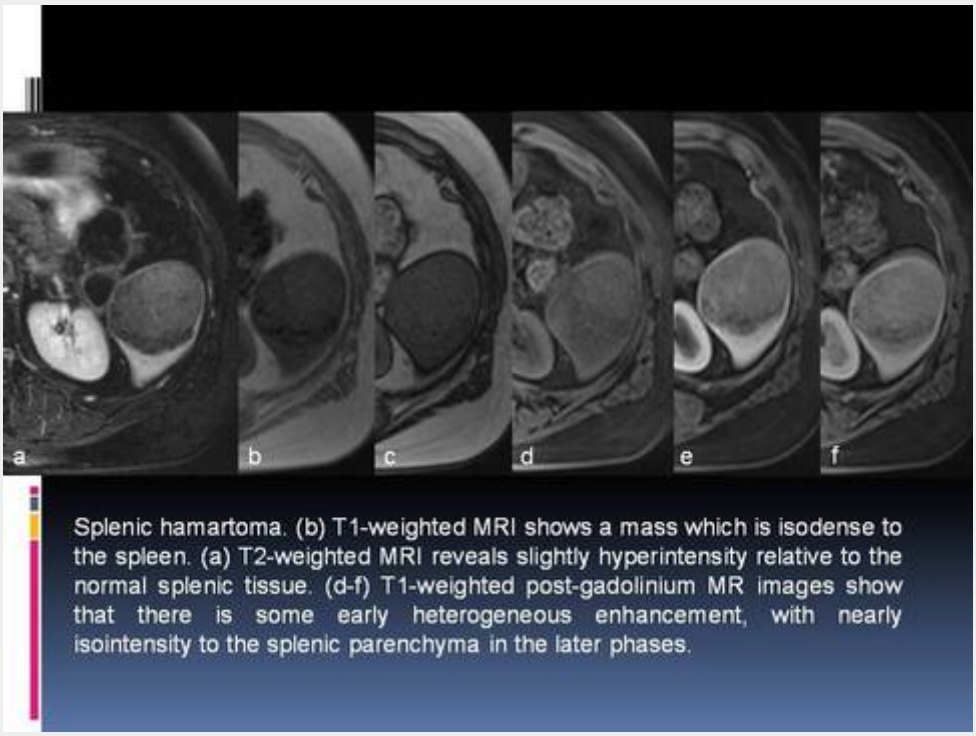

Splenic hamartoma. (b) T1-weighted MRI shows a mass which is isodense to the spleen. (a) T2-weighted MRI reveals slightly hyperintensity relative to the normal splenic tissue. (d-f) T1-weighted post-gadolinium MR images show that there is some early heterogeneous enhancement, with nearly isointensity to the splenic parenchyma in the later phases.

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Malignant Neoplasms

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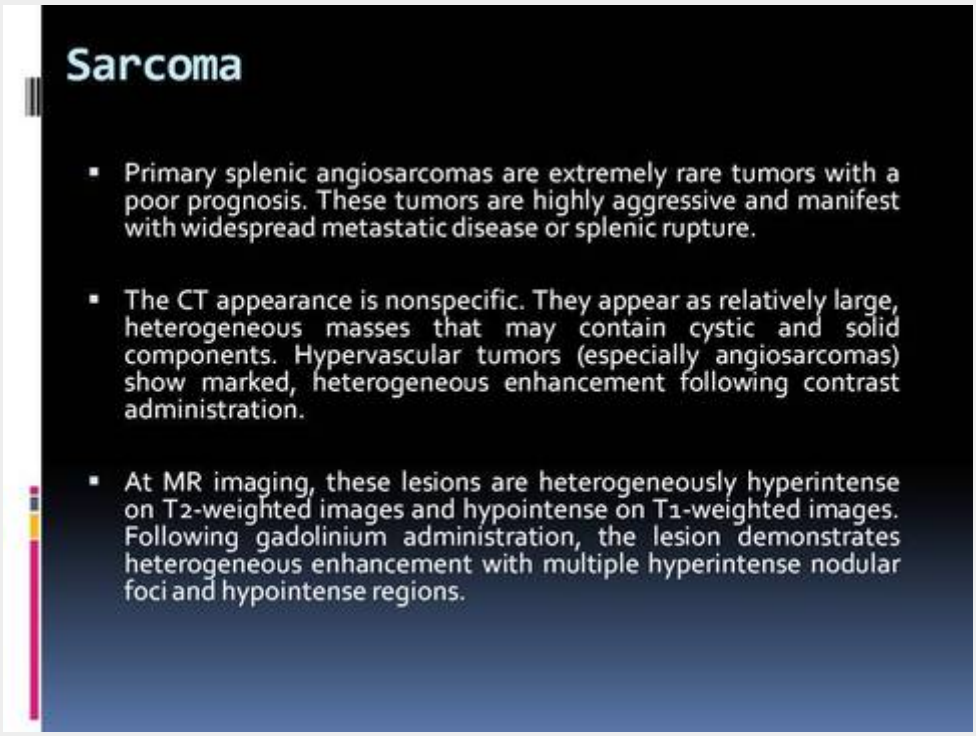

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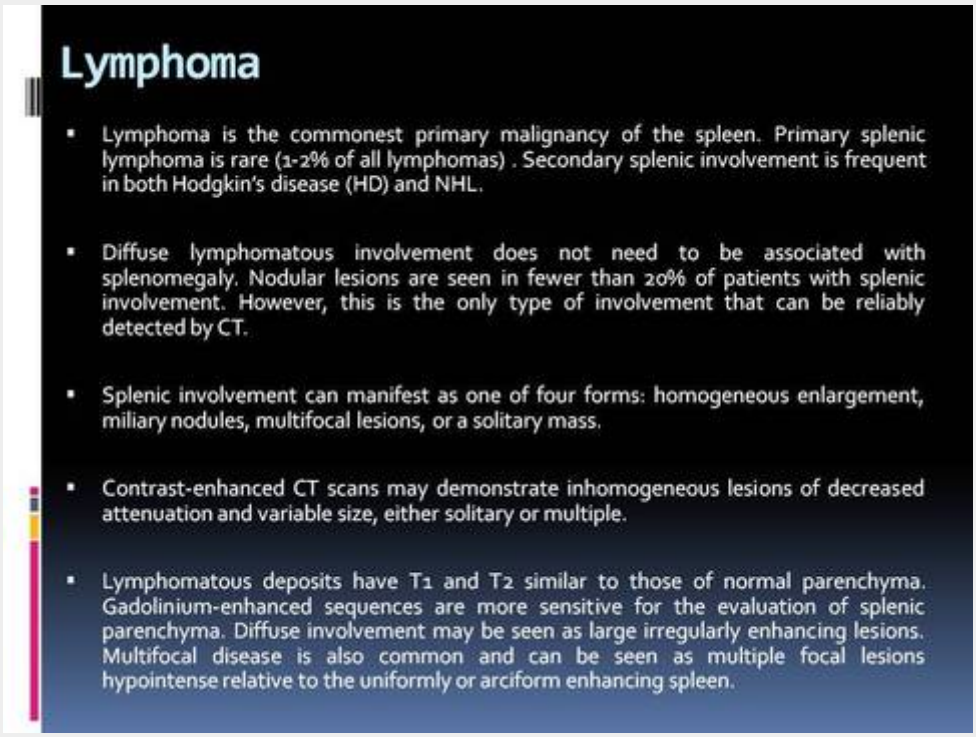

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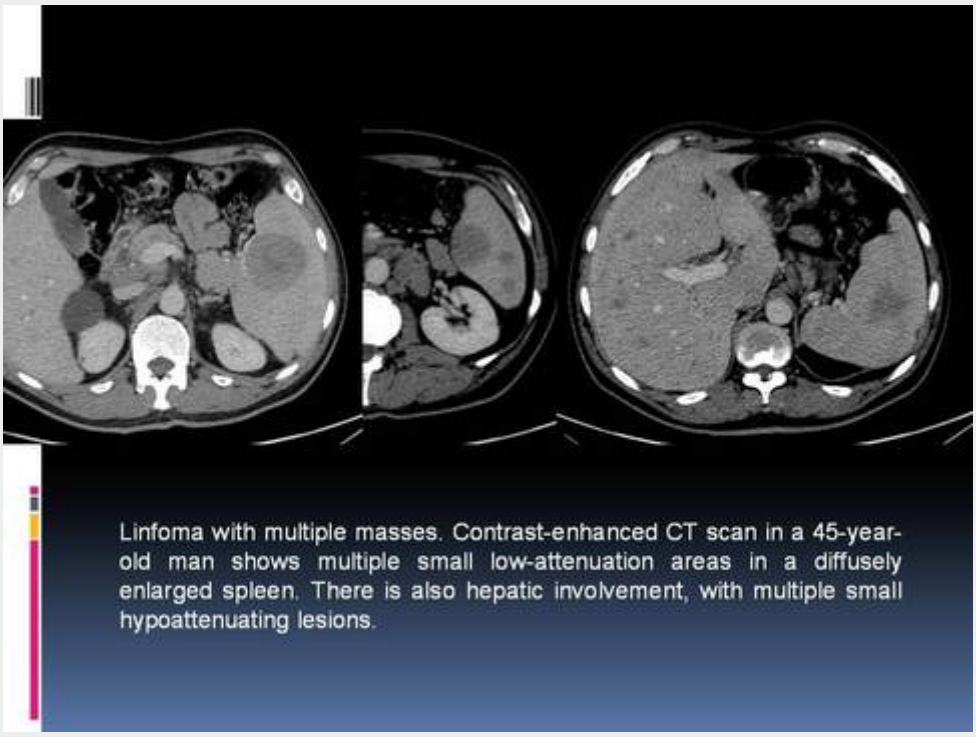

Linfoma with multiple masses. Contrast-enhanced CT scan in a 45-year-old man shows multiple small low-attenuation areas in a diffusely enlarged spleen. There is also hepatic involvement, with multiple small hypoattenuating lesions.

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Metastasis

- Splenic metastasis are relatively uncommon, despite its large mass of lymphoid tissue and its role in the filtration of systemic blood.
- CT demonstrates splenic metastases as ill-defined hypoattenuating areas or well-defined cystic lesions that may be unilocular or septated.
- At MR imaging, metastasis typically appear as hyperintense masses on T_2-weighted images and hypo- to isointense lesions on T_1-weighted images. The degree and characteristics of enhancement depend on the nature and type of the underlying primary neoplasm.

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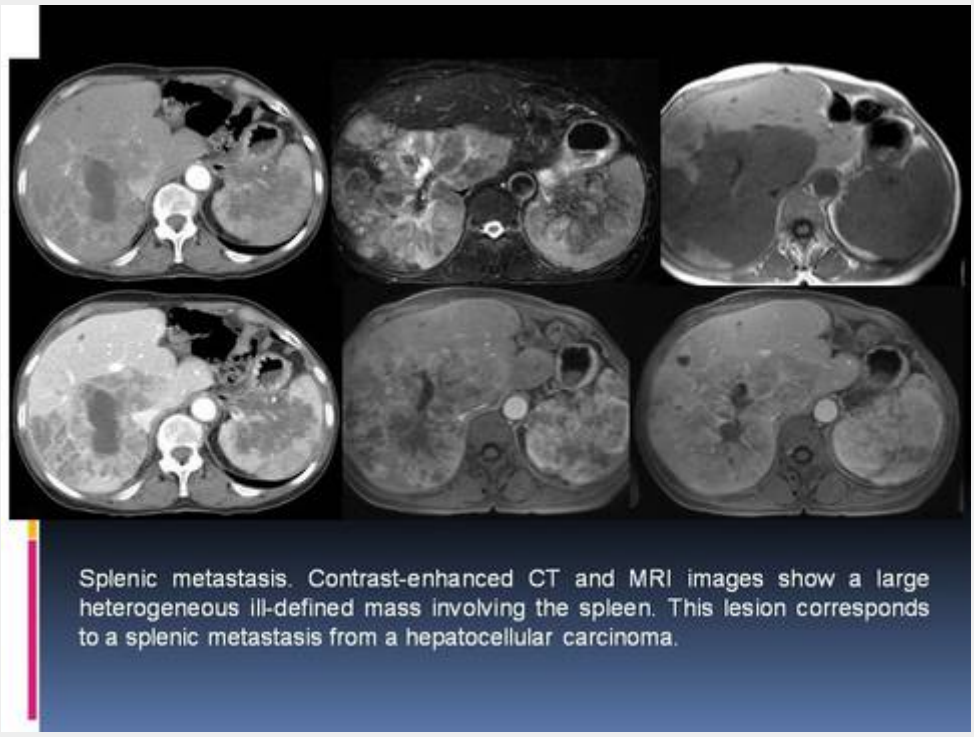

Splenic metastasis. Contrast-enhanced CT and MRI images show a large heterogeneous ill-defined mass involving the spleen. This lesion corresponds to a splenic metastasis from a hepatocellular carcinoma.

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diapositivo52.jpg

Portal Hypertension

- Portal hypertension is a frequent cause of splenomegaly. Associated CT findings include a lobulated, dismorphic liver with a proeminent caudate lobe, ascites, and collateral vessels. The presence of gastroesophageal varices and perisplenic collateral vessels is best demonstrated with dynamic CT tecniques.
- Foci of hemosiderin deposition are seen about 9%-12% of patients with portal hypertension. These foci are called *Gamna-Gandy bodies*. They are typically not seen on CT but are well depicted on MRI due to the paramagnetic properties of the deposited iron. They appear on all pulse sequences as small foci of signal void scattered throughout the spleen. They range in size from a few milimeters up to 1cm in diameter.

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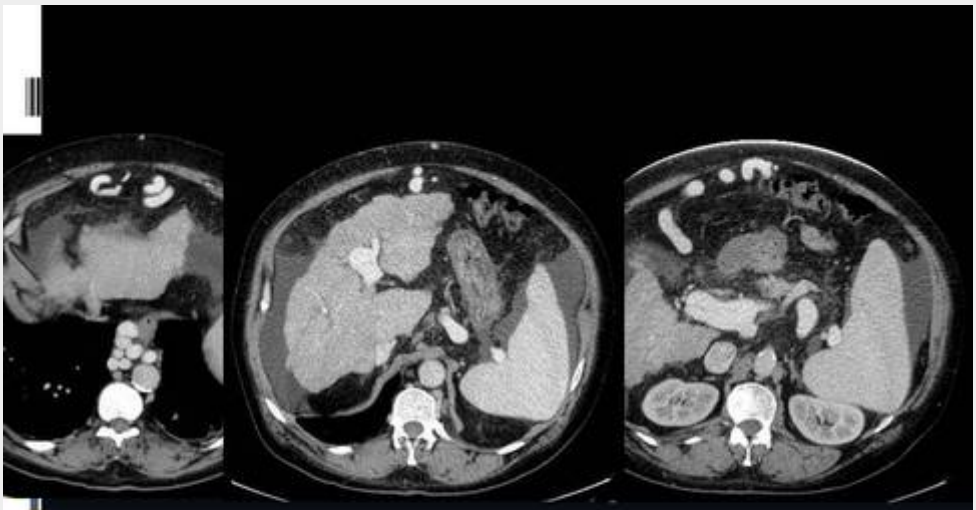

Splenomegaly in a 45-year-old man with portal hypertension. Contrast-enhanced CT images show splenomegaly and cirrhotic liver, with several collateral vessels (splenic, esophageal and periumbilical varices) and ascites.

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Gamna-Gandy bodies. T1-weighted and T1-weighted fat supressed postgadolinium MR images show multiple areas of signal void throughout the splenic parenchyma in this patient with cirrhosis.

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Splenomegaly in a patient with Non-Hodgkin Limphoma. Note the presence of adenopathy near the gastro-hepatic ligament. There is an accessory spleen in the splenic hilum.

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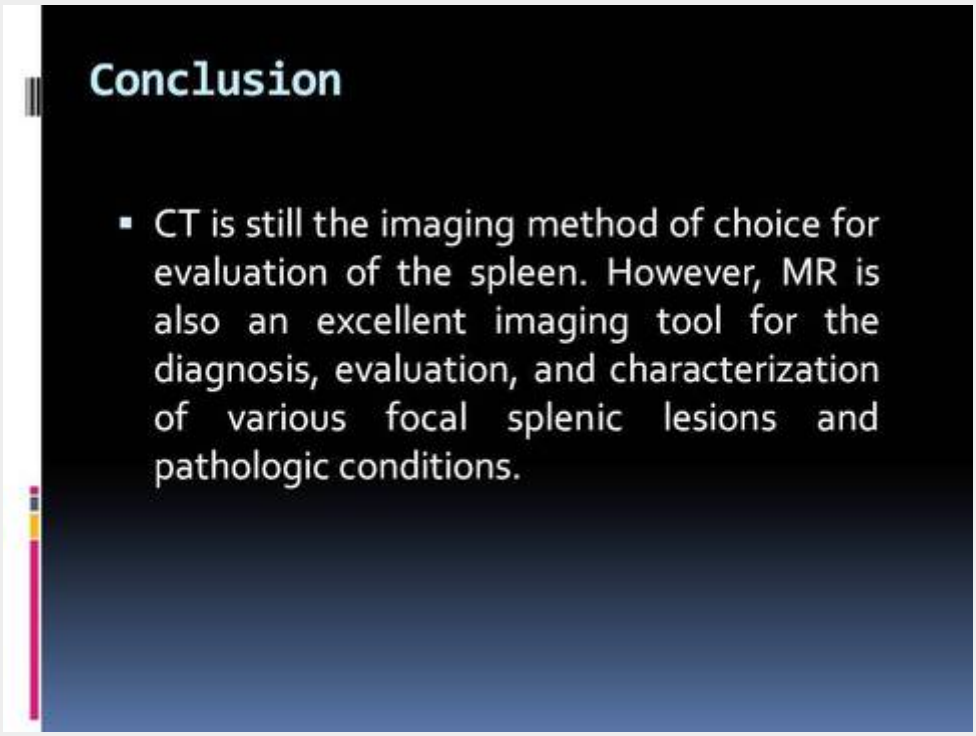

4. Conclusion

CT is still the imaging method of choice for evaluation of the spleen. However, MR is also an excellent imaging tool for the diagnosis, evaluation, and characterization of various focal splenic lesions and pathologic conditions.

5. Author Information

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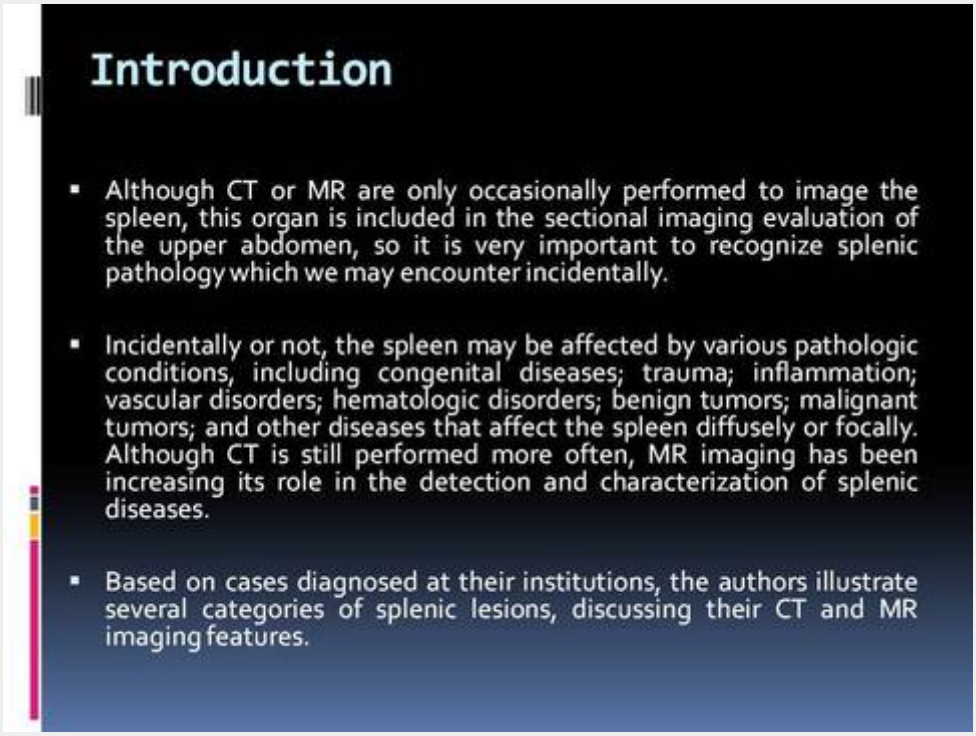
6. Mediafiles

diapositivo1.jpg

diapositivo2.jpg



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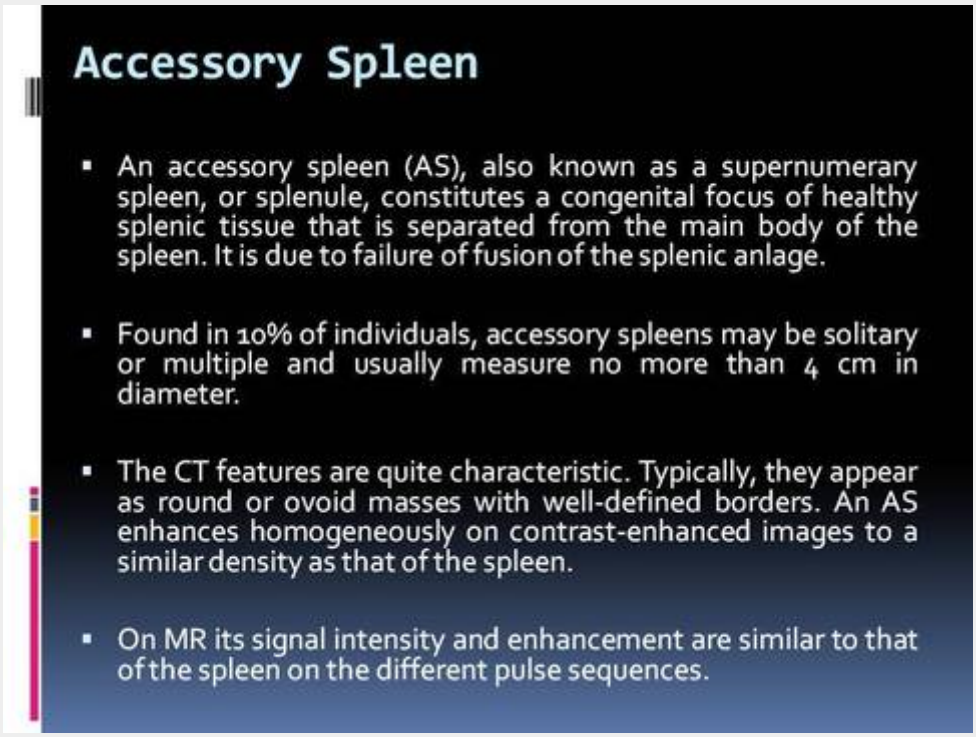

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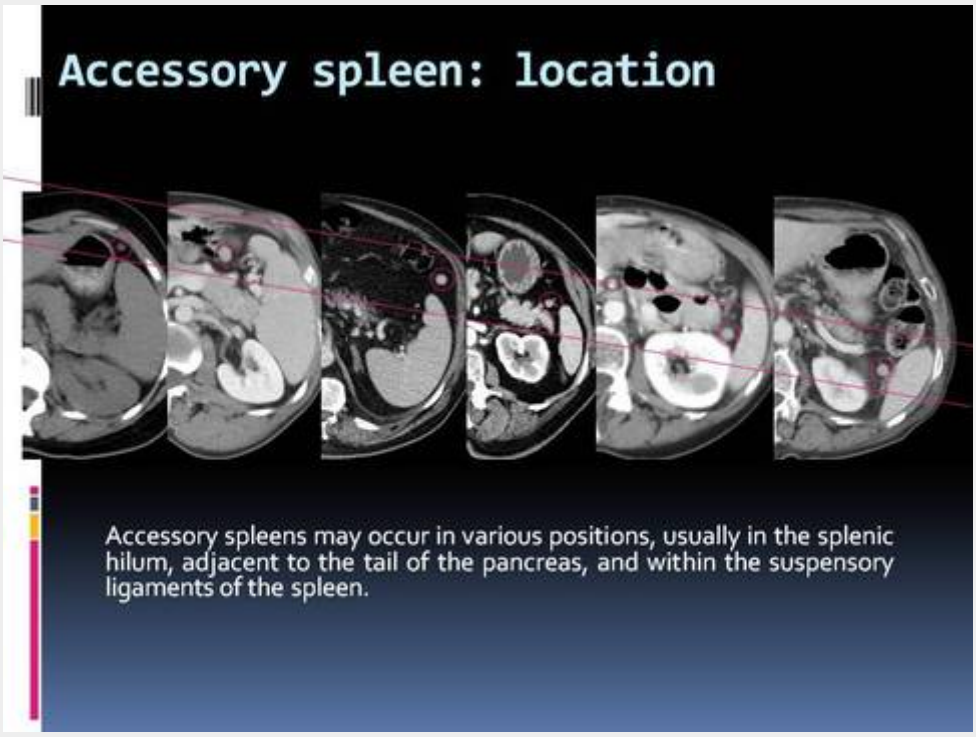

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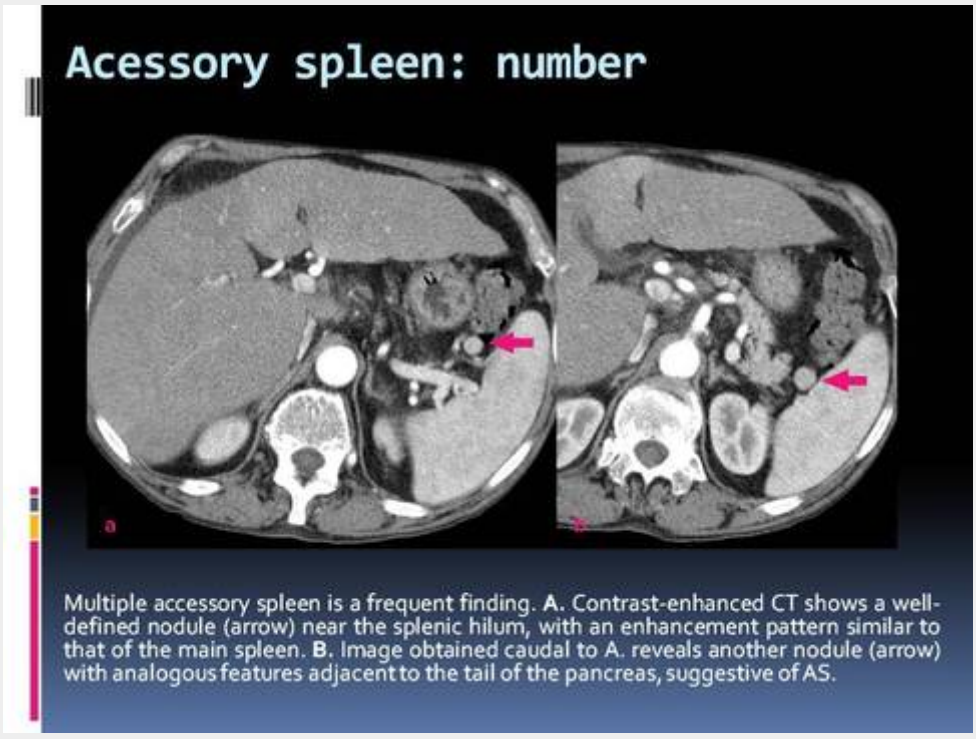

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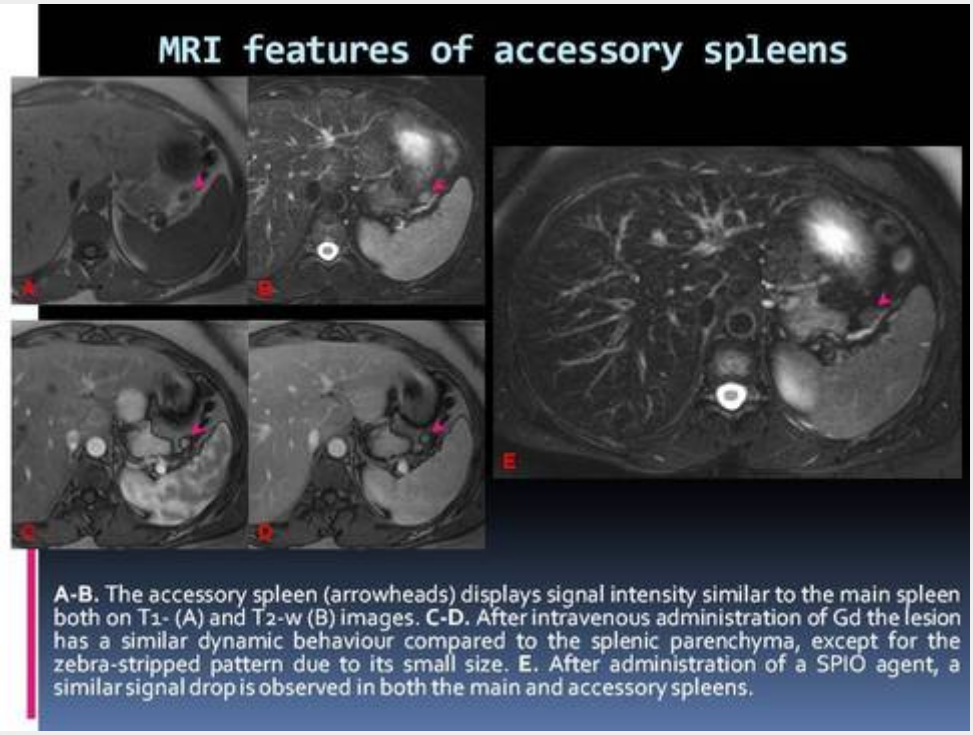

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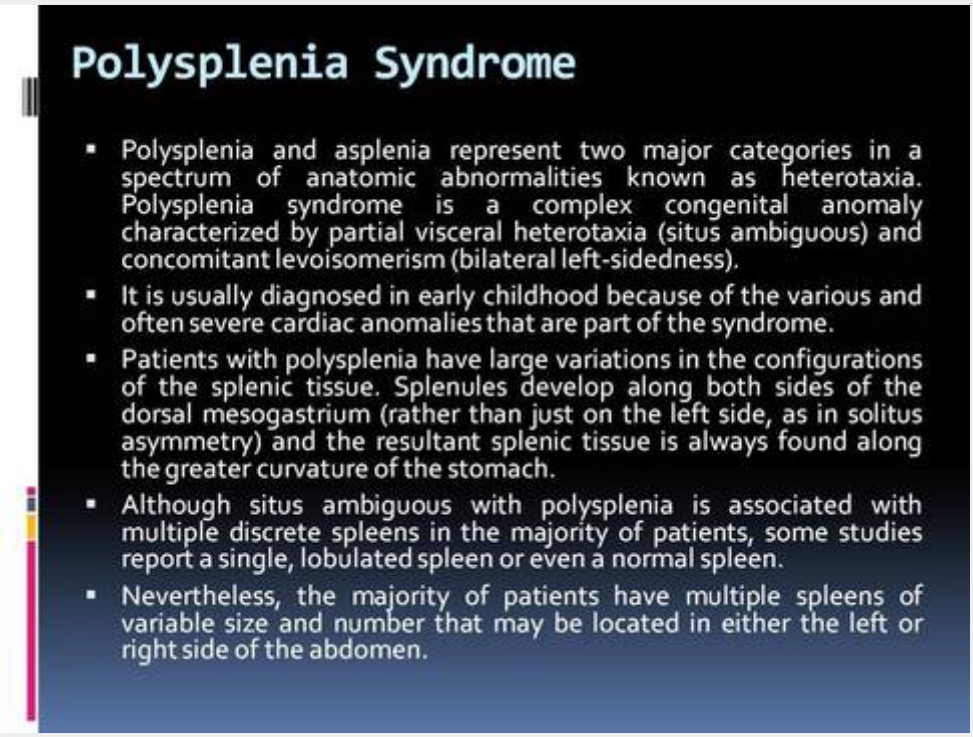

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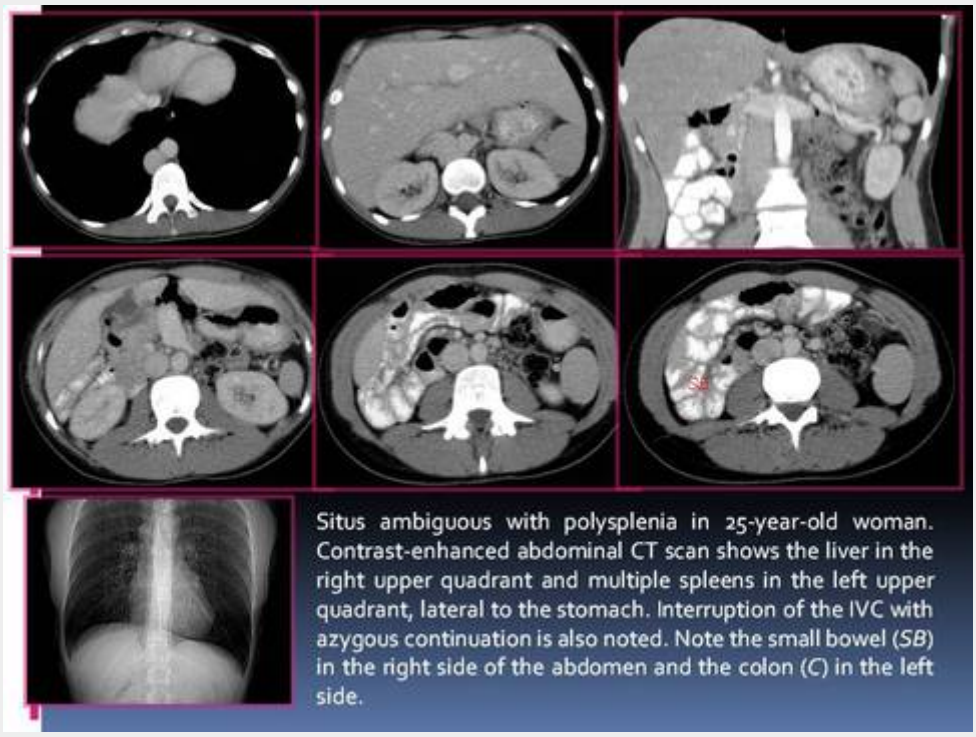
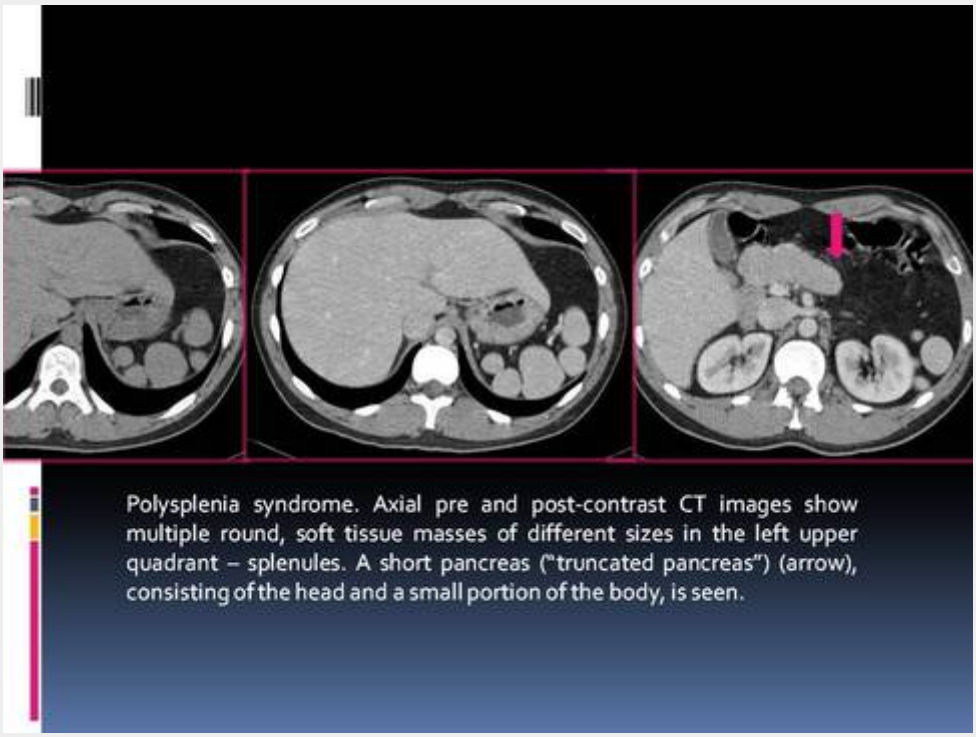


Situs ambiguous with polysplenia in 25-year-old woman. Contrast-enhanced abdominal CT scan shows the liver in the right upper quadrant and multiple spleens in the left upper quadrant, lateral to the stomach. Interruption of the IVC with azygous continuation is also noted. Note the small bowel (*SB*) in the right side of the abdomen and the colon (*C*) in the left side.

diapositivo10.jpg



Polysplenia syndrome. Axial pre and post-contrast CT images show multiple round, soft tissue masses of different sizes in the left upper quadrant – splenules. A short pancreas ("truncated pancreas") (arrow), consisting of the head and a small portion of the body, is seen.

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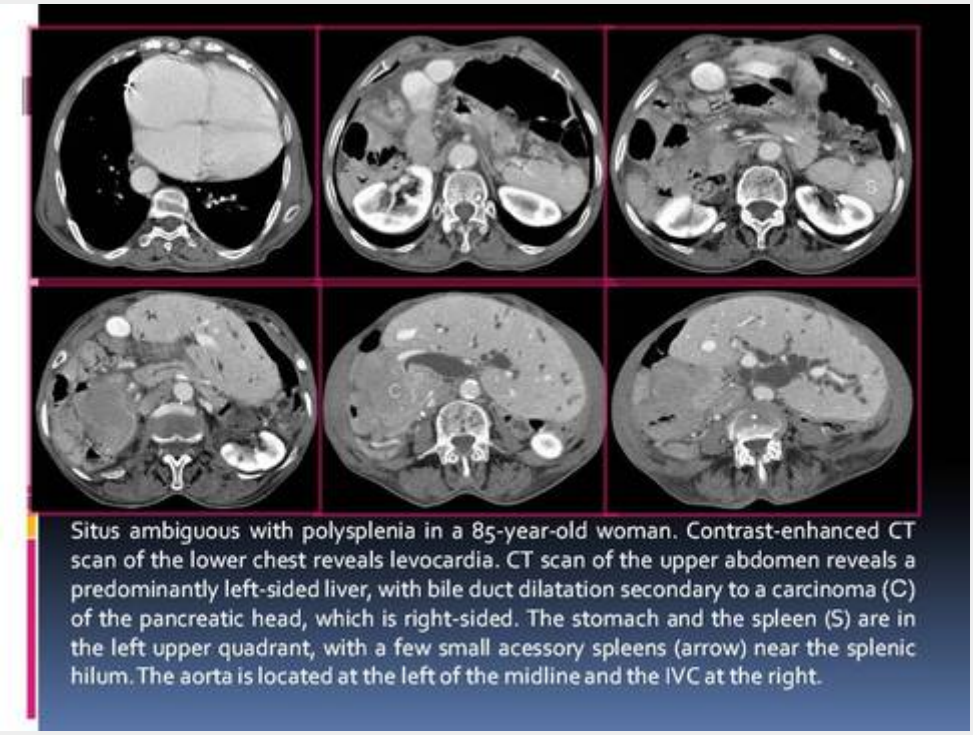


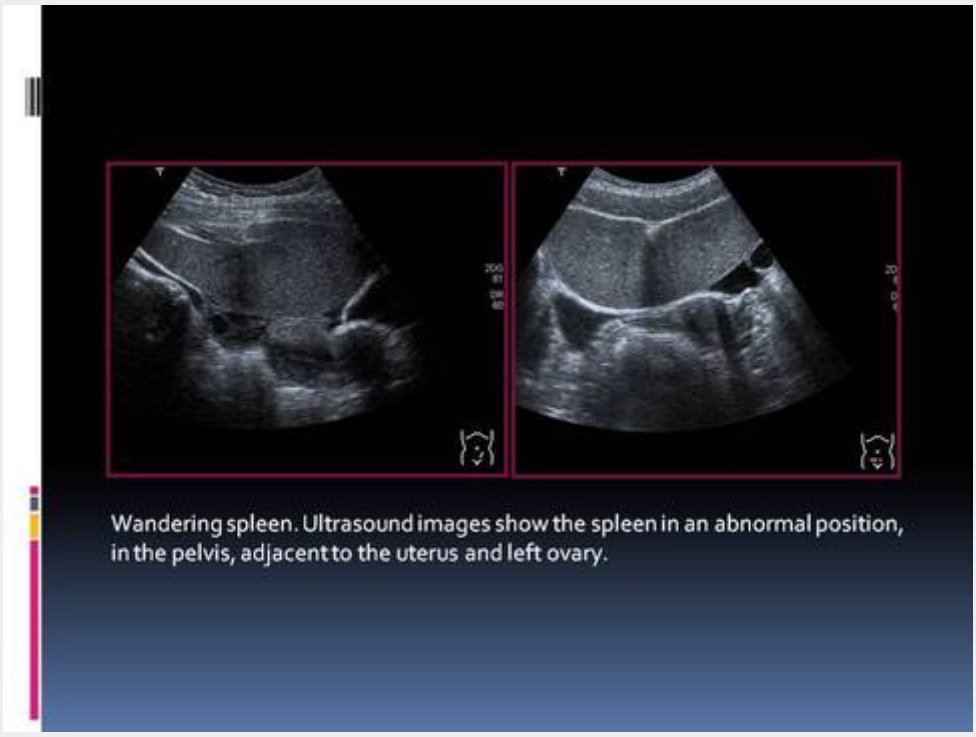
Situs ambiguous with polysplenia in a 85-year-old woman. Contrast-enhanced CT scan of the lower chest reveals levocardia. CT scan of the upper abdomen reveals a predominantly left-sided liver, with bile duct dilatation secondary to a carcinoma (C) of the pancreatic head, which is right-sided. The stomach and the spleen (S) are in the left upper quadrant, with a few small acessory spleens (arrow) near the splenic hilum. The aorta is located at the left of the midline and the IVC at the right.

diapositivo12.jpg

Wandering spleen

- Wandering or ectopic spleen refers to migration of the spleen from its normally fixed location in the left upper quadrant. Absence or laxity of the splenic suspensory ligaments results in increased splenic mobility thereby allowing it to rotate axially on its long pedicle.
- This anomaly is quite rare, with a reported incidence in several large series of splenectomies of less than 0.5%. Wandering spleens are mainly found in children and in women aged 20–40 years.
- The wandering spleen may be incidentally detected as an abdominal or pelvic mass. CT findings of a wandering spleen are absence of the spleen in its normal position with a location somewhere else in the abdomen or pelvis.
- The major complication of a wandering spleen is acute, chronic or intermittent torsion caused by its increased mobility. Early recognition of the condition and timely surgical intervention are highlighted to prevent complications.

diapositivo13.jpg



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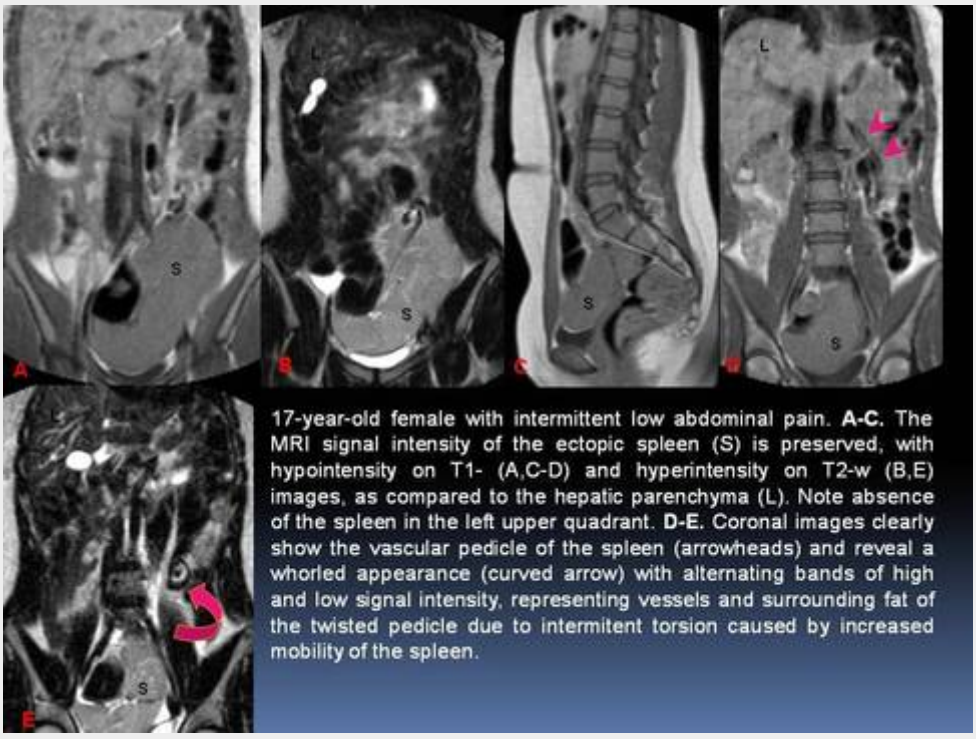

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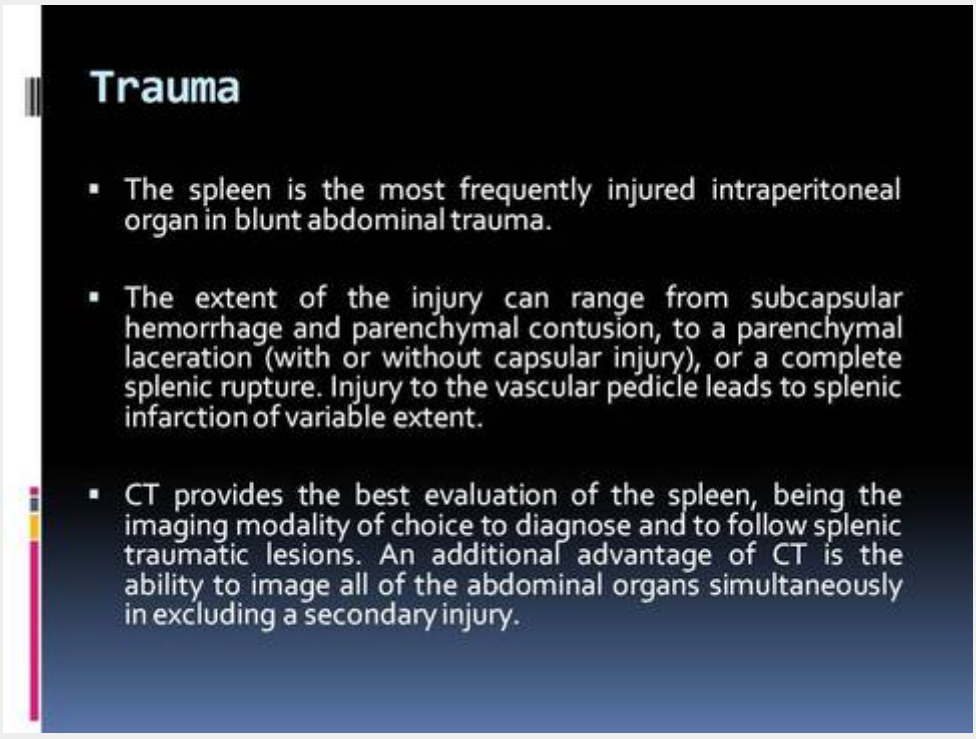

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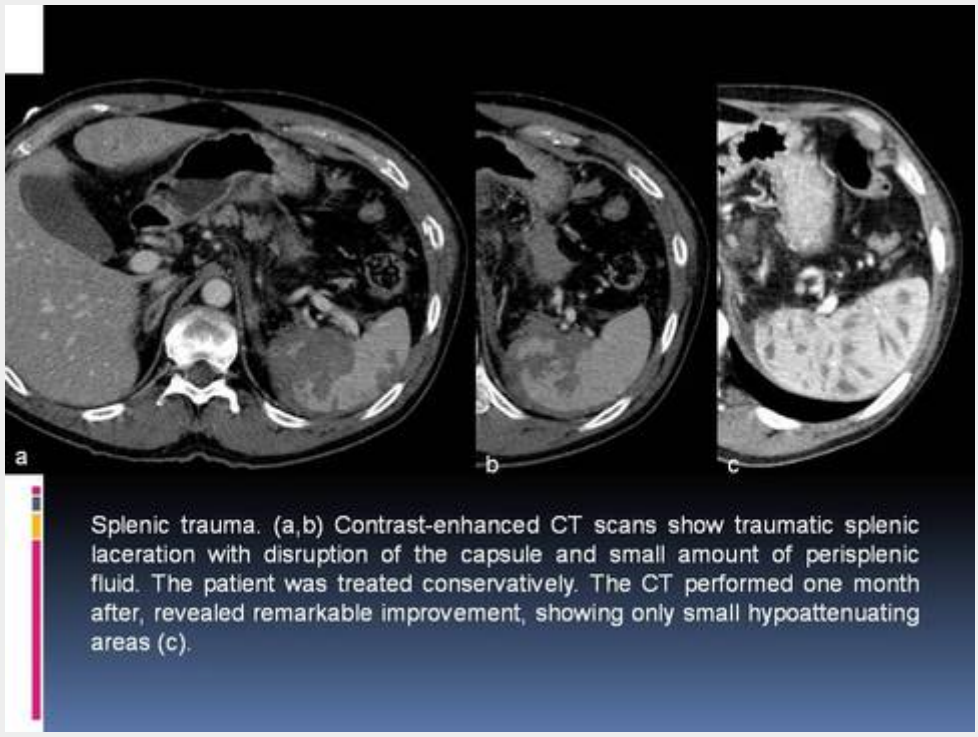


Splenic trauma. (a,b) Contrast-enhanced CT scans show traumatic splenic laceration with disruption of the capsule and small amount of perisplenic fluid. The patient was treated conservatively. The CT performed one month after, revealed remarkable improvement, showing only small hypoattenuating areas (c).

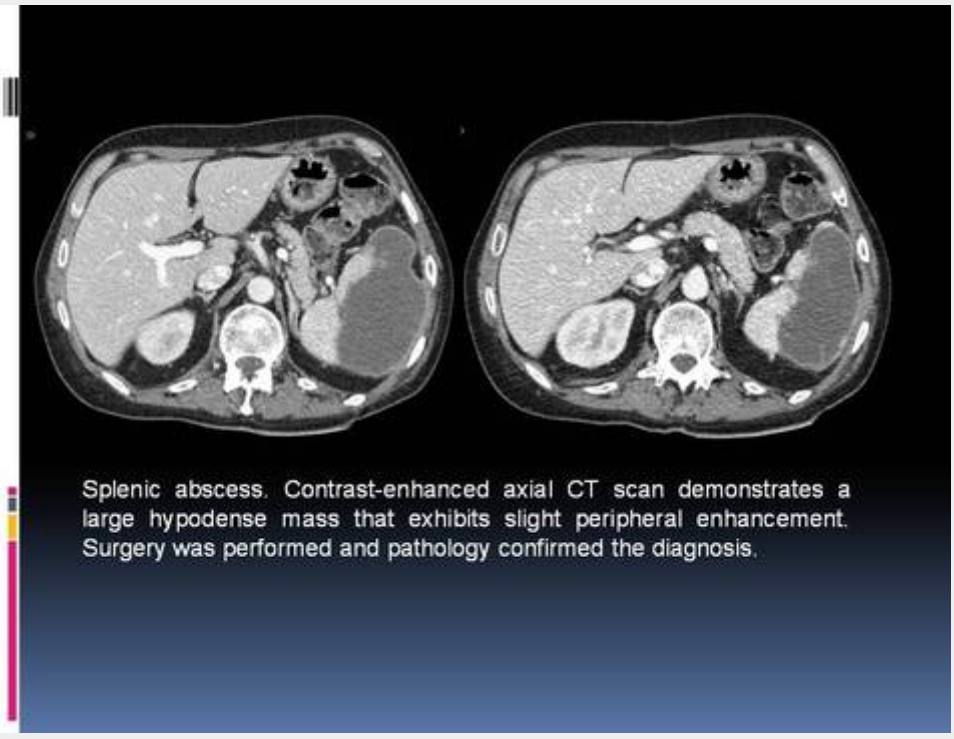
diapositivo18.jpg

diapositivo19.jpg

Splenic Abscess

- Splenic infection can occur either as a single focus or as part of a diffuse or miliary process. Although splenic infection is uncommon, the increasing prevalence of immunosuppression in cancer, transplant, and acquired immunodeficiency syndrome (AIDS) patients has placed a greater population at risk.
- Splenic infection can occur secondary to hematogenous dissemination of a preexisting primary infection. Endocarditis is the most commonly associated primary site, with urinary tract infection, appendicitis, pneumonia, and wound infections also implicated. Infection may be secondary to spreading from an adjacent organ or as superinfection of necrotic tissue following splenic infarction or injury.
- A solitary spleen abscess appears as a hypodense area on CT with low signal on T_1-weighted MR images and intermediate or increased signal on T_2-weighted images. The margins may be smooth or irregular. Gas can be seen within the abscess but it is usually absent. Peripheral enhancement may be seen following IV contrast administration, although it is less frequently observed than in liver abscess.

diapositivo20.jpg



Splenic abscess. Contrast-enhanced axial CT scan demonstrates a large hypodense mass that exhibits slight peripheral enhancement. Surgery was performed and pathology confirmed the diagnosis.

diapositivo21.jpg

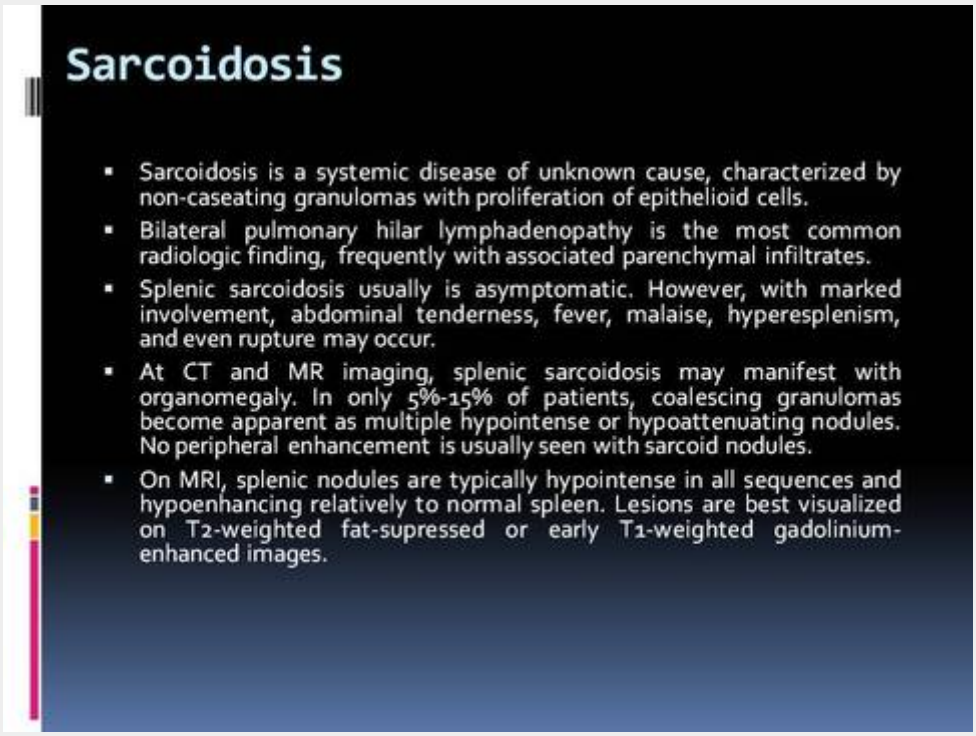
Candidiasis / Histoplasmosis

- Fungal infection in the spleen is most likely to appear as a miliary, multifocal, or multilocular process. Whereas 64% of multilocular abscesses have a fungal etiology, unilocular abscesses have a bacterial etiology in 94% of cases.
- Gas is occasionally noted within splenic abscesses, but usually it is absent. Calcification has been seen in treated *Candida* microabscesses as in lesions caused by other fungi (most notably *Histoplasmosis*), mycobacteria, and *Pneumocystis jirovecii.*

diapositivo22.jpg

Splenic calcifications. Non-enhanced axial CT scan demonstrates two milimetric foci of high attenuation representing residual calcifications following candidal microabscesses.

diapositivo23.jpg



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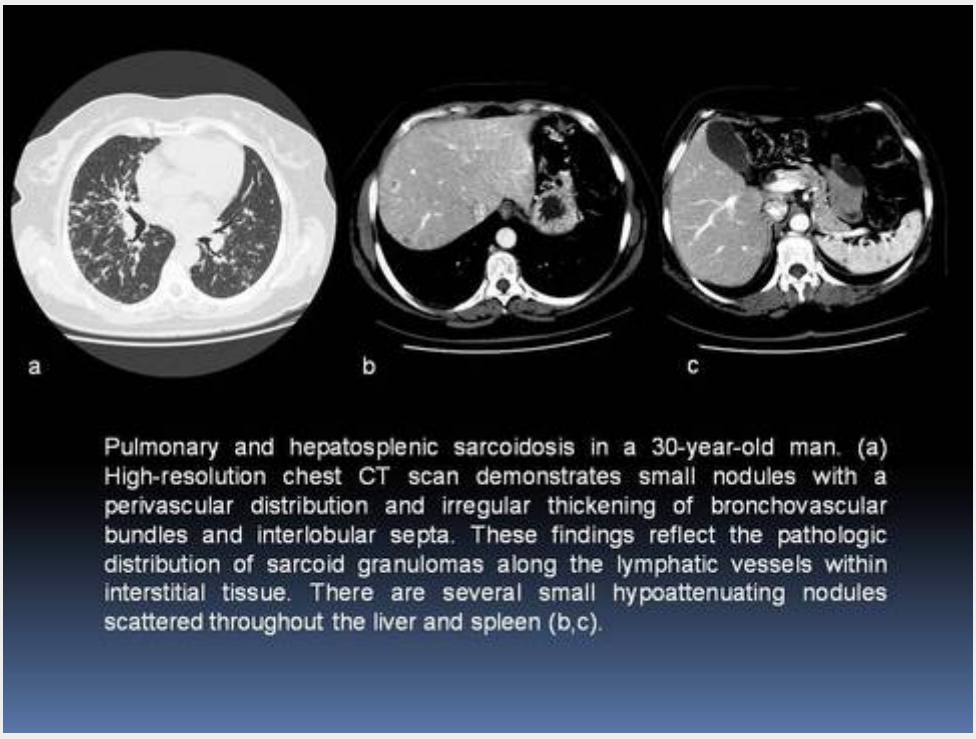

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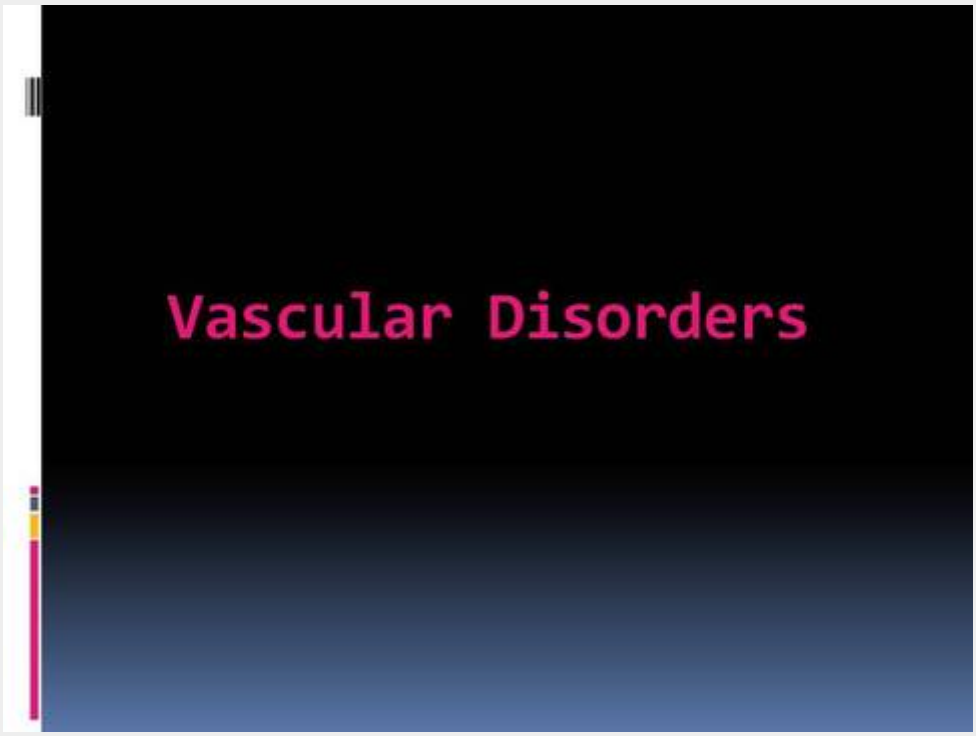

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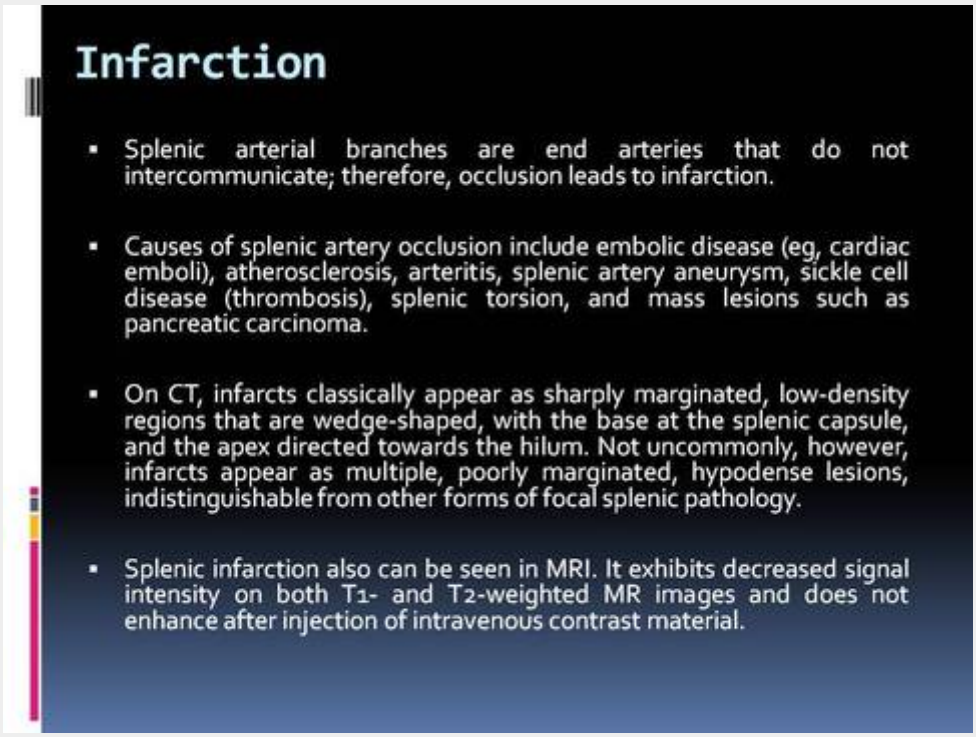

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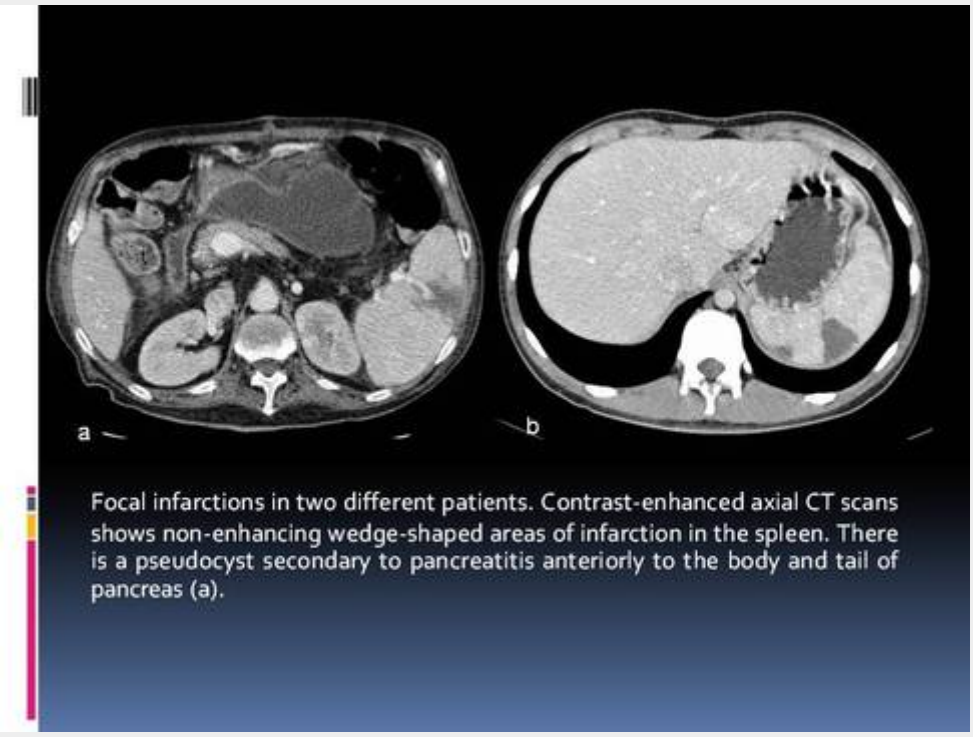


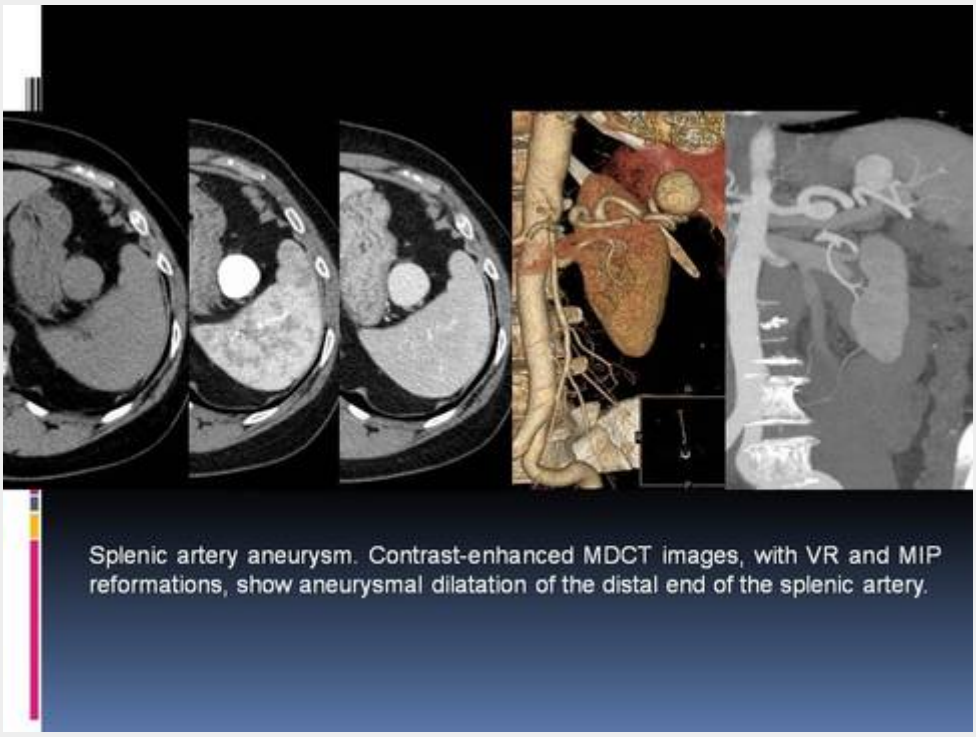
Focal infarctions in two different patients. Contrast-enhanced axial CT scans shows non-enhancing wedge-shaped areas of infarction in the spleen. There is a pseudocyst secondary to pancreatitis anteriorly to the body and tail of pancreas (a).

diapositivo28.jpg

Splenic Artery Aneurysm

- Splenic artery aneurysm is the most common abdominal visceral artery aneurysm.
- Predisposing conditions include pregnancy and multiparity, systemic and portal hypertension, and atherosclerotic disease.
- Occasionally, a specific cause can be cited for the development of splenic artery pseudoaneurysms. Acute and chronic pancreatitis, penetrating gastric ulcer, trauma and septic emboli have all been implicated. Mycotic aneurysms involving the intrasplenic branches of the splenic artery have also been reported.
- On unenhanced CT, a low-density lesion with peripheral calcification is observed along the course of the splenic artery. When large, there may be significant areas of heterogeneous attenuation corresponding to clot and hemorrhage. On unenhanced MRI, heterogeneous signal can be observed on T1- and T2-weighted sequences, representing areas of clotting. Following IV administration of contrast material, on both MRI and CT, bright enhancement is observed unless the lesion is thrombosed.

diapositivo29.jpg



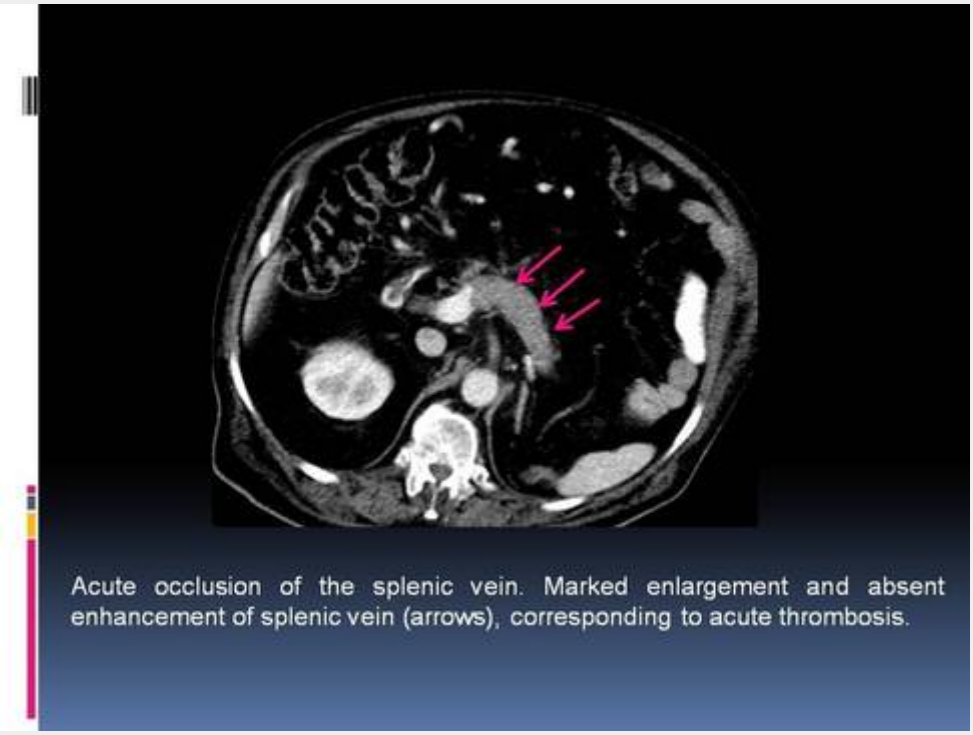
Splenic artery aneurysm. Contrast-enhanced MDCT images, with VR and MIP reformations, show aneurysmal dilatation of the distal end of the splenic artery.

diapositivo30.jpg

Splenic Vein Thrombosis

- Splenic vein thrombosis has multiple causes but it is most commonly secondary to pancreatitis. It may result in gastric varices and at times either esophageal or colonic varices.
- Splenic vein thrombosis is usually recognized as an intraluminal filling defect after intravenous contrast material administration.

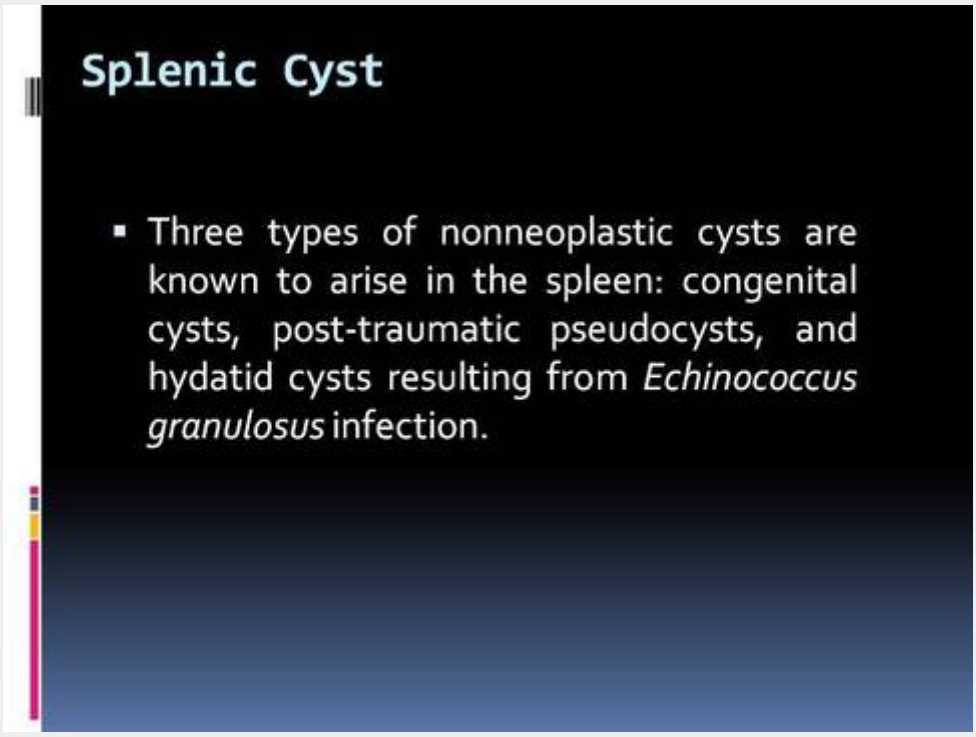
diapositivo31.jpg



Acute occlusion of the splenic vein. Marked enlargement and absent enhancement of splenic vein (arrows), corresponding to acute thrombosis.

diapositivo32.jpg

diapositivo33.jpg



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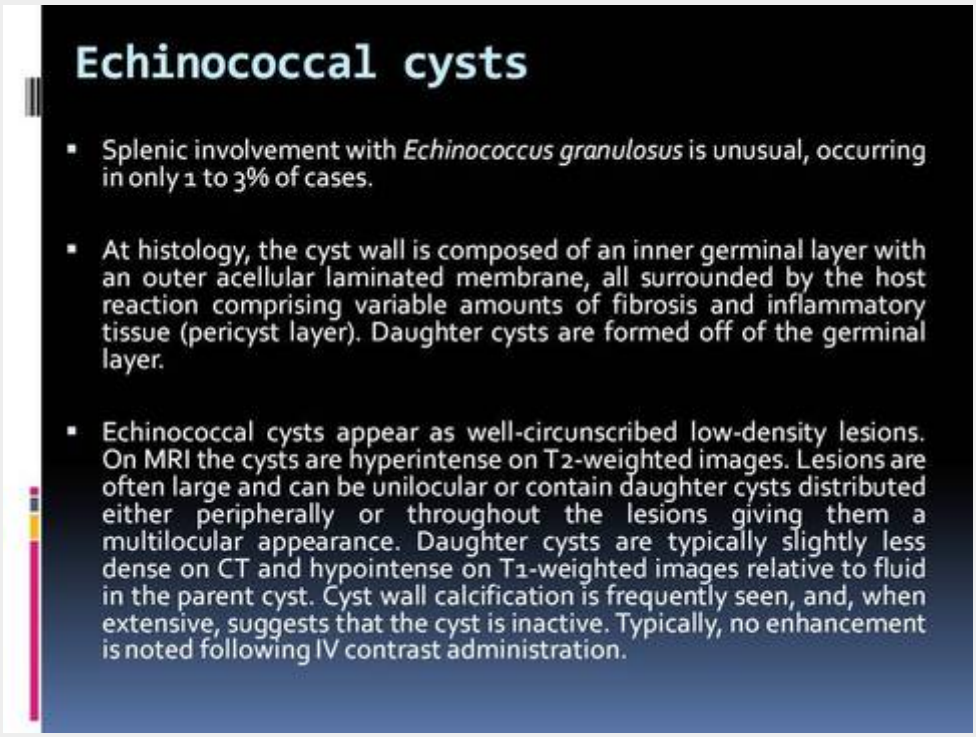

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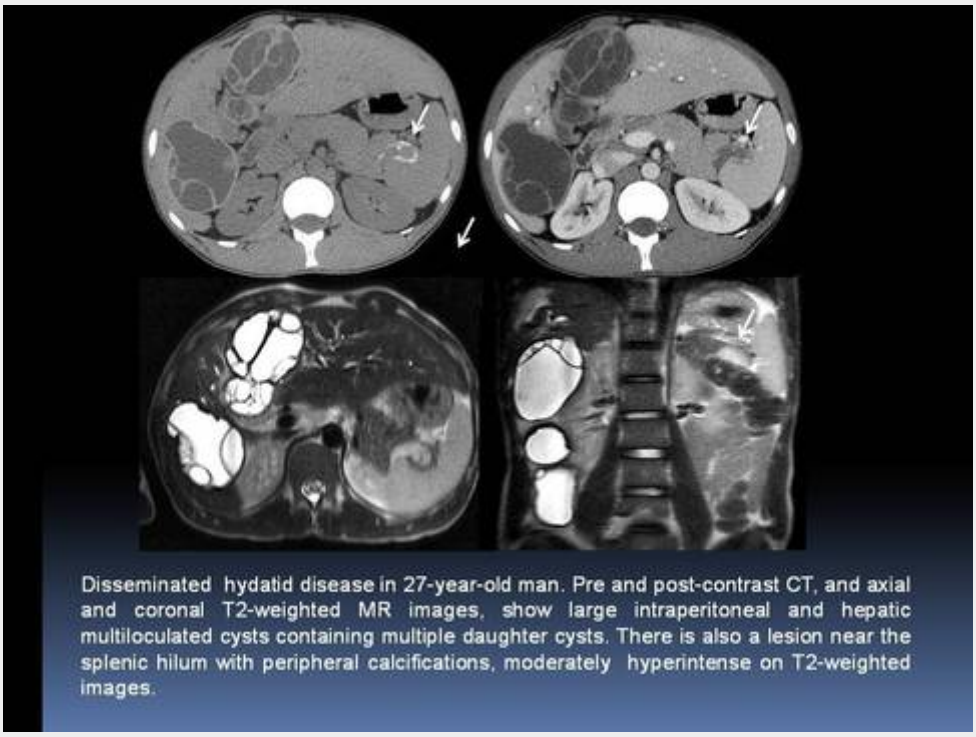
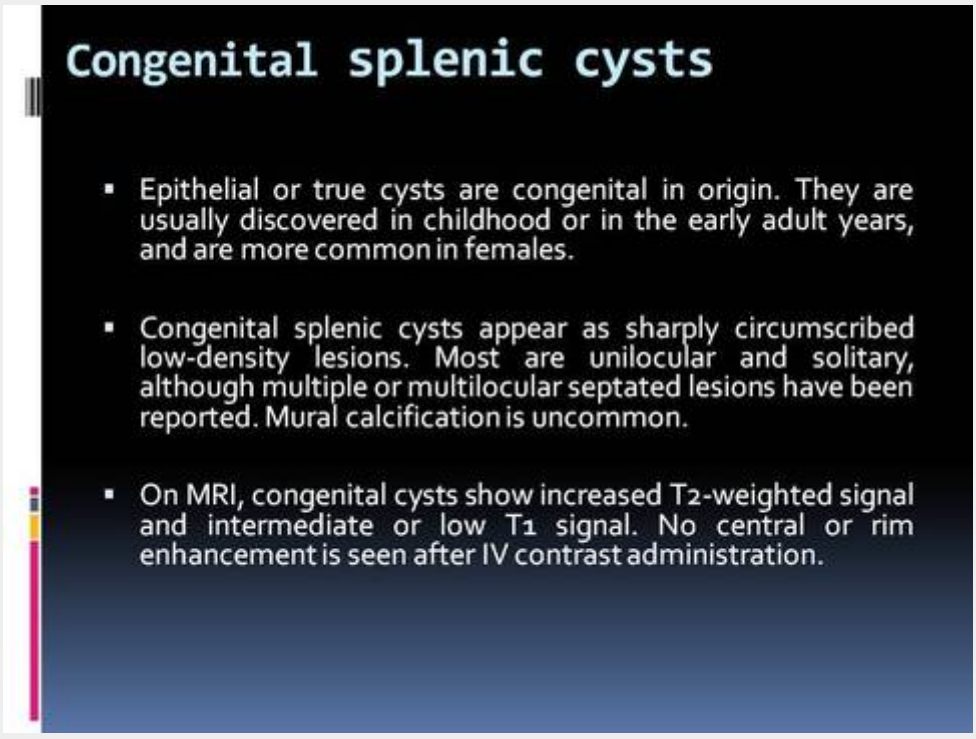


Disseminated hydatid disease in 27-year-old man. Pre and post-contrast CT, and axial and coronal T2-weighted MR images, show large intraperitoneal and hepatic multiloculated cysts containing multiple daughter cysts. There is also a lesion near the splenic hilum with peripheral calcifications, moderately hyperintense on T2-weighted images.

diapositivo36.jpg



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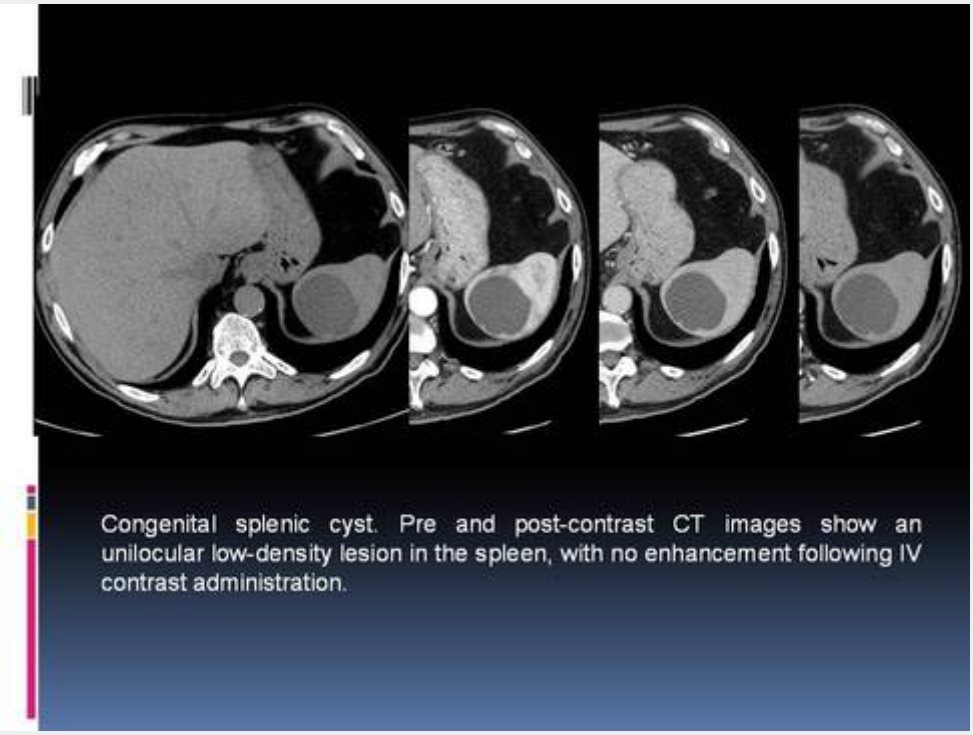


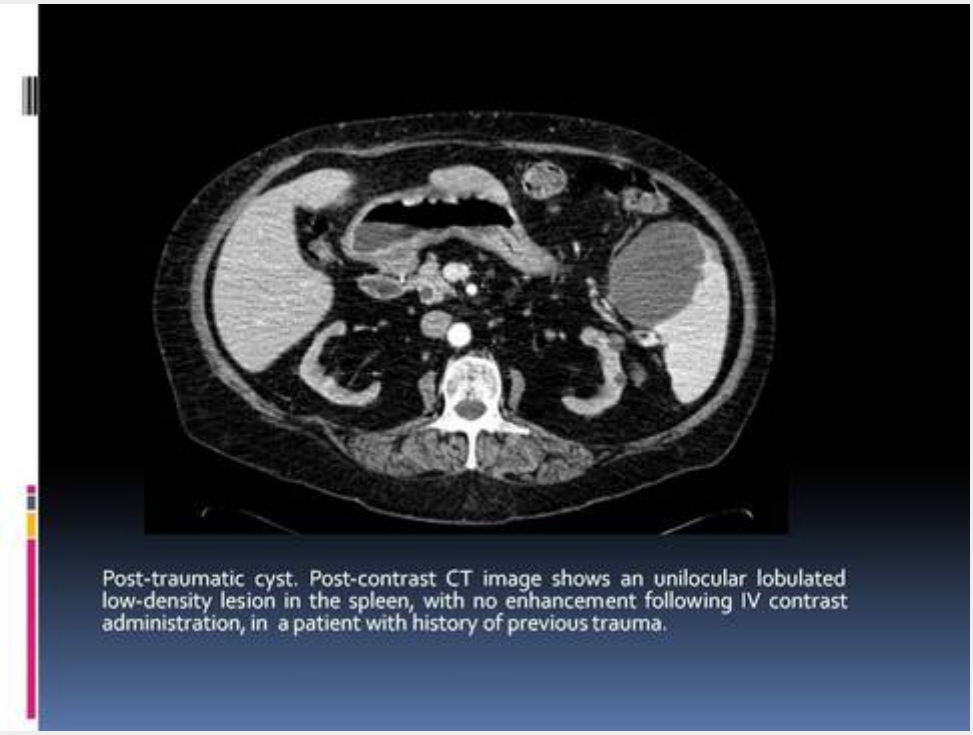
Congenital splenic cyst. Pre and post-contrast CT images show an unilocular low-density lesion in the spleen, with no enhancement following IV contrast administration.

diapositivo38.jpg

Post-traumatic pseudocysts

- Post-traumatic pseudocysts are thought to represent the final stage in evolution of a splenic hematoma, although some have suggested that acute necrosis secondary to infarction or infection may also lead to pseudocysts. The wall is composed of dense fibrous tissue and lacks a true cellular lining.
- On CT, post-traumatic cysts appear as sharply demarcated, unilocular, low-density regions. No peripheral enhancement is evident. Peripheral septation or cyst wall trabeculation is more common in congenital cysts. Mural calcification, however, is more common in cysts of traumatic etiology.

diapositivo39.jpg



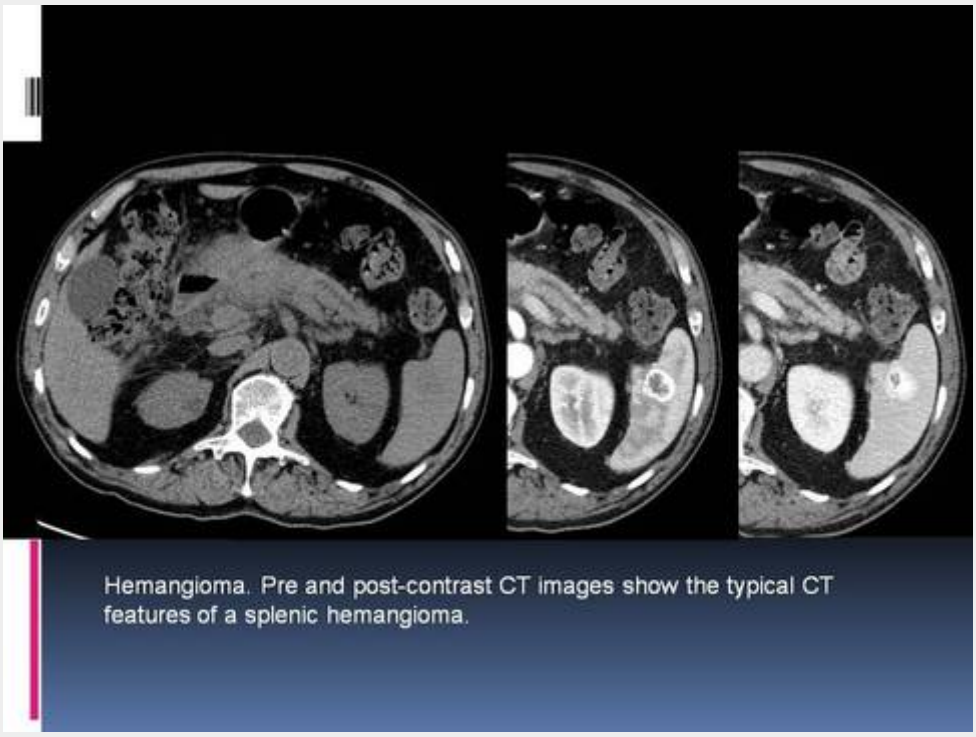
Post-traumatic cyst. Post-contrast CT image shows an unilocular lobulated low-density lesion in the spleen, with no enhancement following IV contrast administration, in a patient with history of previous trauma.

diapositivo40.jpg

Hemangioma

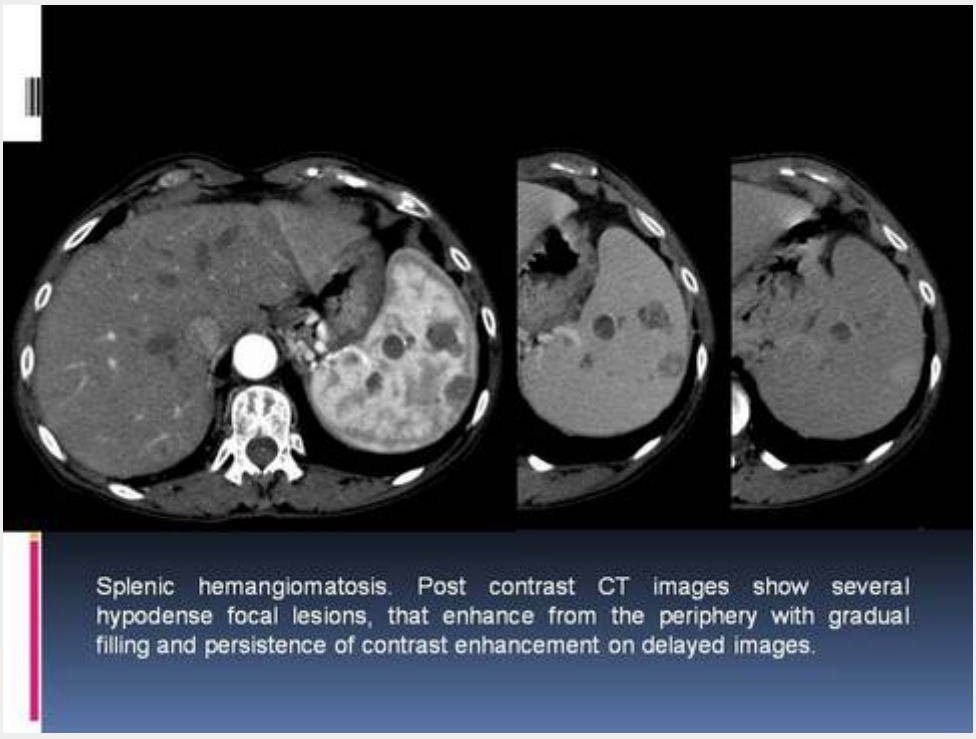
- Although rare, hemangioma is the most common primary neoplasm of the spleen. Pathologically, the lesion is similar to hemangiomas in other organs.
- Most commonly, it is a single asymptomatic lesion unless splenomegaly or rupture develops. Anemia, thrombocytopenia, and coagulopathy (Kasabach-Merrit syndrome) have been reported with large hemangiomas. Splenic hemangiomas may also be multiple and part of a generalized angiomatosis, as in Kippel-Trenaunay-Weber syndrome.
- The imaging findings of splenic hemangiomas are similar to those of the liver. On unenhanced CT, they appear as a well-defined hypodense masses that may contain cystic components. With contrast administration, most enhance from the periphery with gradual fill-in and persistence of contrast enhancement on delayed images. Some lesions, however, may remain hypodense, show diffuse enhancement , or show discrete mottled areas of density. Calcification can occur as scattered, punctate, curvilinear densities, or as dense rays radiating from a central point.
- On MR, these lesions are hypointense to the spleen on T_1-weighted images and hyperintense on T_2-weighted images. Heterogeneous signal is sometimes noted on T_2-weighted images, reflecting the presence of cystic and solid components with various amounts of fibrosis, necrosis, and hemorrhage. Injection of IV Gd-DTPA causes enhancement similar to that observed with iodinated contrast material on CT.

diapositivo41.jpg



Hemangioma. Pre and post-contrast CT images show the typical CT features of a splenic hemangioma.

diapositivo42.jpg



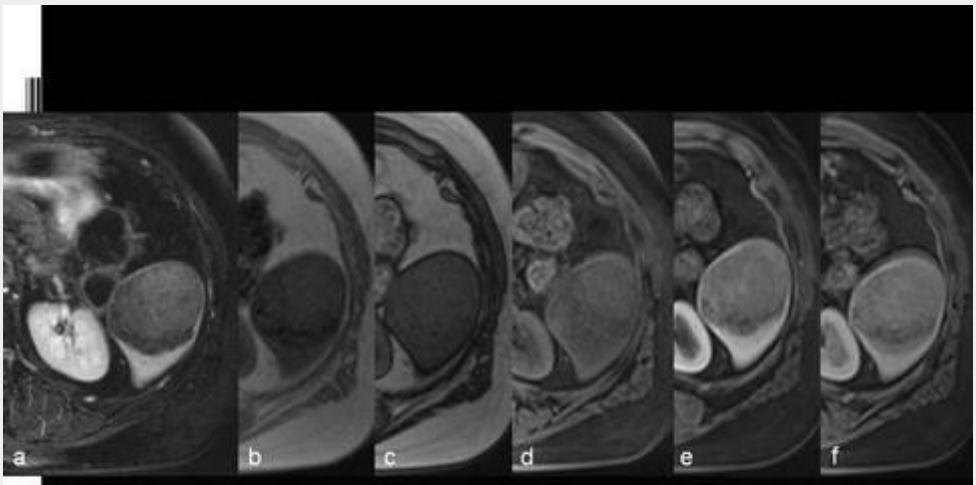
Splenic hemangiomatosis. Post contrast CT images show several hypodense focal lesions, that enhance from the periphery with gradual filling and persistence of contrast enhancement on delayed images.

diapositivo43.jpg

Hamartoma

- Hamartomas are rare benign asymptomatic lesions, composed of a mixture of normal splenic structures such as white and red pulp.
- Splenic hamartomas are usually solitary and may be solid or cystic. The solid lesion may reveal a nearly equal attenuation to that of spleen on contrast-enhanced CT scans.
- On CT, they appear as well-circunscribed, iso- to hypodense masses on pre-contrast images, with occasional lesions showing cystic components. Calcification can be observed. They usually show slow enhancement and fill in after IV administration of contrast material. Prolonged enhancement similar to that seen with hemangiomas is often noted and can help to differentiate hamartomas from lymphoma.
- On unenhanced MR images, the lesions are usually isointense on T1-weighted images and heterogeneously hyperintense on T2-weighted images relative to the spleen. Slow, diffuse, heterogeneous enhancement is noted following gadolinium injection. On delayed images, more uniform and persistent enhancement is seen, often greater than that of the normal spleen.

diapositivo44.jpg



Splenic hamartoma. (b) T1-weighted MRI shows a mass which is isodense to the spleen. (a) T2-weighted MRI reveals slightly hyperintensity relative to the normal splenic tissue. (d-f) T1-weighted post-gadolinium MR images show that there is some early heterogeneous enhancement, with nearly isointensity to the splenic parenchyma in the later phases.

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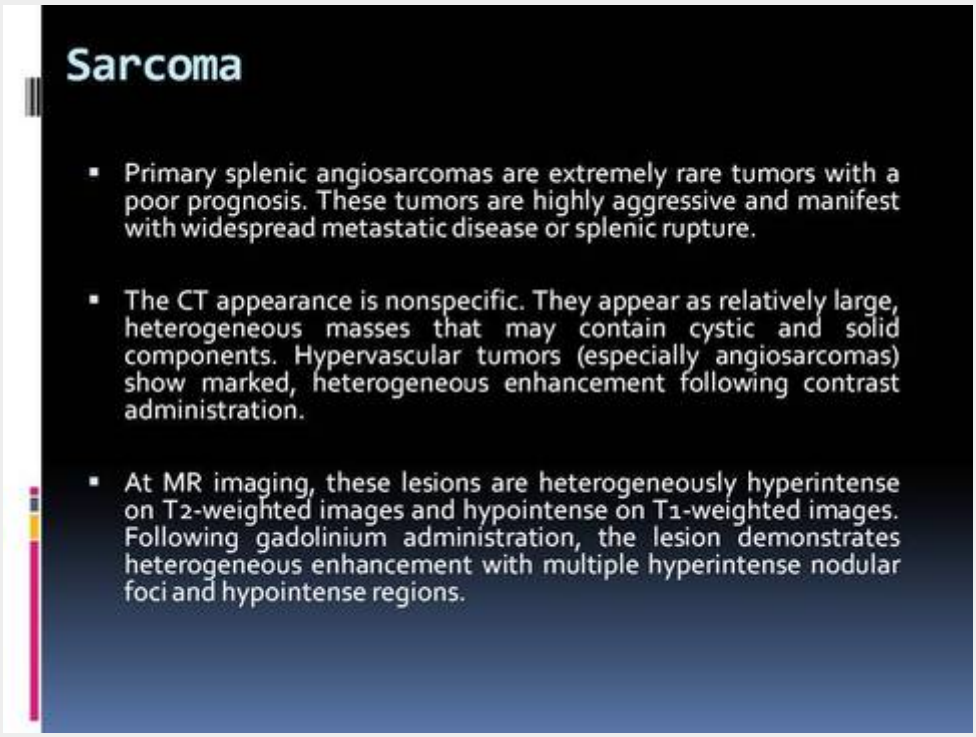
diapositivo46.jpg

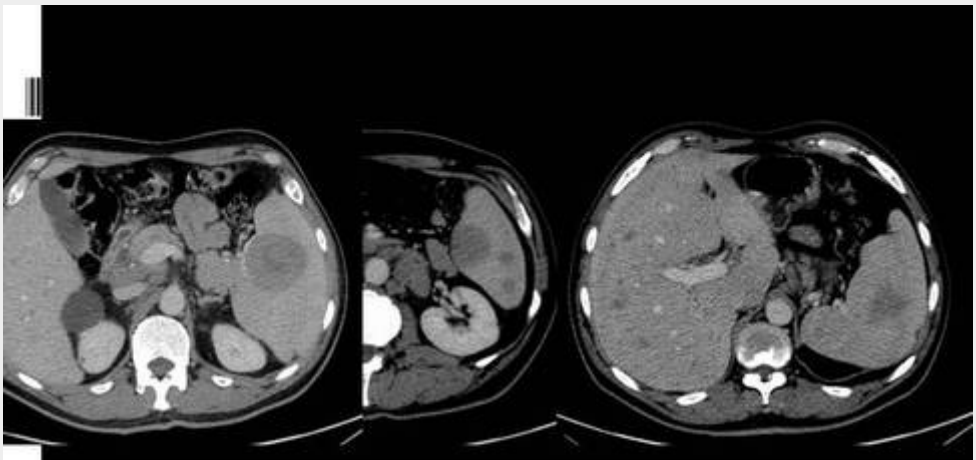


diapositivo47.jpg

Lymphoma

- Lymphoma is the commonest primary malignancy of the spleen. Primary splenic lymphoma is rare (1-2% of all lymphomas) . Secondary splenic involvement is frequent in both Hodgkin's disease (HD) and NHL.
- Diffuse lymphomatous involvement does not need to be associated with splenomegaly. Nodular lesions are seen in fewer than 20% of patients with splenic involvement. However, this is the only type of involvement that can be reliably detected by CT.
- Splenic involvement can manifest as one of four forms: homogeneous enlargement, miliary nodules, multifocal lesions, or a solitary mass.
- Contrast-enhanced CT scans may demonstrate inhomogeneous lesions of decreased attenuation and variable size, either solitary or multiple.
- Lymphomatous deposits have T1 and T2 similar to those of normal parenchyma. Gadolinium-enhanced sequences are more sensitive for the evaluation of splenic parenchyma. Diffuse involvement may be seen as large irregularly enhancing lesions. Multifocal disease is also common and can be seen as multiple focal lesions hypointense relative to the uniformly or arciform enhancing spleen.

diapositivo48.jpg



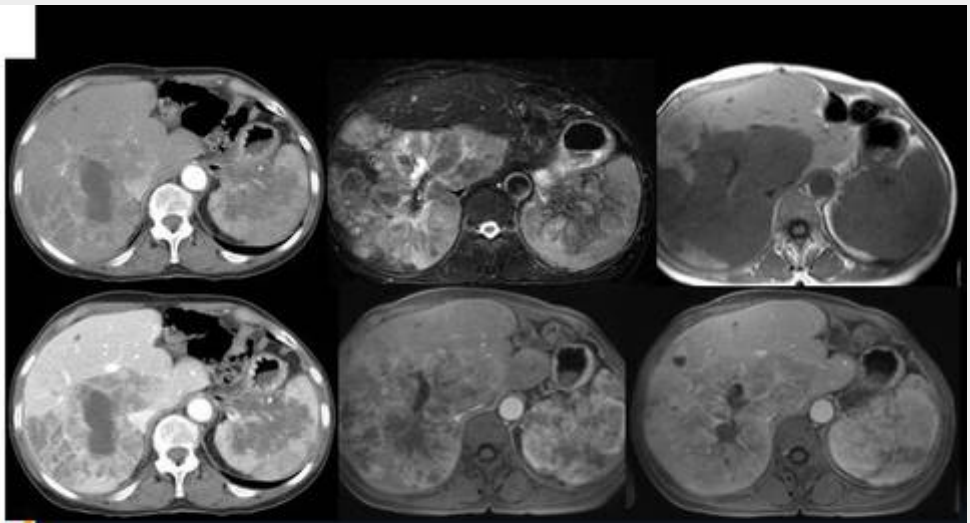
Linfoma with multiple masses. Contrast-enhanced CT scan in a 45-year-old man shows multiple small low-attenuation areas in a diffusely enlarged spleen. There is also hepatic involvement, with multiple small hypoattenuating lesions.

diapositivo49.jpg

Metastasis

- Splenic metastasis are relatively uncommon, despite its large mass of lymphoid tissue and its role in the filtration of systemic blood.
- CT demonstrates splenic metastases as ill-defined hypoattenuating areas or well-defined cystic lesions that may be unilocular or septated.
- At MR imaging, metastasis typically appear as hyperintense masses on T_2-weighted images and hypo- to isointense lesions on T_1-weighted images. The degree and characteristics of enhancement depend on the nature and type of the underlying primary neoplasm.

diapositivo50.jpg



Splenic metastasis. Contrast-enhanced CT and MRI images show a large heterogeneous ill-defined mass involving the spleen. This lesion corresponds to a splenic metastasis from a hepatocellular carcinoma.

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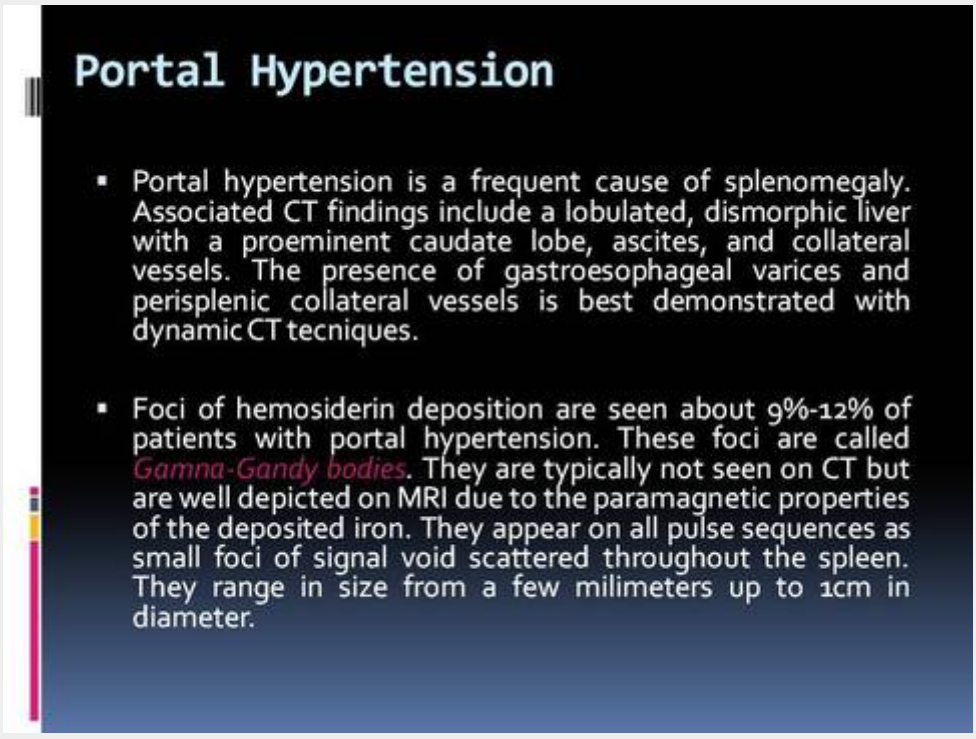
diapositivo52.jpg



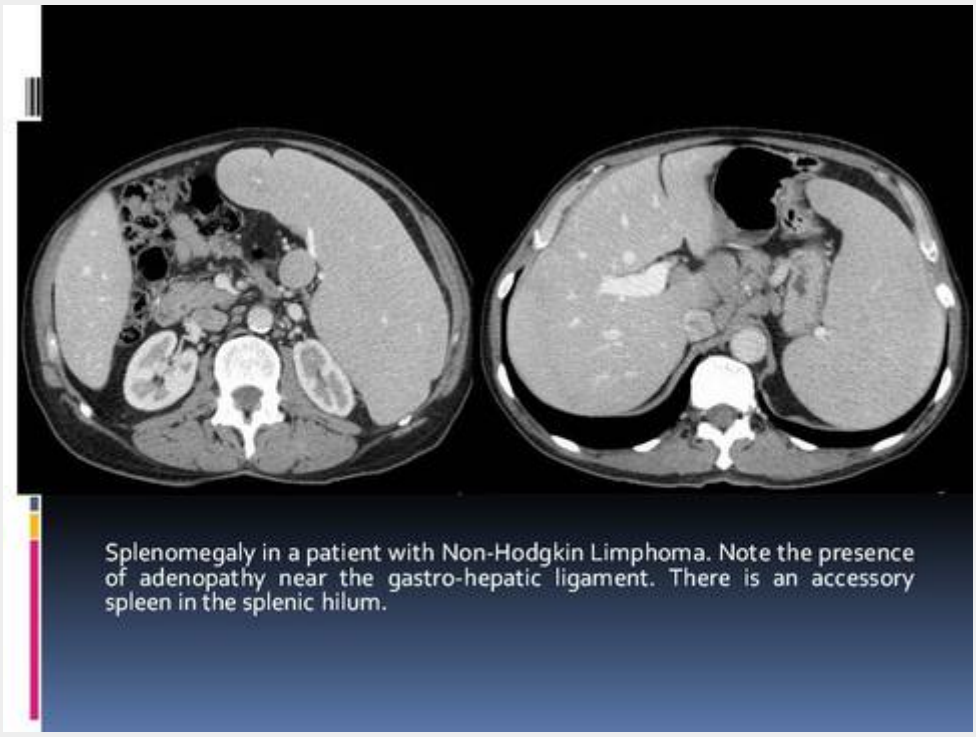
diapositivo53.jpg

Splenomegaly in a 45-year-old man with portal hypertension. Contrast-enhanced CT images show splenomegaly and cirrhotic liver, with several collateral vessels (splenic, esophageal and periumbilical varices) and ascites.

diapositivo54.jpg

Gamna-Gandy bodies. T1-weighted and T1-weighted fat supressed postgadolinium MR images show multiple areas of signal void throughout the splenic parenchyma in this patient with cirrhosis.

diapositivo55.jpg



Splenomegaly in a patient with Non-Hodgkin Limphoma. Note the presence of adenopathy near the gastro-hepatic ligament. There is an accessory spleen in the splenic hilum.

diapositivo56.jpg

Conclusion

- CT is still the imaging method of choice for evaluation of the spleen. However, MR is also an excellent imaging tool for the diagnosis, evaluation, and characterization of various focal splenic lesions and pathologic conditions.