

# Ultrasonographic Atlas of Splenic Lesions

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# Purposes

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- ♥ To understand fundamentals of splenic ultrasonography
- ♥ To illustrate key imaging findings of splenic abnormalities in ultrasonography

# Contents

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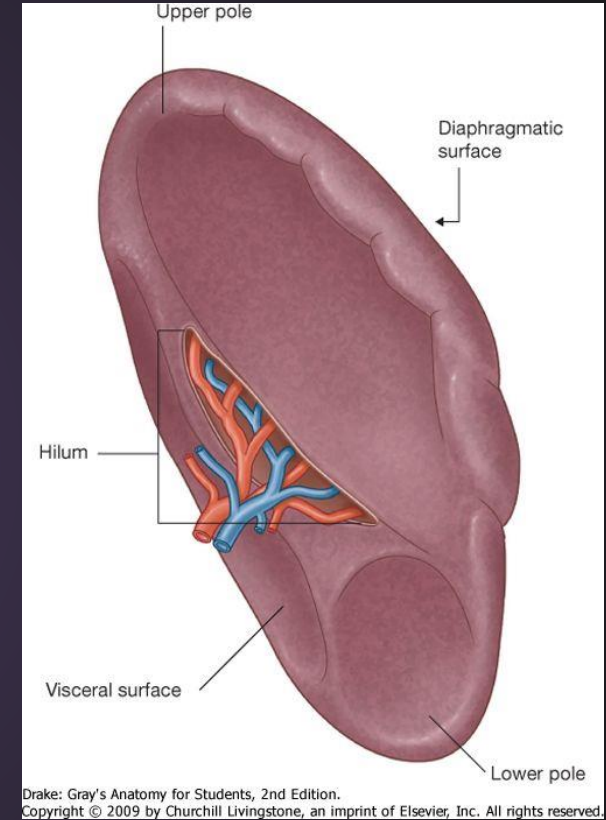
- ♥ Introduction
- ♥ Fundamentals of spleen imaging: special focus on US
- ♥ Anomalies and anatomic variants
- ♥ Non neoplastic diseases
- ♥ Infection and inflammatory diseases
- ♥ Benign neoplasms
- ♥ Malignant neoplasms
- ♥ Differential diagnosis

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# INTRODUCTION

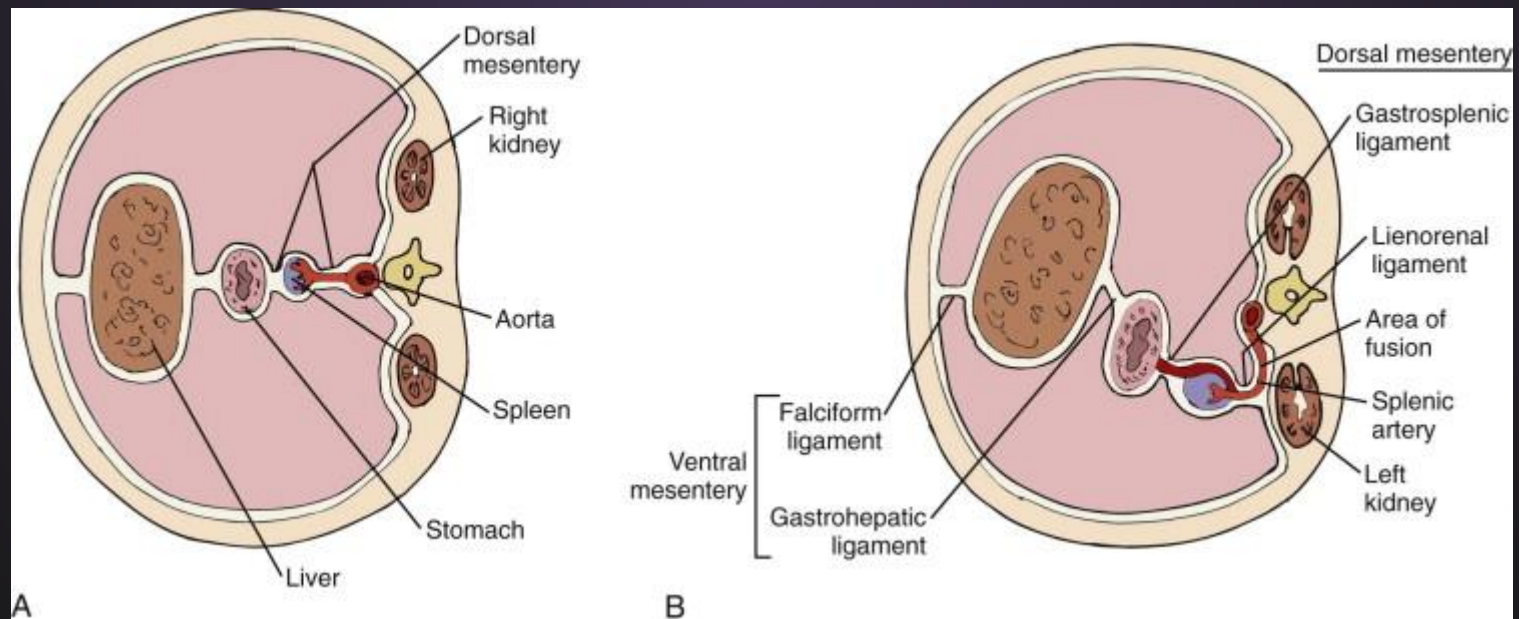
# Spleen

- ♥ Part of the mononuclear phagocytic system (formally known as reticuloendothelial)
- ♥ The largest lymphatic organ
- ♥ Length 10-12cm, weight 130~170g
- ♥ Red pulp
  - ❖ RBC, PLT metabolism
  - ❖ Monocyte reservation
- ♥ White pulp: immune response
  - ❖ Produce antibodies, macrophages, lymphocytes
  - ❖ Remove antibody-laden bacteria
- ♥ Disease/absence of spleen: susceptible to various infections



# Anatomy and Embryology

- ♥ GA 5<sup>th</sup> week: a condensation of mesenchymal cells from dorsal mesogastrium
  - ❖ Hematopoietic function in GA 4-8mo: lost with embryo development
  - ❖ Migration of lymphoid precursor cells: lymphocyte and monocyte production
- ♥ Location
  - ❖ Left upper abdomen, posterolateral to stomach, pancreas tail, and colic flexure
  - ❖ Between 9 and 12th ribs with its long axis in line with the 11th rib



# Physiology

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- ♥ Blood flow 150mL/min (=350L/day)
  - ❖ 10% directly into venous sinus
  - ❖ 90% through red pulp
- ♥ Selectively sequesters abnormal and aged RBC, WBC, PLT
- ♥ Remove viruses, bacteria, nuclear remnants (Howell-Jolly bodies), and parasites
- ♥ Initiation of humoral and cellular immune responses
  - ❖ Perfusion by blood rather than lymph of white pulp
  - ❖ Tuftsin: facilitate phagocytosis of leukocytes
  - ❖ immunoglobulin M antibody synthesis
- ♥ Blood storage: 200-250mL

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# FUNDAMENTALS OF SPLEEN IMAGING: SPECIAL FOCUS ON US

# Radiography

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- ♥ Moderate or massive splenomegaly
- ♥ Splenic calcifications
  - ❖ Granulomatous disease (tuberculosis, histoplasmosis, brucellosis)

# Ultrasound

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- ♥ Position: left anterior oblique, right lateral decubitus, prone
- ♥ A 3-5 MHz curved transducer
- ♥ Subcostal or oblique intercostal plane
  - ❖ The best window: 10th or 11th intercostal spaces, on the left midaxillary line
- ♥ Special US
  - ❖ Color Doppler: macrocirculation
  - ❖ Contrast-enhanced US (CEUS): both macro- and microcirculation in real-time
    - A high-frequency transducer and tissue harmonic imaging in the presence of a low mechanical index (MI)
  - ❖ Elastography

# Ultrasound

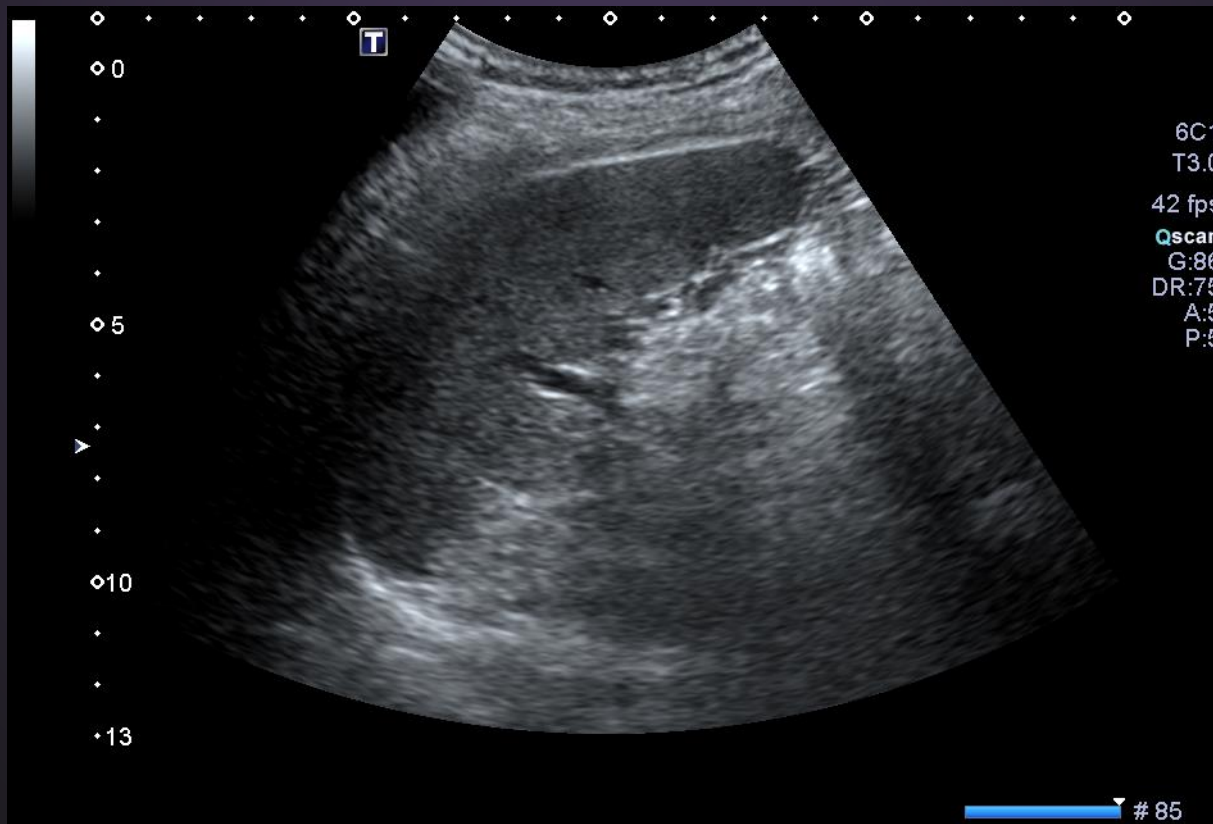
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- ♥ Homogeneous, mid- to low-level fine tissue echotexture punctuated by occasional bright echoes representing blood vessels
  - ❖ Slightly more echogenic than normal liver
  - ❖ Markedly more echogenic than normal renal parenchyma
- ♥ Size, shape, position of the hilum, relationship to the diaphragm, stomach, pancreas, and left kidney
- ♥ Detecting and characterizing focal lesions
- ♥ Estimating splenic size and volume

# Normal Appearance on US

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- ♥ Crescent shape, smooth outer convexity and nodulous inner margin
- ♥ Homogeneous and uniform parenchyma
- ♥ Slightly echogenic than normal hepatic parenchyma

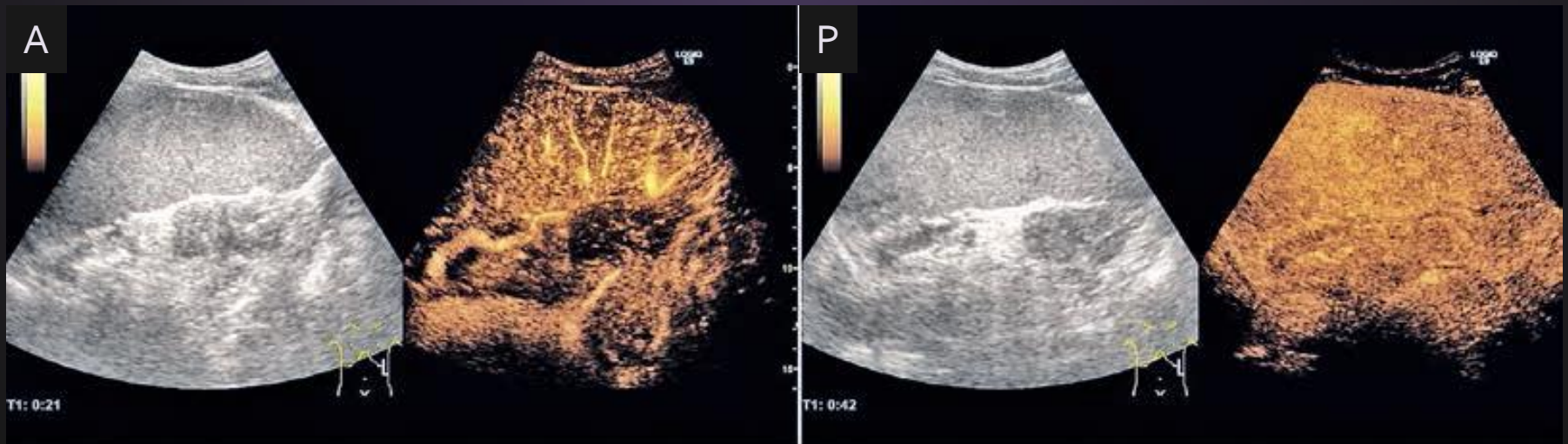


# Normal Appearance on US

## ♥ CEUS

- ❖ Arterial (10–25 s): arterial splenic vessels
- ❖ Portal venous (30–120 s): homogeneous enhancement of parenchyma
- ❖ Late phases (over 120 s)

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Gray-scale and CEUS of the spleen (dual examination)

A) Arterial time (at 21 seconds after contrast agent administration) – the arterial splenic vessels are seen

P) Portal time (42 seconds), the splenic parenchyma becomes homogeneously enhanced (also called the parenchymal time)

# CT

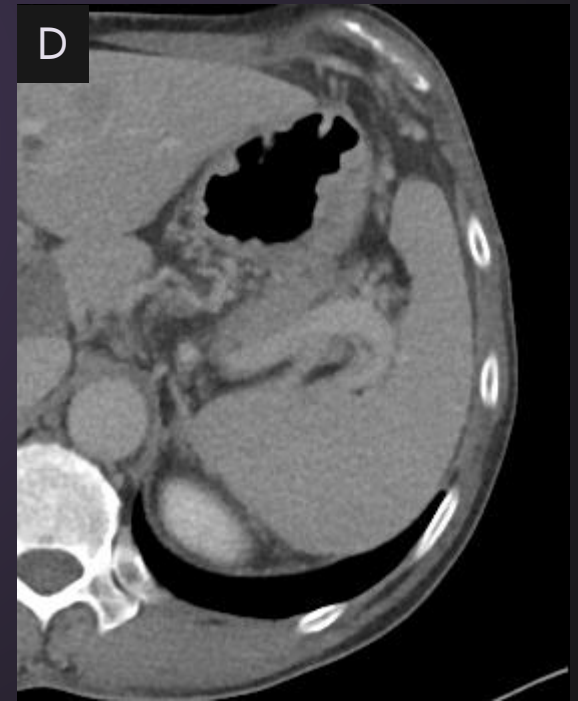
- ♥ Early arterial mottled enhancement
  - ❖ Due to variable flow rates of the splenic red pulp
- ♥ Homogeneous in the portal venous phase



Arterial phase  
Mottled or striped enhanced pattern

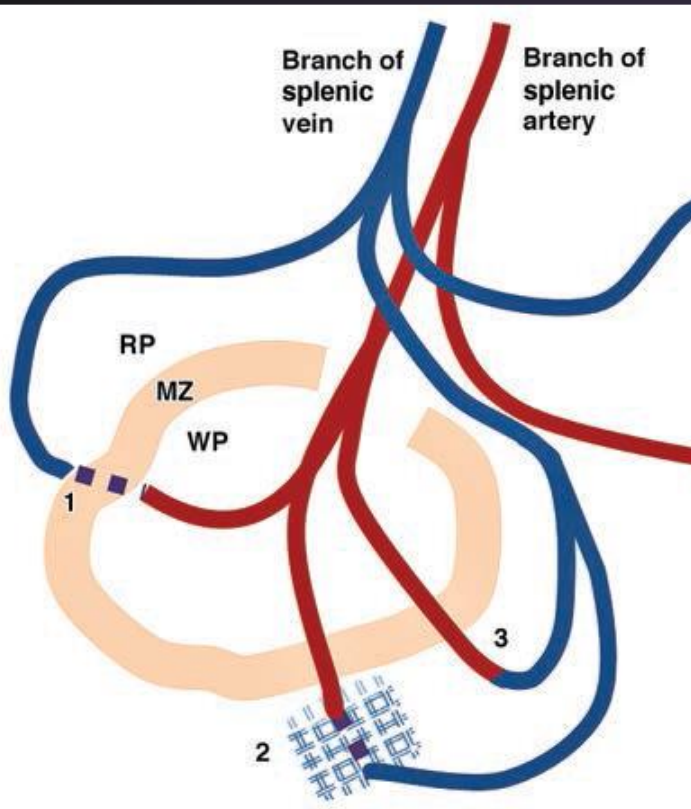


Portal phase  
Homogeneous enhancement



Delayed phase (equilibrium phase)  
Washout of contrast

# Heterogeneous enhancement: zebra pattern



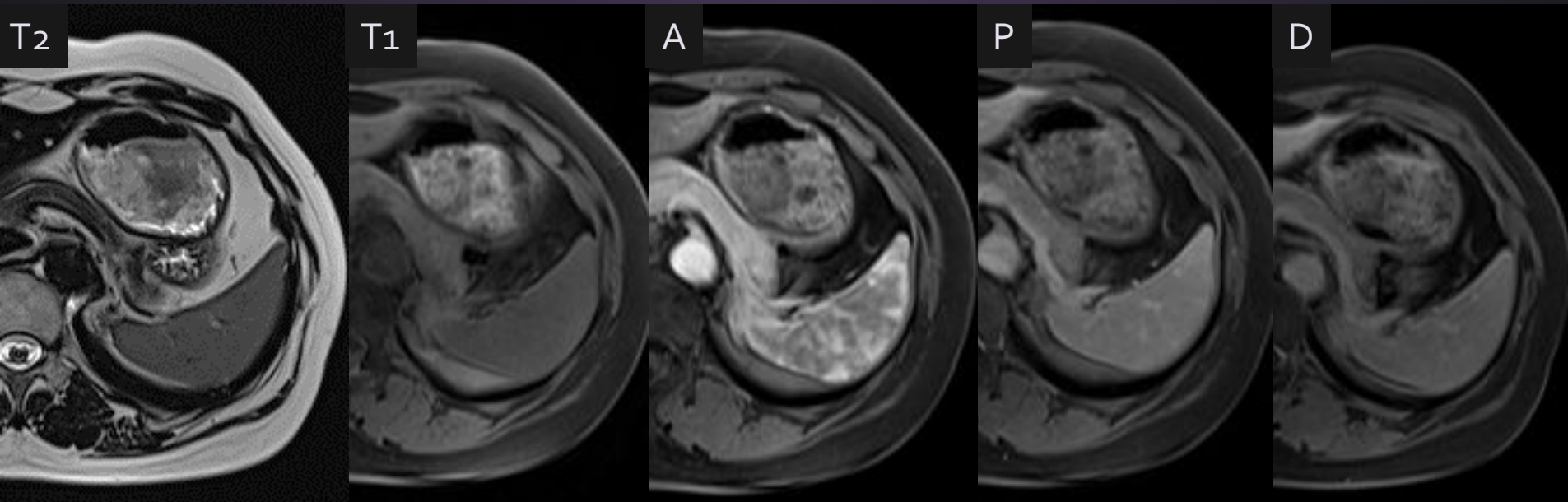
♥ Due to variable flow rates of the splenic red pulp

1. Open system, low resistance, high flow
  - ❖ Arterioles terminate in marginal zone (MZ)
2. Open system, high resistance, slow flow
  - ❖ Arterioles cross marginal zone and end in reticular meshwork of red pulp (RP)
3. Closed system, low resistance, high flow
  - ❖ Drain directly into venous sinusoids in red pulp

# MRI

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- ♥ Low SI on T<sub>1</sub>WI
- ♥ High SI on T<sub>2</sub>WI
- ♥ Similar enhancement pattern as on CT



<u>T<sub>2</sub>WI</u>	<u>T<sub>1</sub>WI</u>	<u>Arterial phase</u>	<u>Portal phase</u>	<u>Delayed phase</u>
Homogeneously high SI	Homogeneously low SI	Mottled or striped enhancement	Homogeneous enhancement	Washout of contrast

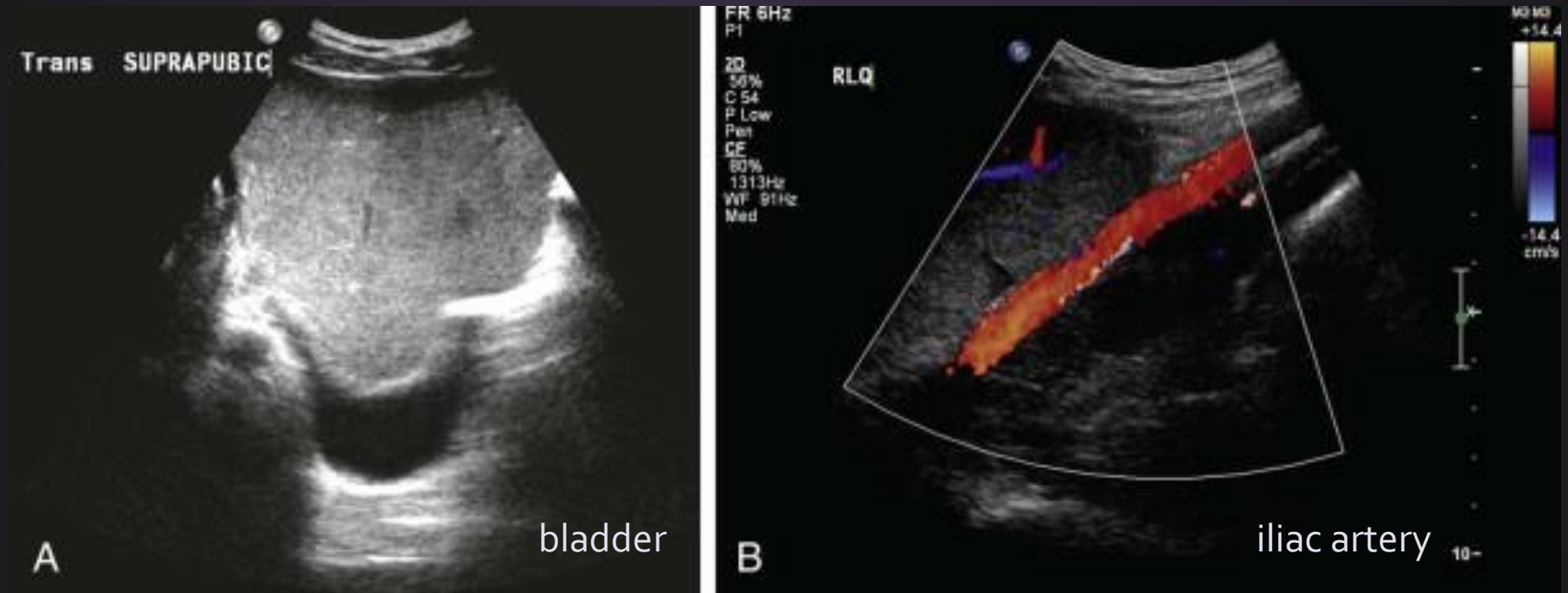
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# **ANOMALIES AND ANATOMIC VARIANTS**

# Wandering or Ectopic Spleen

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- ♥ Migration of the spleen from its normal fixed posterolateral location in the left upper abdomen
- ♥ Normally anchored in the left upper abdomen
  - ❖ Gastrosplenic, splenorenal ligaments
- ♥ Congenital or acquired
- ♥ Solely attached by its vascular pedicle and can become a wholly intraperitoneal hypermobile organ
- ♥ US
  - ❖ Diagnosis, complications (torsion, infarction)
  - ❖ Real time exam for hypermobility and twisting of vascular pedicle



### Wandering spleen

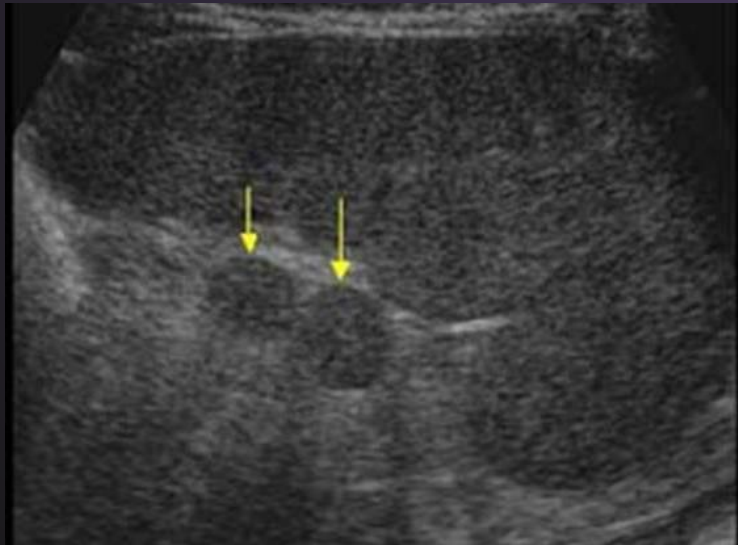
A) Transverse ultrasound image of the pelvis shows the spleen overlying the bladder

B) Color Doppler image shows blood flow in the splenic parenchyma adjacent to the iliac artery

# Accessory Spleen

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- ♥ <2.5cm
- ♥ Congenital anomaly
  - ❖ Failure of embryonic splenic buds to unite within the dorsal mesogastrium
  - ❖ Extreme lobulation of the spleen with pinching off of splenic tissue
- ♥ Splenic hilum, splenic ligaments, pancreas tail
- ♥ Intrapancreatic accessory spleen can mimic pancreatic neoplasms, such as hypervascular islet cell tumors





# NONNEOPLASTIC DISEASES

# Splenomegaly

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- ♥ Diffuse splenic enlargement (long axis length > 11~12cm)
- ♥ Congestive
  - ❖ Portal hypertension, splenic vein occlusion, congestive heart failure
- ♥ Hyperplastic
  - ❖ Hypertrophy due to removal of abnormal blood cells from the circulation (e.g., polycythemia vera)
- ♥ Inflammatory
  - ❖ Infection/inflammation: increase in the immune response with resultant lymphoid hyperplasia (e.g., infectious mononucleosis)
- ♥ Infectious
  - ❖ Splenic filtering of blood-borne pathogens, may lead to microabscess formation (e.g., mycobacterial infection)
- ♥ Infiltrative
  - ❖ Engorgement of macrophages with indigestible materials (e.g., Gaucher's disease, amyloidosis, malignant disease)

M/33 Alcoholic hepatitis, splenomegaly (>21cm)



# Gamna-Gandy Bodies

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- ♥ Siderotic nodules caused by focal organized hemorrhagic infarcts
- ♥ Congestive splenomegaly, sickle cell disease, hemolytic anemia, leukemia, lymphoma, acquired hemochromatosis, multiple blood transfusions
- ♥ US: multiple, punctate, hyperechoic foci
- ♥ CT: multiple, faint, hyperdense nodules shown by the calcifications within them
- ♥ MRI: markedly hypointense nodules on T<sub>1</sub>, T<sub>2</sub>WI



2D  
51%  
C 55  
P Low  
Gen



✦ Dist 11.5 cm

### Gamna-Gandy bodies

Numerous tiny nodules throughout the spleen

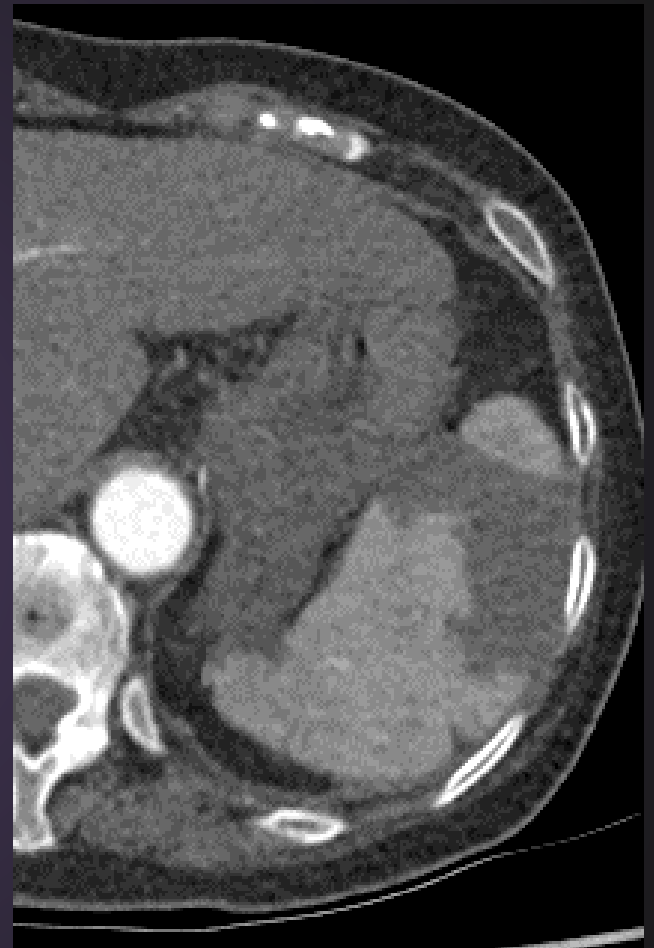
CT) calcifications

US) echogenic nodules

# Splenic Infarction

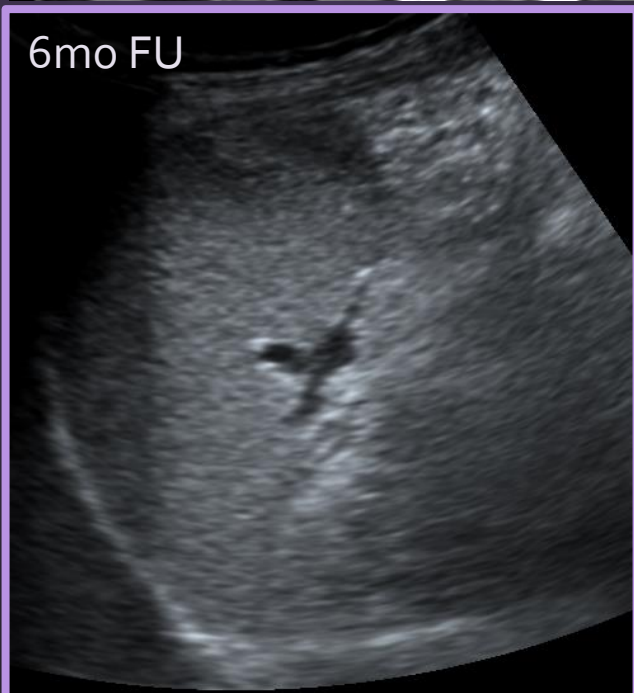
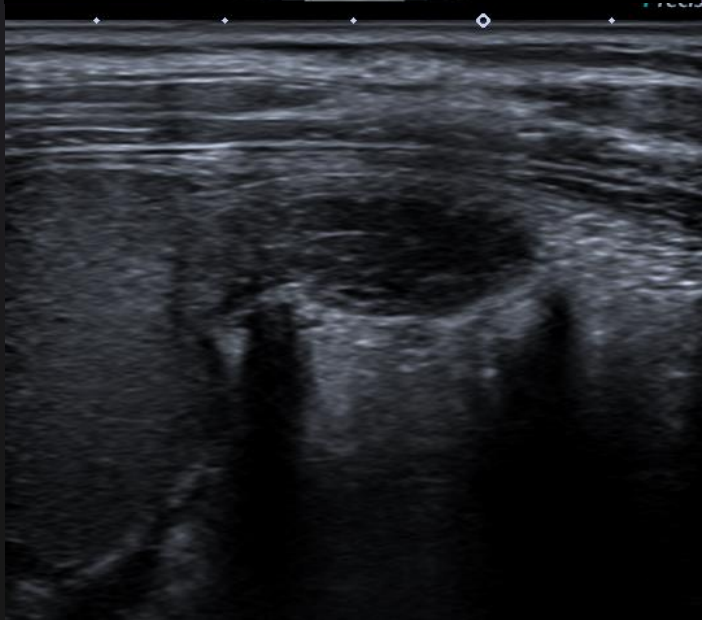
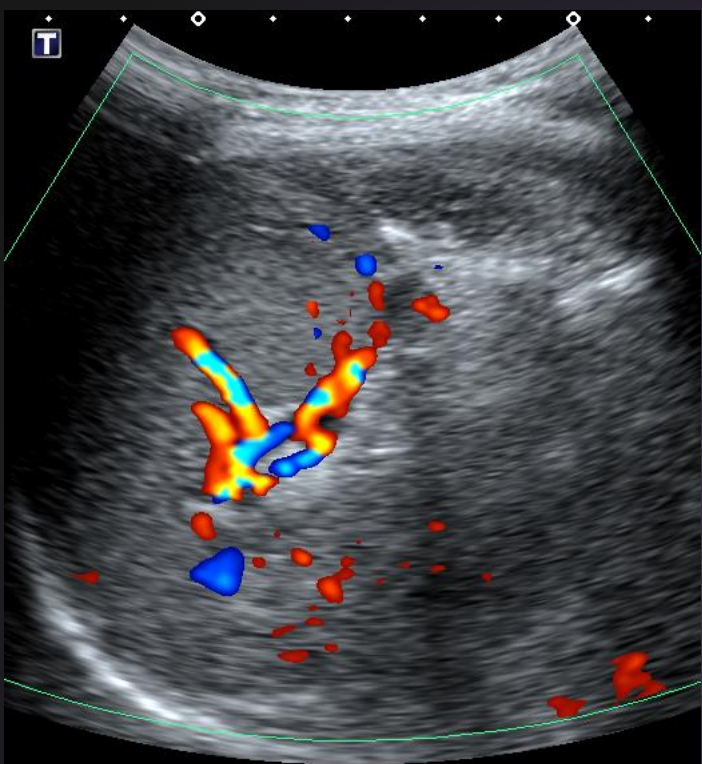
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- ♥ Result of arterial or venous compromise
  - ❖ Branches of the splenic artery are end arteries
  - ❖ Segmental or massive
  - ❖ Many potential causes: hematologic disorders (m/c, <40yrs), thromboembolic disease (>40yrs), vascular diseases, trauma
- ♥ Complications (7-20%): abscesses, pseudocysts, hemorrhage, subcapsular hematoma, rupture
- ♥ Wedge-shaped area with the base at the splenic capsule and the apex pointing toward the hilum
- ♥ Multinodular or mottled appearance
- ♥ A masslike appearance with irregular margins
- ♥ US: single or multiple, wedge-shaped or round, variable echogenicity
  - ❖ Acute stage: hypoechoic, peripheral, and wedge shaped or round
  - ❖ Chronic stage: increased echogenicity that represent fibrotic scar



F/78, Patient with infective endocarditis

Focal hypoechoic area in spleen, matched as wedge shaped low density area in CT, suggesting splenic infarction



F/24, S/P Distal pancreatectomy

Loculated fluid collection with  
volume shrinkage at spleen lower  
pole suggesting sequelae of  
splenic infarction  
→ Improved after 6mo FU

# Cystic Splenic Lesions

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Congenital	Epidermoid cysts (primary, true, mesothelial) Dermoid (rare)
Acquired	Pseudocysts (secondary cysts): postinflammatory, post-traumatic, postinfarction, pancreatic
Infection	Parasitic: echinococcosis Abscess: pyogenic, fungal
Neoplastic	Benign: cystic hemangioma, hamartoma, lymphangioma, peliosis Malignant: angiosarcoma, lymphoma, metastases

# Cystic Splenic Lesions

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- ♥ Congenital cysts (epithelial cysts, epidermoid cysts)
  - ❖ Cysts lined with epithelial cells
  - ❖ US: well-defined hypoechoic mass
    - Low-level echoes: secondary to the deposition of cholesterol crystals
  - ❖ CT: difficult to differentiate from a pseudocyst
- ♥ Secondary cysts (pseudocysts)
  - ❖ After trauma, sequelae of prior hematoma
  - ❖ Not true cysts: lack of an inner endothelial lining
  - ❖ Fibrous wall  $\pm$  wall calcifications, internal debris



M/83, About 4cm sized cyst in spleen upper pole



F/20, palpable abdominal mass

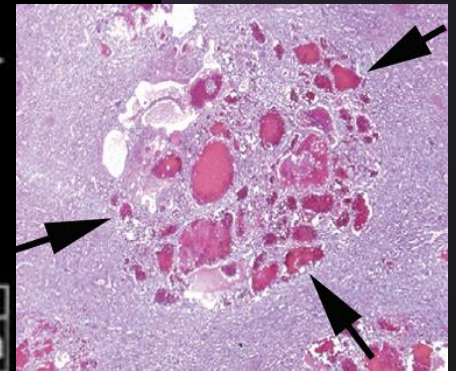
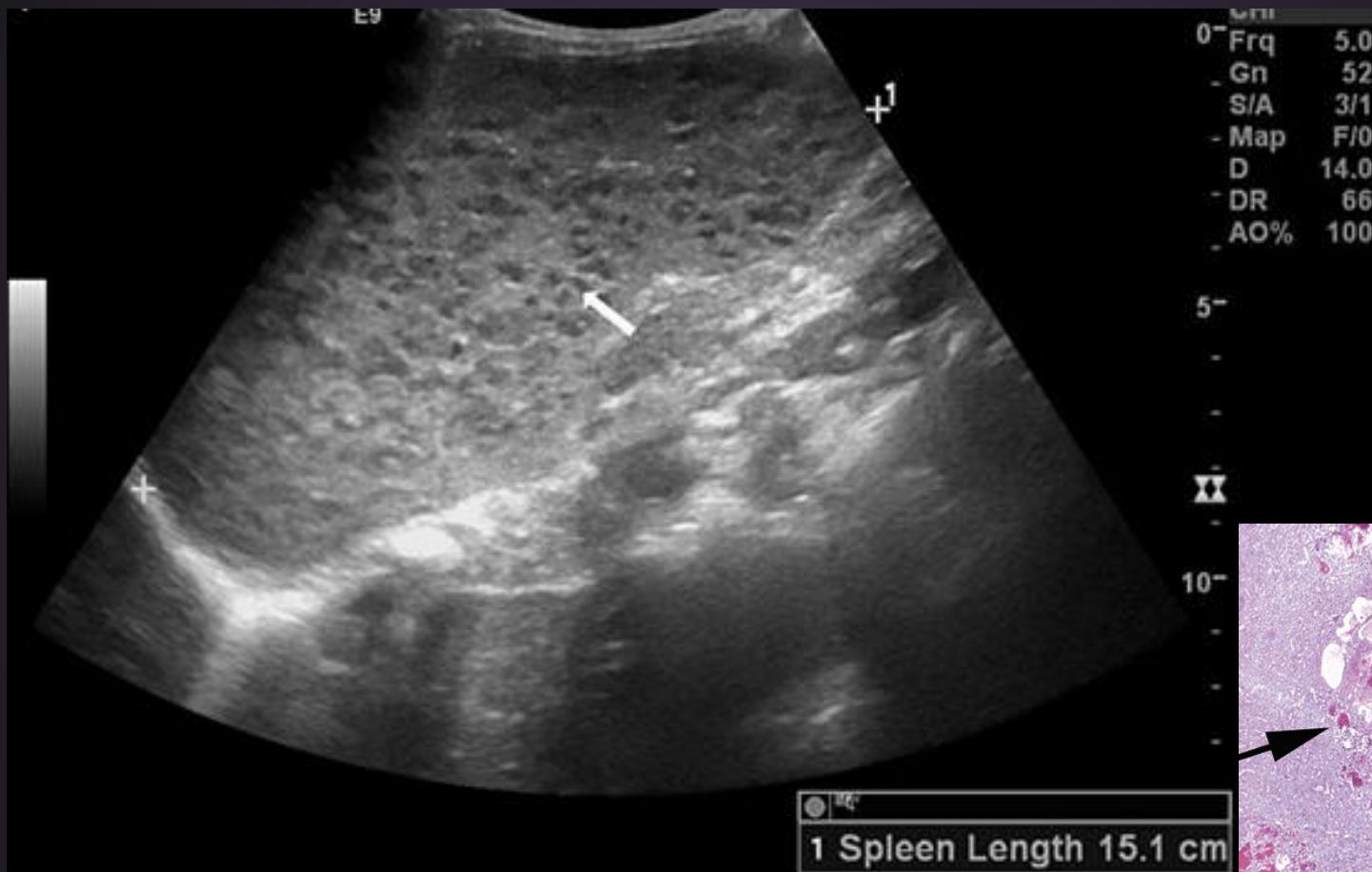
About 12cm\*7.5cm sized well circumscribed cystic lesion in spleen with focal wall calcification and some lobulation, confirmed as epidermoid cyst



# Peliosis of the Spleen

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- ♥ Sinusoidal dilation and formation of multiple, cystlike, blood-filled cavities within the parenchyma
- ♥ M/C in the liver, any other organs including spleen
- ♥ Use of anabolic steroids, hematologic disorders, TB, AIDS, cancer
- ♥ Potential of surface lesions to rupture and cause life-threatening intraperitoneal hemorrhage
  
- ♥ US: multiple, poorly defined, hypoechoic lesions
  - ❖ Thrombosis: hyperechoic
- ♥ CT: multiple, small, well-defined, hypoattenuating, cystlike lesions
- ♥ MRI: SI depends on the age and status of the blood components



F/3, splenomegaly

Multiple poorly defined hypoechoic lesions throughout the spleen in US suggesting peliosis

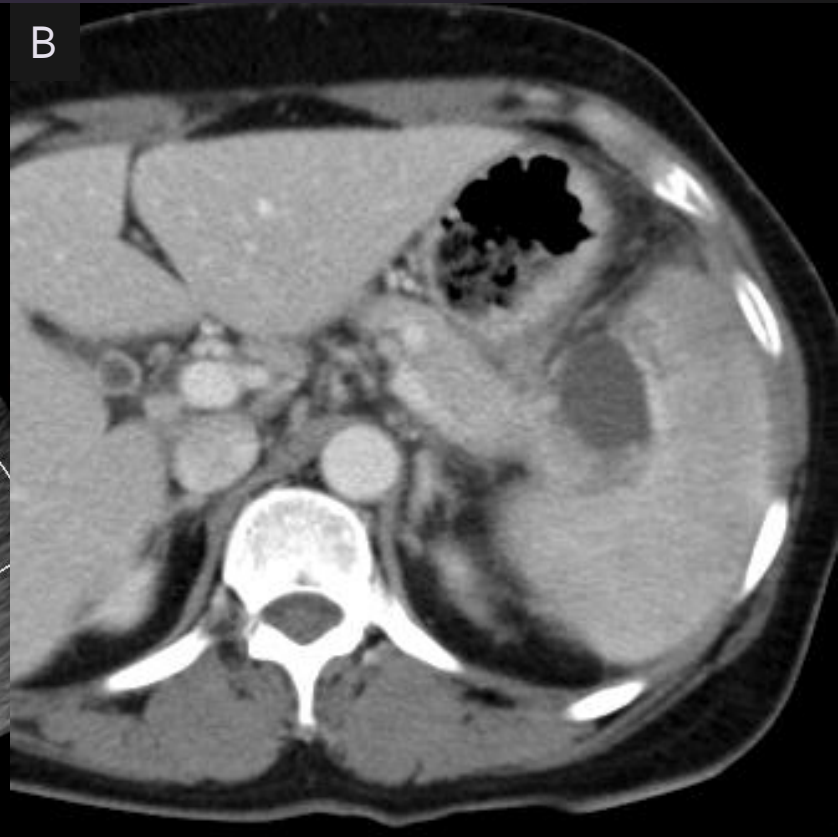
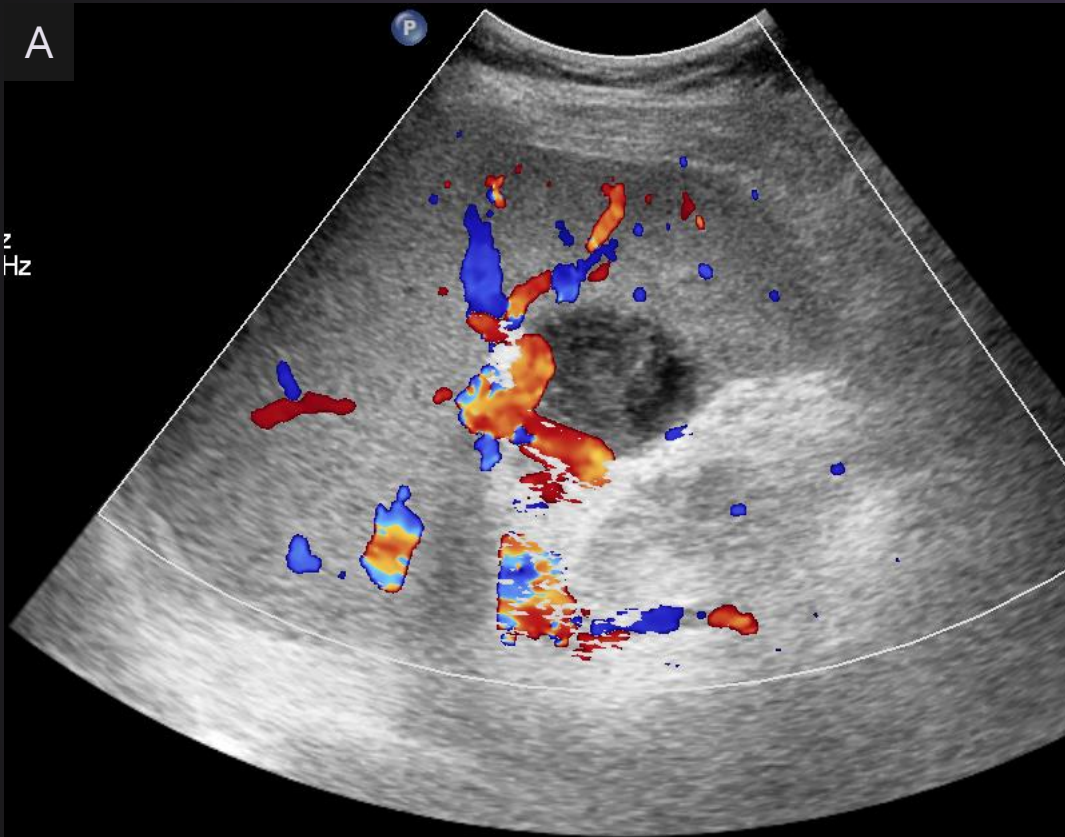


# INFECTION AND INFLAMMATORY DISEASES

# Pyogenic Abscess

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- ♥ Hematogenous spread (m/c), penetrating trauma, prior splenic infarction
- ♥ US: poorly defined hypoechoic or cystic lesions
  - ❖ Typical: hypoechoic (pus or debris) with internal septations, little distal acoustic enhancement
  - ❖ Atypical: reverberation artifacts from gas, rarely echogenic
- ♥ CT
  - ❖ Ill-defined low-attenuation lesions with peripheral enhancement
  - ❖ Internal air density, septations



F/60, abdominal pain

A) Oval heterogeneous echoic lesion in splenic hilum suggesting an abscess, and *Klebsiella pneumoniae* was identified in US-guided aspiration

B) Oval hypodense cystic lesion at splenic hilum



F/65, fever

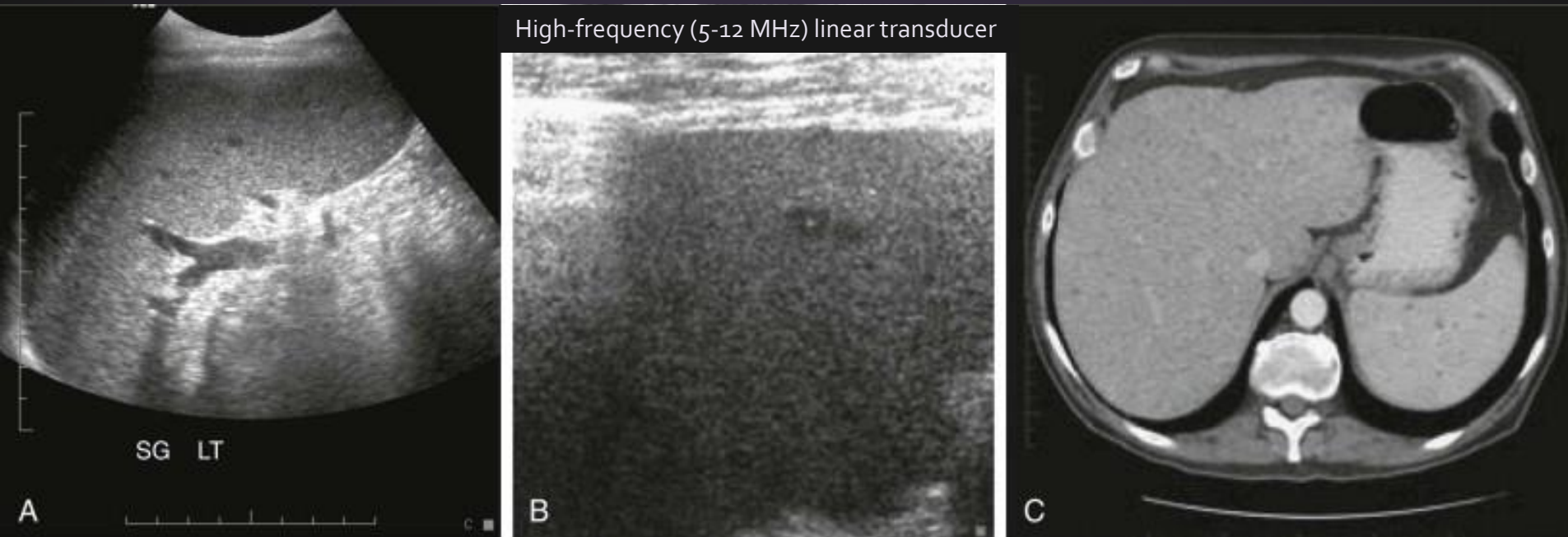
A) Round hypoechoic lesion with echogenic internal debris suggesting an abscess, and *Salmonella group D* was identified in US-guided aspiration

B) Round multiseptated hypodense cystic lesion in spleen

# Fungal Abscess and Microabscess

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- ♥ Typically in immunocompromised patients with neutropenia
  - ❖ AIDS, chemotherapy, immunosuppressive agents, lymphoproliferative disorders
  - ❖ *Candida* (m/c), *Aspergillus* , *Cryptococcus* , *Histoplasma*
- ♥ Microabscesses: target or "bull's-eye" appearance similar to hepatic microabscesses
  - ❖ Peripheral hypoechoic zone of fibrosis
  - ❖ Echogenic second wheel of inflammatory cells
  - ❖ Central echogenic nidus containing necrosis and fungal elements
  - ❖ Late stage with healing: small and hyperechoic with various degrees of posterior acoustic shadowing, with or without calcification



High-frequency (5-12 MHz) linear transducer

Disseminated *Candida* infection in a patient with acute myelogenous leukemia

- A) Transverse ultrasound image shows multiple, small, hypoechoic lesions in the splenic parenchyma
- B) Sonogram with a high-frequency (5-12 MHz) linear transducer demonstrates a small, hypoechoic nodule with a central echogenic nidus
- C) Contrast-enhanced CT shows numerous, subcentimeter, hypodense nodular lesions throughout the liver and spleen

# Tuberculosis

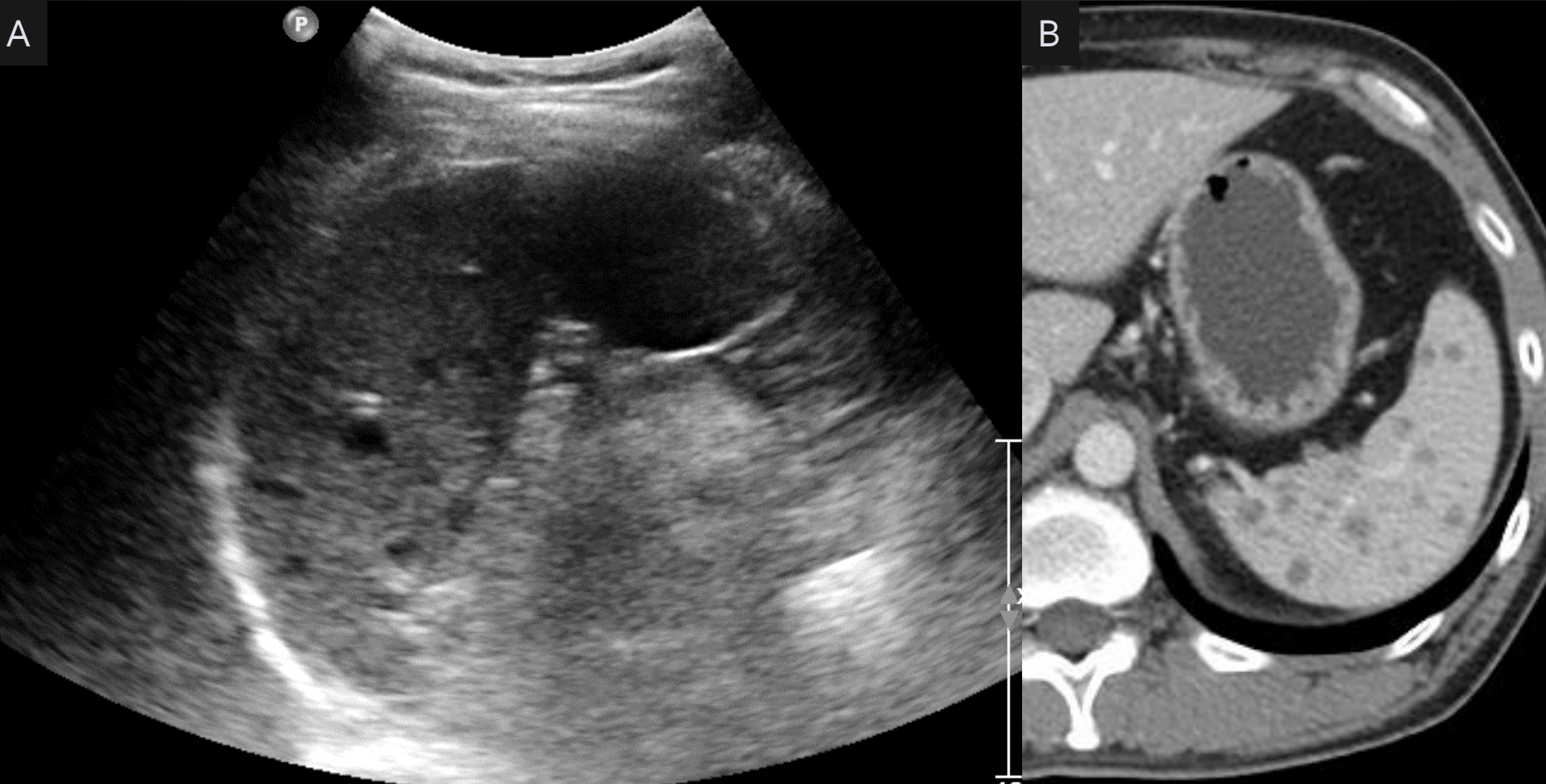
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- ♥ In the setting of disseminated, miliary infection
  - ❖ Spleen involvement in 80-100% at autopsy
- ♥ Multiple splenic nodules between 0.2 and 1 cm in diameter
- ♥ Associated lymphadenopathy

A

P

B



M/35, HIV (+), miliary TB

A) Transverse ultrasound image shows multiple small (less than 1cm) hypoechoic lesions in the splenic parenchyma, and US guided biopsy confirmed AFB(+), *M.tuberculosis*

B) Contrast-enhanced CT shows numerous, subcentimeter, hypodense nodular lesions throughout spleen

# Sarcoidosis

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- ♥ Systemic disease of unknown cause characterized by formation of noncaseating, epithelioid granulomas
- ♥ Splenomegaly, hepatomegaly, abdominal lymphadenopathy
- ♥ Nodules 0.1 - 3.0 cm
- ♥ US: hypoechoic to slightly hyperechoic or inhomogeneous
- ♥ CT: hypodense, no enhancement
- ♥ MR: hypointense on all MR sequences



F/69, sarcoidosis

Numerous tiny ill defined hypodense lesions in spleen



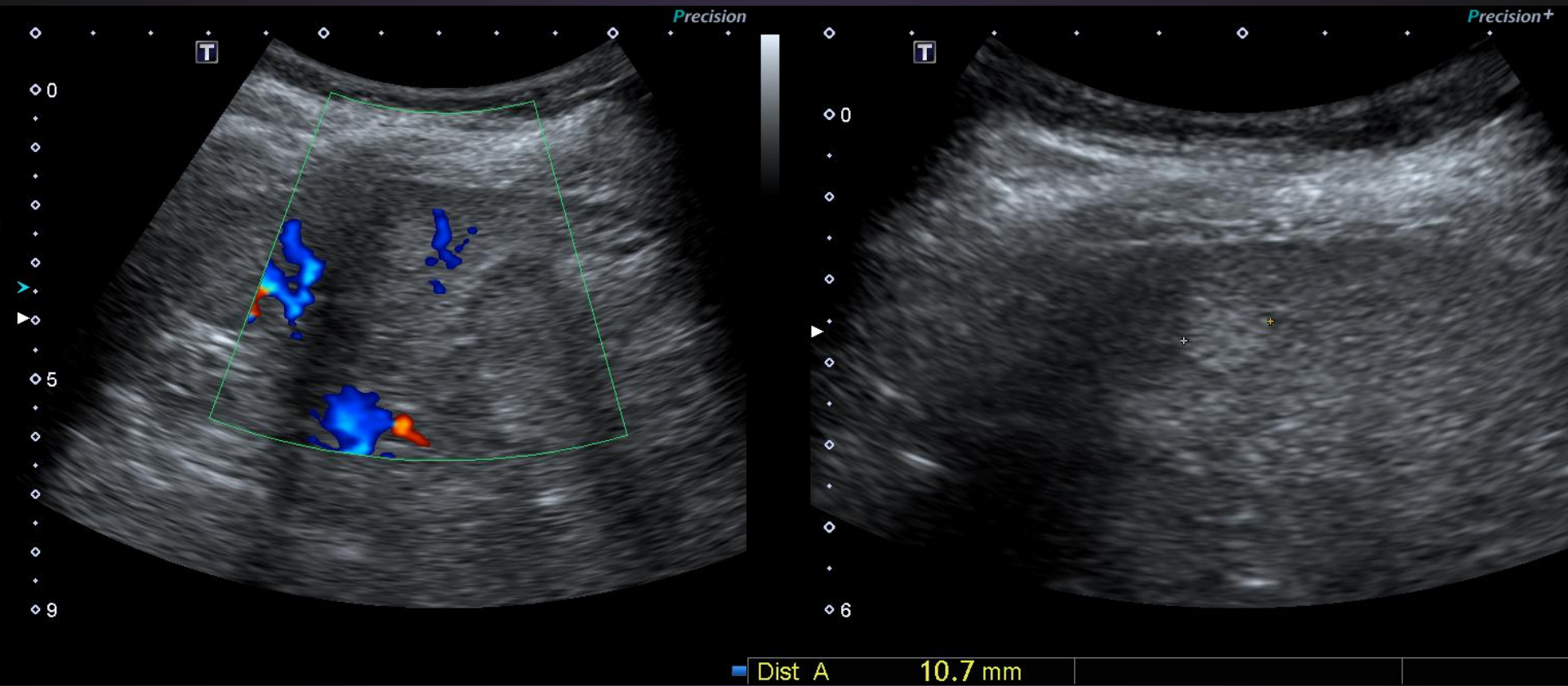
# BENIGN NEOPLASMS

# Hemangioma

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- ♥ Most common benign neoplasm of the spleen
- ♥ Incidentally found
  - ❖ Infarction, thrombosis, hemorrhage, or fibrosis
  - ❖ Rarely rupture, malignant degeneration
- ♥ Hemangiomatosis: multiple or diffuse
- ♥ Spectrum from solid to mixed to purely cystic
- ♥ US
  - ❖ Small splenic hemangiomas appear as discrete echogenic lesions similar to those in the liver
  - ❖ Large hemangiomas may appear as complex masses with both solid and cystic areas
  - ❖ Acoustic shadowing due to calcifications may be seen
- ♥ CT: hypodense lesions with persistent enhancement
- ♥ MRI: high SI on T2WI, persistent enhancement on delayed images

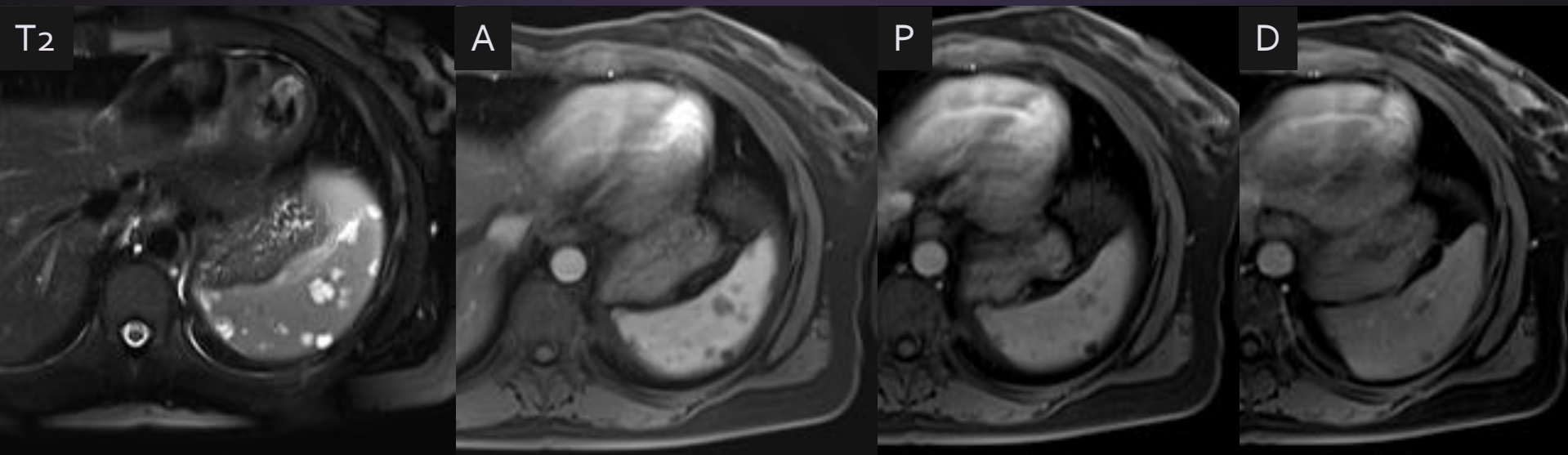
F/33



F/33, incidental finding of spleen

Multiple discrete round echogenic nodules in spleen with peripheral vascularity

MRI



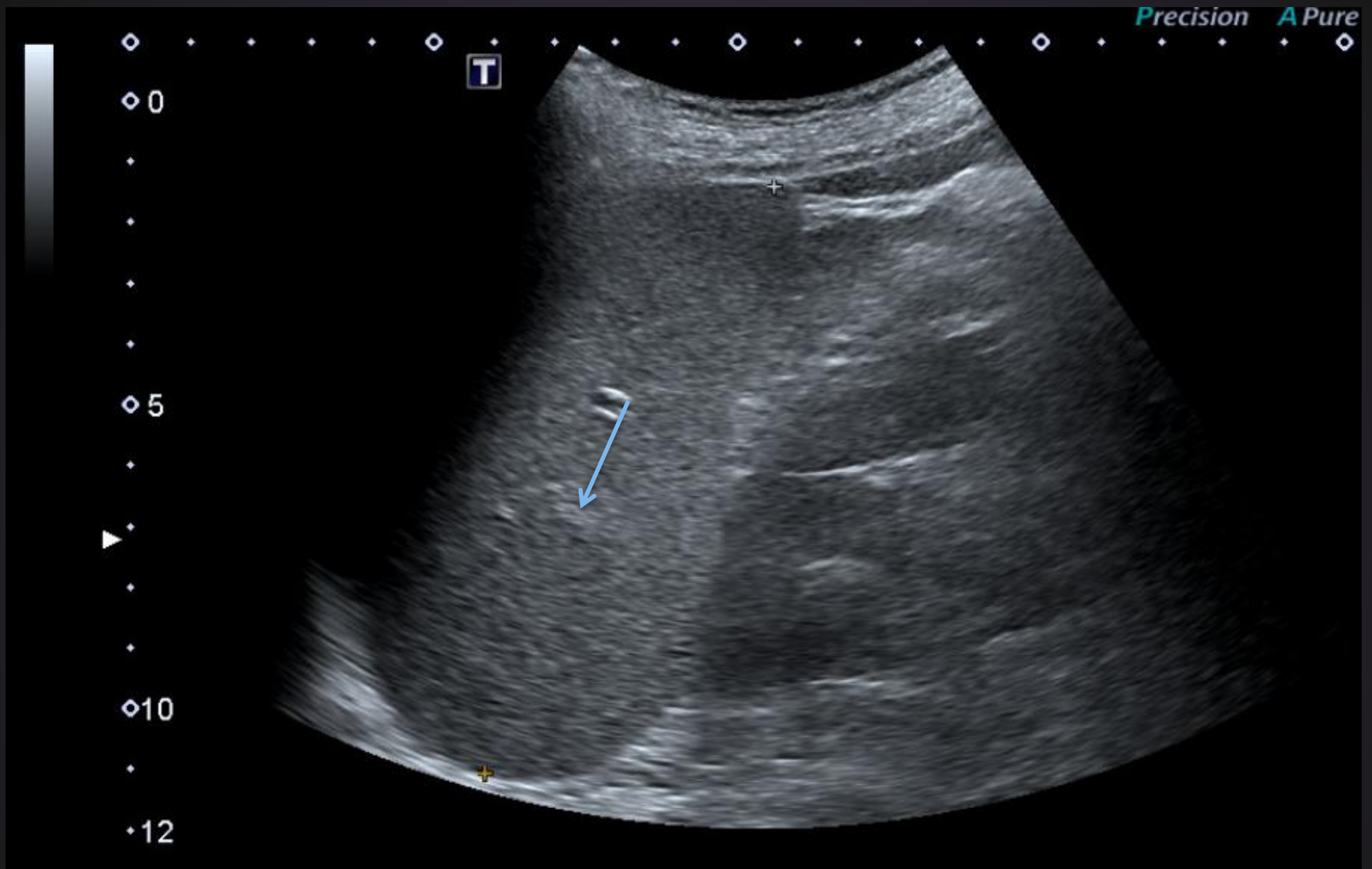
F/33, incidental finding of spleen

Multiple discrete round T2 high SI lesions with peripheral nodular and centripetal enhancement pattern suggesting hemangiomas

# Hamartoma

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- ♥ A rare benign tumor
- ♥ A spleen within a spleen, post-traumatic scar, nodular hyperplasia, hyperplastic nodule
  - ❖ Disorganized red pulp elements with reticuloendothelial cell proliferation
- ♥ Associated disorders
  - ❖ Hematologic disorders (pancytopenia, anemia, thrombocytopenia)
  - ❖ Tuberous sclerosis and wiskott-aldrich-syndrome
- ♥ Expansile growth with compression of surrounding splenic tissue without a true capsule
- ♥ US: mostly hyperechoic, homogeneous and well-defined appearance
- ♥ CT: isodense, calcification, cystic/necrotic change, fat
- ♥ MRI: T<sub>1</sub> iso SI T<sub>2</sub> hyper SI, immediate diffuse heterogeneous enhancement



M/70, abdominal discomfort

About 5cm sized round slightly echogenic mass in spleen upper pole, confirmed as hamartoma

Pre



Arterial

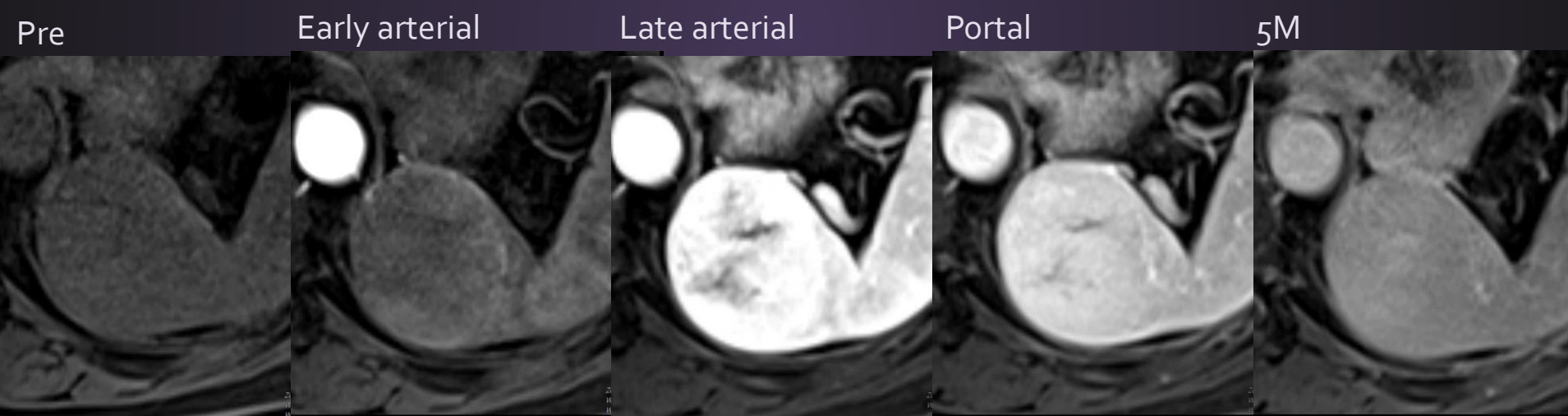
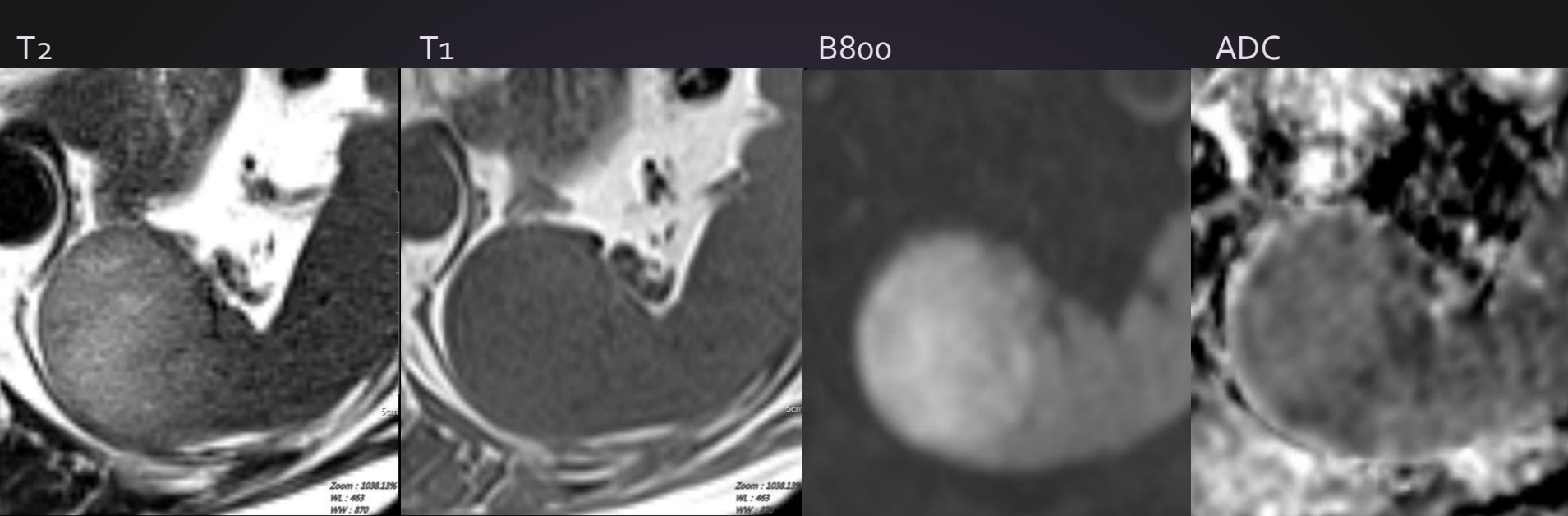


Portal



M/70, abdominal discomfort

About 5cm sized ill defined heterogeneous enhancing mass in the spleen confirmed as hamartoma



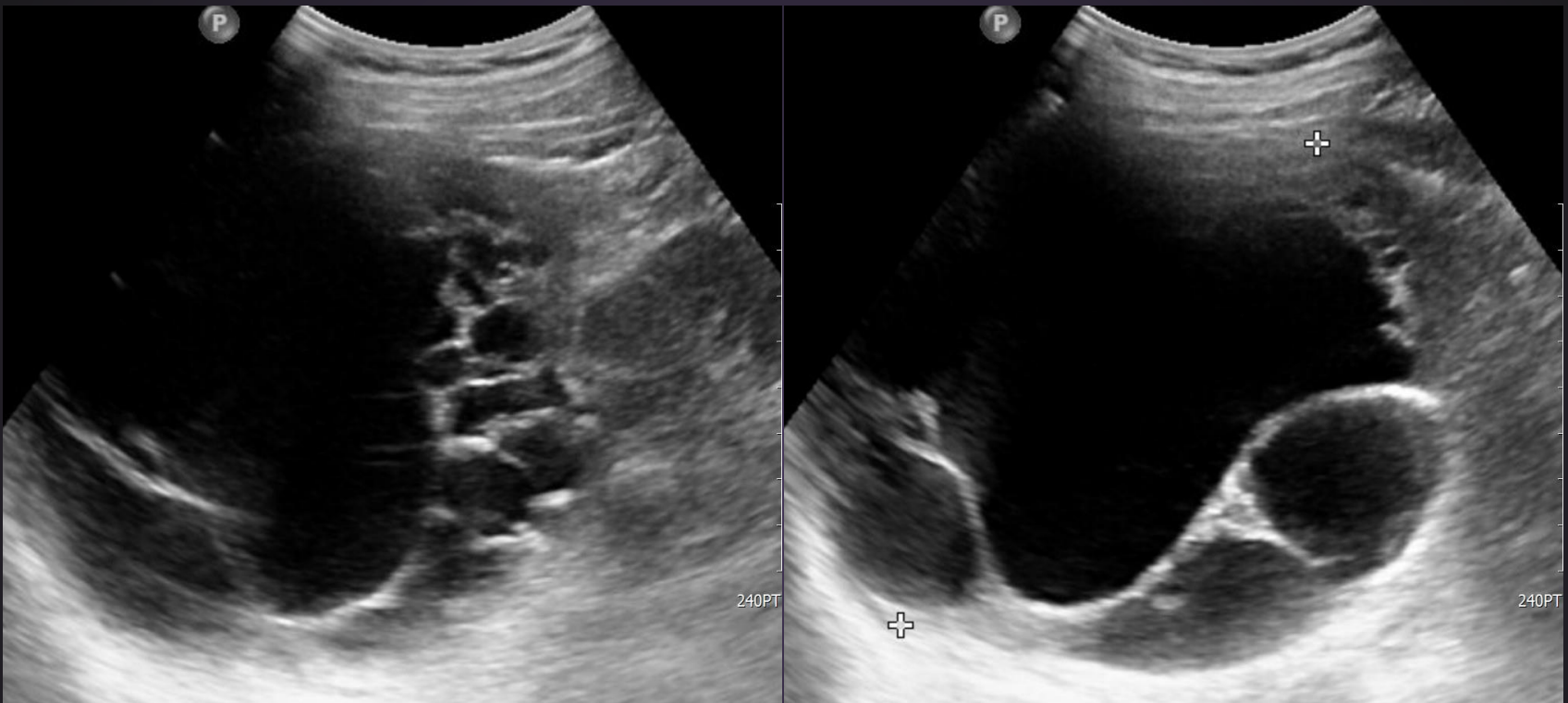
M/70, abdominal discomfort

About 5cm sized round T1 iso, T2 subtle high SI with centripetal enhancement pattern without significant restricted diffusion confirmed as hamartoma

# Lymphangioma

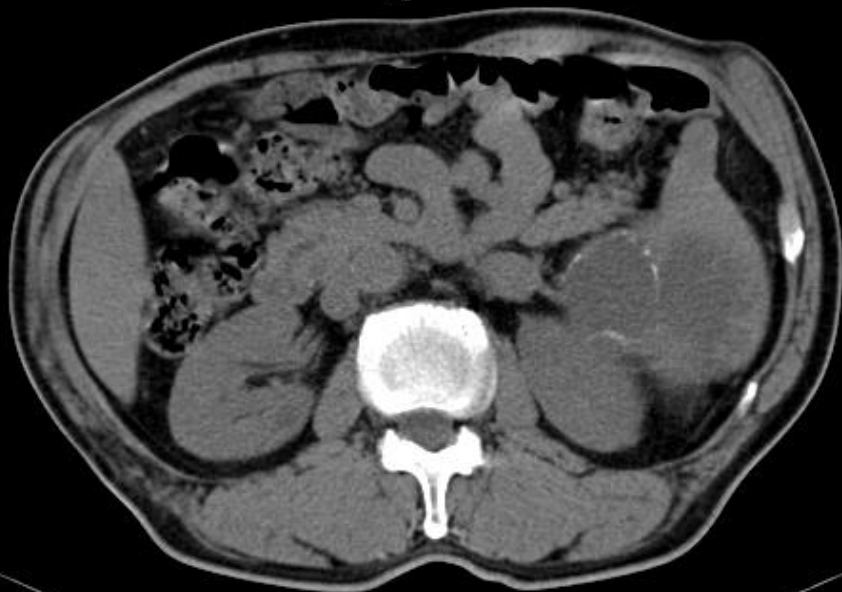
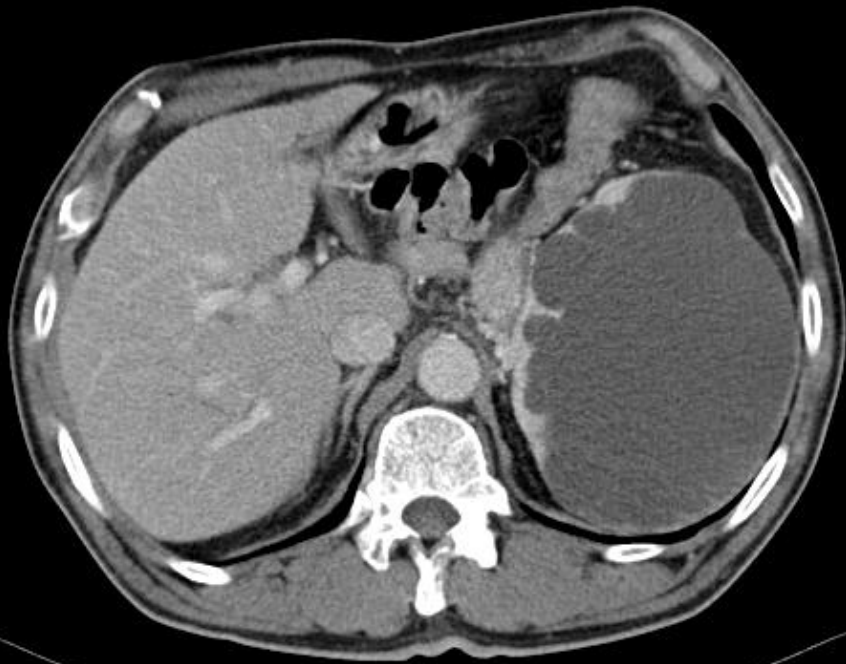
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- ♥ Benign, slow-growing, congenital neoplasm
- ♥ Typically seen in childhood
- ♥ Subcapsular, multicystic lesions filled with watery pink proteinaceous fluid
- ♥ US: multiple cysts (mm-cm) with thin septae, calcifications, various internal echoes depending on contents
- ♥ CT
  - ❖ Multiple discrete, nonenhancing low-attenuation lesions
  - ❖ Usually subcapsular in location
  - ❖ Curvilinear peripheral mural calcifications
- ♥ MR: well-circumscribed fluid SI lesions



F/74, incidental finding in spleen

About 12cm sized multiloculated cystic lesion in spleen upper pole



CT: multilobulated cystic mass in spleen with thin wall calcification  
 Multi-locular cystic change, filled with serous fluid and yellowish calcification in gross specimen, confirmed as lymphangioma

# Sclectrosing Angiomaatoid Nodular Transformation

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- ♥ A rare benign vascular tumor composed of multiple red pulp nodules made from endothelial cells interspersed with fibrous bands
- ♥ Associated with pancytopenia and ↑ESR
- ♥ US: hypoechoic mass
- ♥ CT: hypoattenuating mass with peripheral enhancing radiating lines (spoke-wheel appearance)
- ♥ MRI
  - ❖ T2WI: heterogeneous hypointense mass with hyperintense central scar
  - ❖ T1WI: heterogeneous hypointense mass with multiple peripheral enhancing radiating lines

2D  
57%  
C 55  
P Med  
HGen



Dist 5.25 cm  
Dist 3.89 cm

2D  
57%  
C 55  
P Med  
HGen

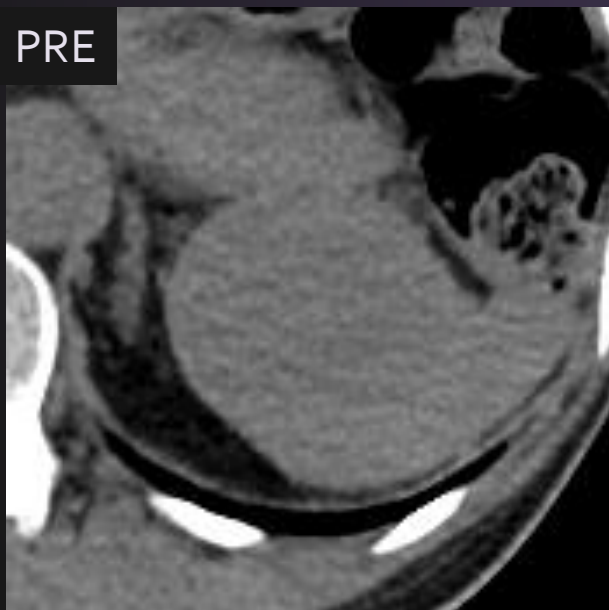


Dist 4.51 cm  
Dist 4.25 cm

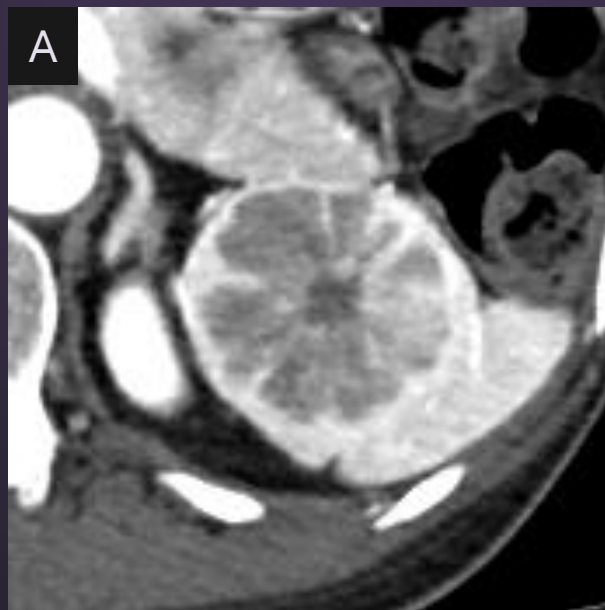
F/51, abnormal finding in abdomen US

About 5.2 x 3.9 cm sized well-defined oval high echoic mass abutting spleen, between spleen and left kidney.

PRE



A



D

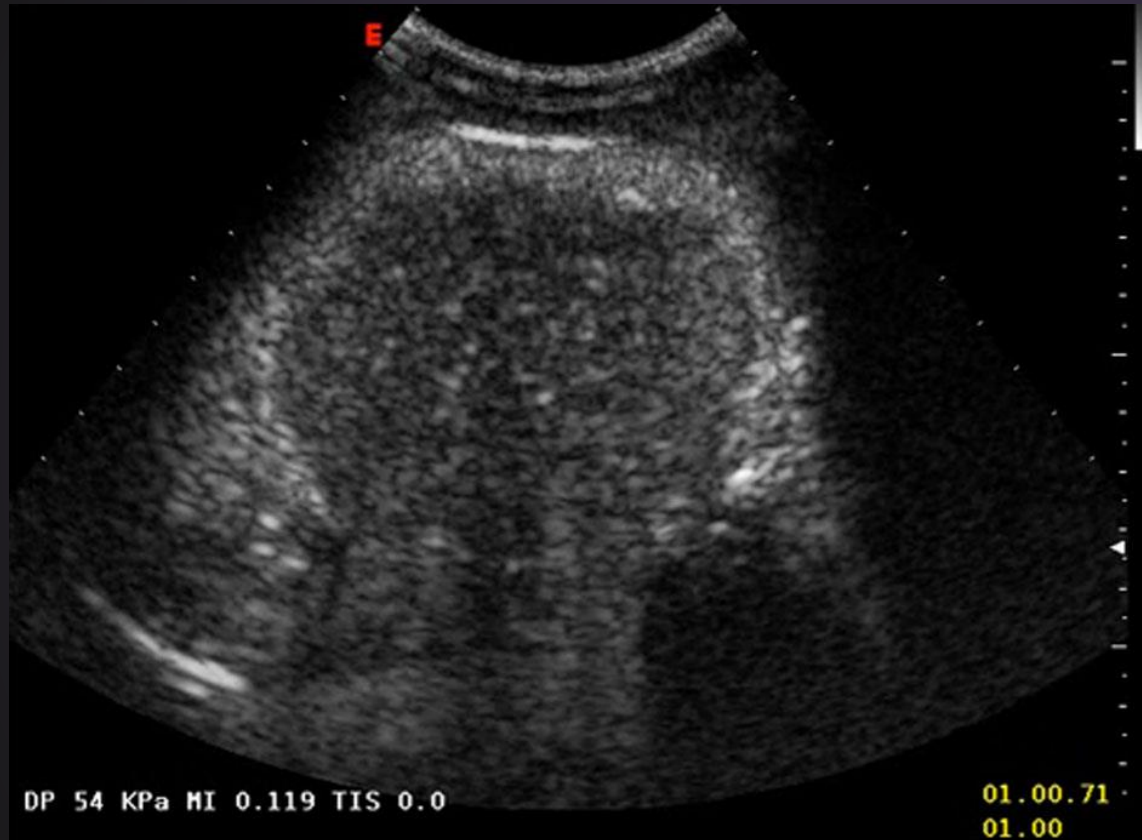


Characteristic spoke-wheel appearance in the arterial phase and delayed fill-in suggesting sclerosing angiomatoid nodular transformation and central nonenhancing hypodense portion within the mass, suggesting central scar or necrosis

# Inflammatory Pseudotumor

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- ♥ Unusual, nonspecific, inflammatory reparative response to injury such as infection
- ♥ A mixture of inflammatory cells and a component of myofibroblastic spindle cells
- ♥ US: well-defined hypoechoic mass, acoustic shadowing on calcification
- ♥ CT
  - ❖ Well-circumscribed solitary low attenuation mass
  - ❖ Gradual filling of the lesion on delayed phase imaging
  - ❖ Central satellite area corresponding to fibrous plaque



F/28, epigastric discomfort

Hypoechoic round mass in spleen confirmed as inflammatory pseudotumor

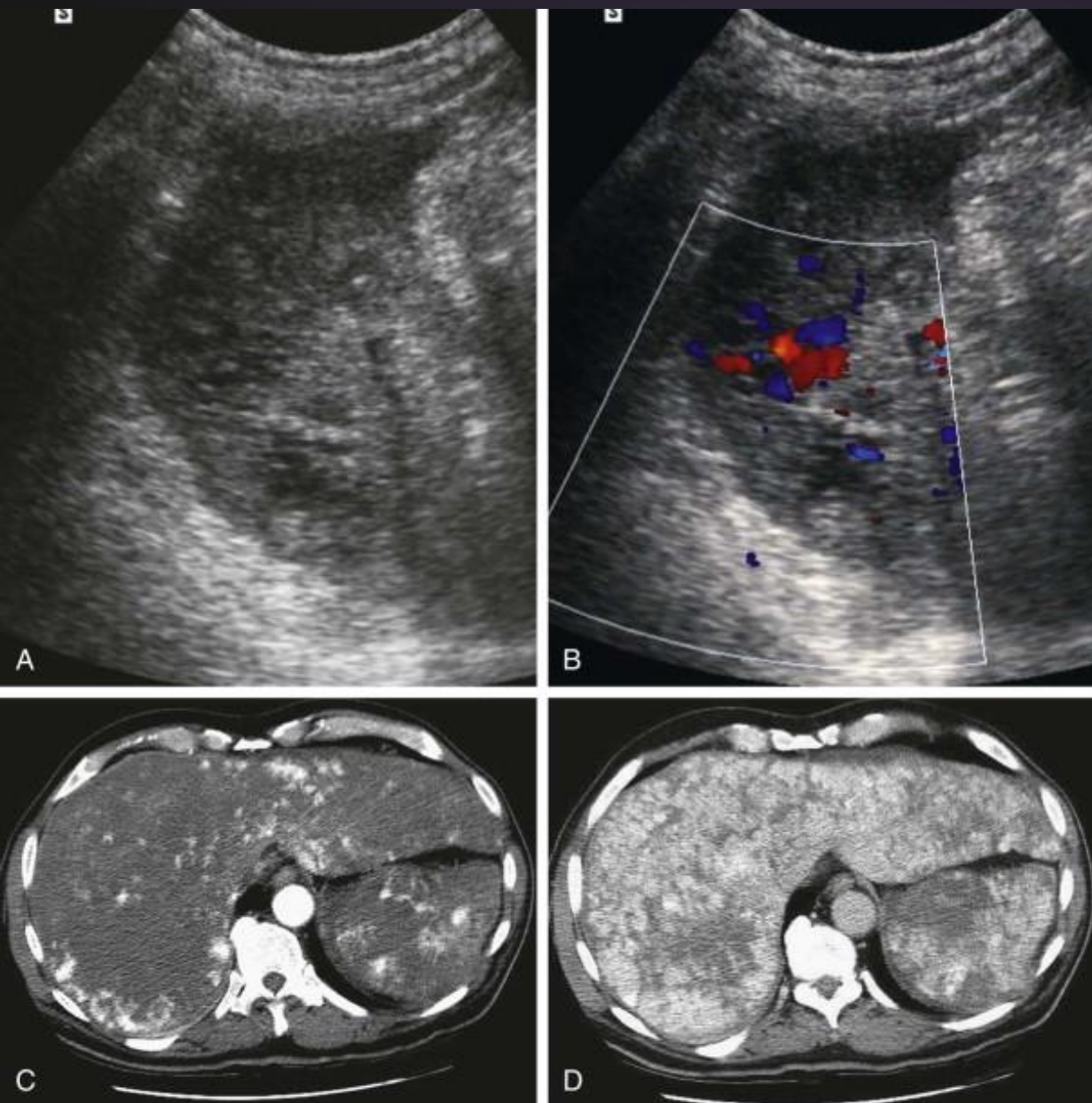
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# **MALIGNANT NEOPLASMS**

# Angiosarcoma

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- ♥ M/C primary nonhematopoietic malignant tumor of the spleen
  - ❖ Arises from the endothelial lining of splenic blood vessels
- ♥ Well-defined mass or diffusely infiltrative
- ♥ Clinical presentation: LUQ pain, anemia, thrombocytopenia
- ♥ US: splenomegaly and numerous, solid, ill-defined masses with a heterogeneous architecture
- ♥ CT: multiple, ill-defined, hypervascular masses with heterogeneous contrast enhancement and areas of necrosis
  - ❖ Intrasplenic, subcapsular, or perisplenic hemorrhage



### Angiosarcoma of liver and spleen

A) Ultrasound demonstrates a normal-sized, inhomogeneous spleen with a few cystic areas

B) Color flow is demonstrated in some of these areas, consistent with vascular lakes

C,D) CT after intravenous administration of contrast material in the arterial phase (C) and portal venous phase (D) shows many irregular areas of enhancement in the liver and spleen and areas of relatively low attenuation in the spleen

Autopsy revealed multiple angiosarcomas involving the spleen and liver (unknown primary site)

# Lymphoma

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- ♥ M/C malignant tumor of spleen
- ♥ Patterns of involvement
  - ❖ Homogeneous enlargement without masses
  - ❖ Miliary masses (<5 mm): follicular, mantle cell lymphoma
  - ❖ Multiple solid masses of various sizes
  - ❖ A large, solitary mass (>5 cm): large cell lymphoma
- ♥ US: splenomegaly with a normal echotexture, hypoechoic masses
- ♥ CT: low attenuation best seen on portal venous phase
- ♥ MRI
  - ❖ T<sub>1</sub>WI : low to intermediate SI
  - ❖ T<sub>2</sub>WI : mild to moderate high SI
  - ❖ Hypoenhancing to background splenic parenchyma



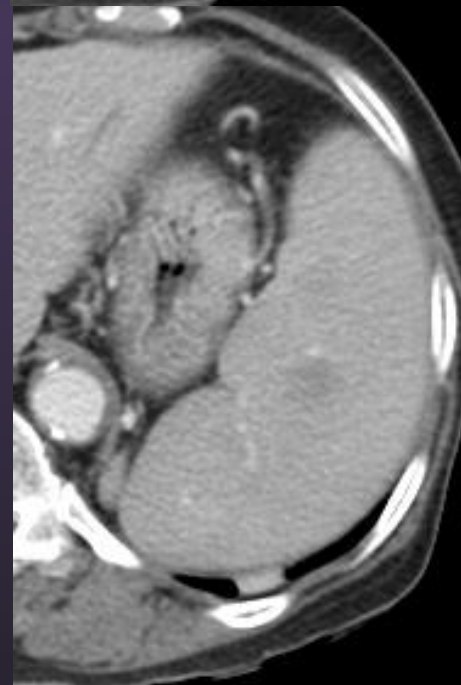
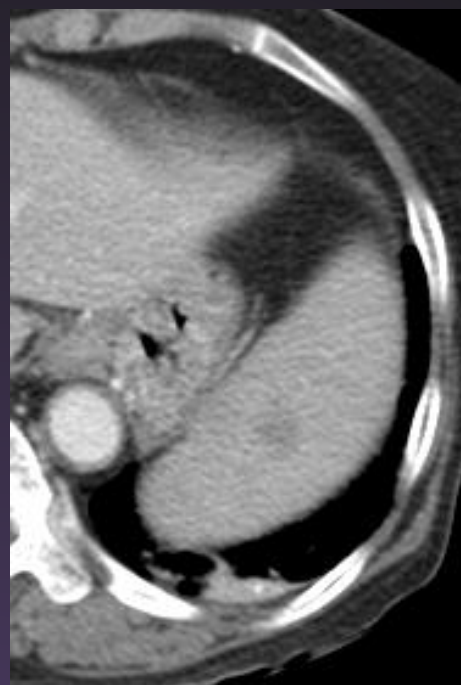
F/56, diffuse large B-cell lymphoma (DLBCL) patient with spleen involvement

Numerous conglomerated hypodense nodules are noted in the entire spleen with resulting splenomegaly



M/58, left flank pain and weight loss in DLBCL patient

Huge splenomegaly with multiple poorly defined mass like lesions combined with multifocal infarction, biopsy confirmed DLBCL involvement

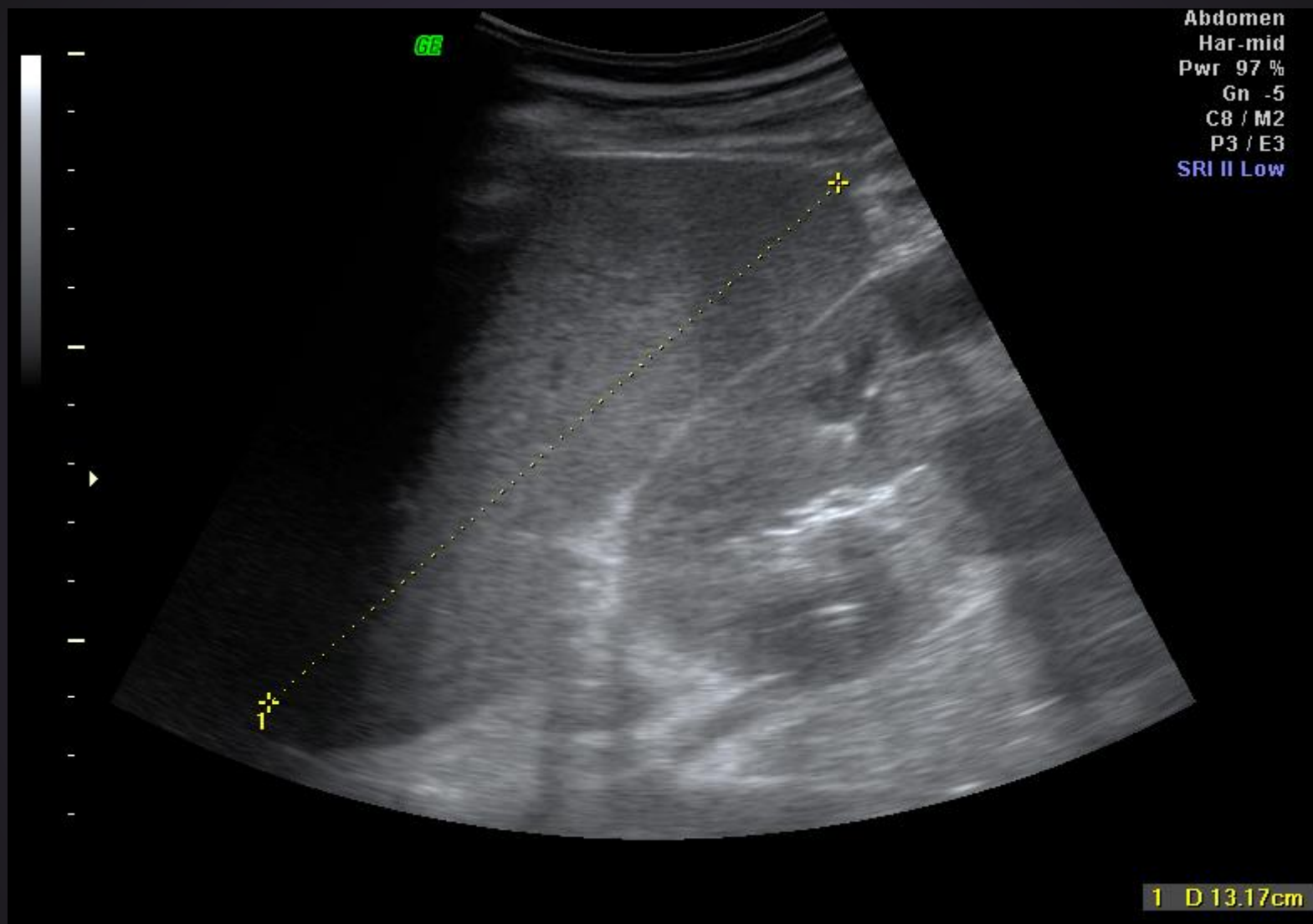


F/76, DLBCL patient  
Splenomegaly with ill-defined low density lesions confirmed as DLBCL involvement

# Leukemia and Myeloproliferative Disorders

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- ♥ Mainly affect the red pulp
- ♥ Splenomegaly
- ♥ US: often hyperechoic focal lesions (unlike lymphoma)



M/36 Acute myeloid leukemia  
Splenomegaly

# Metastasis

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- ♥ Most commonly present with solitary or multiple nodules
- ♥ Melanoma (34%), breast (12%), ovary (12%), colon (10%), lung (9%)
- ♥ US: variable appearance
  - ❖ Hypoechoic (50%), mixed, cystic, a target or halo appearance
  - ❖ Hyperechoic: melanoma, colon cancer
- ♥ CT: ill-defined, hypodense, rounded lesions
- ♥ MRI: T<sub>1</sub> low SI, T<sub>2</sub> high SI, various enhancement



F/48, rectal cancer patient with multiple metastases and peritoneal carcinomatosis  
Several round echogenic nodules and masses in spleen suggesting metastases

The background of the slide is a dark purple gradient with a bokeh effect, featuring numerous out-of-focus light circles of varying sizes and brightness, creating a dreamy, ethereal atmosphere.

# DIFFERENTIAL DIAGNOSIS

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### Diffuse abnormal echogenicity

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#### Increased

Polycythemia  
Sarcoidosis  
Leukemia  
Tuberculosis  
Malaria  
Brucellosis

#### Decreased

Congestion from portal hypertension  
Leukemia  
Lymphoma  
Multiple myeloma

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Mass		
Hypoechoic	Echogenic	Heterogeneous
Hamartoma	Hereditary spherocytosis	Hematoma
Hemangioma	Chronic infarction	Abscess
Cysts	Hematoma	Infarction
Lymphangiomatosis	Metastases	Angiosarcoma
Lymphoma	Calcified granulomas	Hemangioma
Metastases	Plasmacytoma	Hemangiosarcoma
Abscess		
Septic emboli		
Infarction		
Granulomatous disease (TB, sarcoidosis)		
Splenic artery aneurysm		

## Splenomegaly

Normal echogenicity	Echogenic	Hypoechoic
Congestion from portal hypertension	Leukemia	Noncaseating granulomatous infection
Myelogenous leukemia	Lymphoma	Lymphoma
Infection	Malaria	Multiple myeloma
Sickle cell disease (early)	Tuberculosis	Chronic lymphocytic leukemia
Hereditary spherocytosis	Brucellosis	Congestion from portal hypertension
Hemolysis	Sarcoidosis	
Still's disease	Polycythemia	
Felty's syndrome	Hereditary spherocytosis	
Wilson's disease	Portal vein thrombosis	
Polycythemia	Dysgammaglobulinemia	
Myelofibrosis	Myelofibrosis	
	Hematoma	
	Metastases	

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