Ultrasound of the Pancreas, spleen and kidneys

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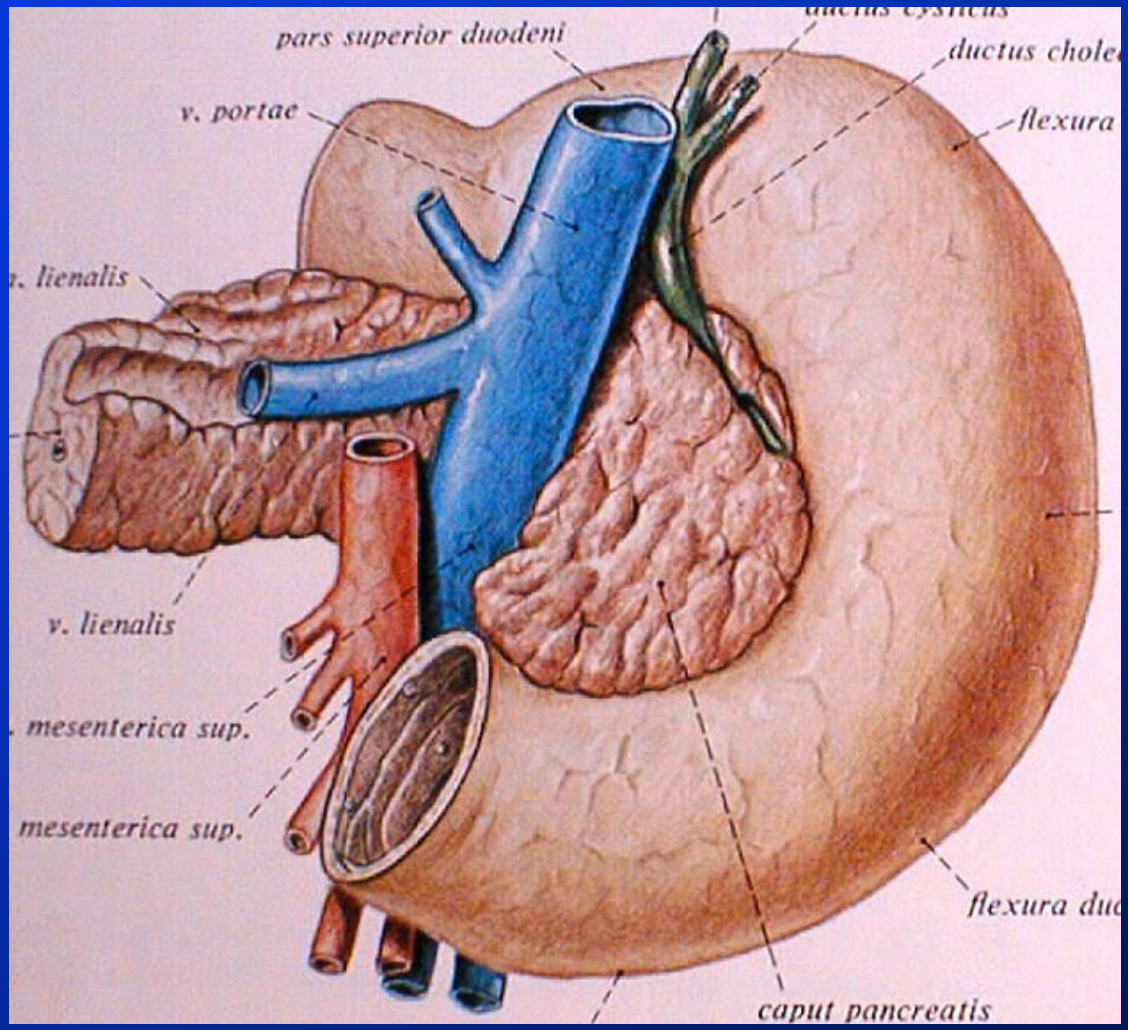
Pancreas viewed from behind

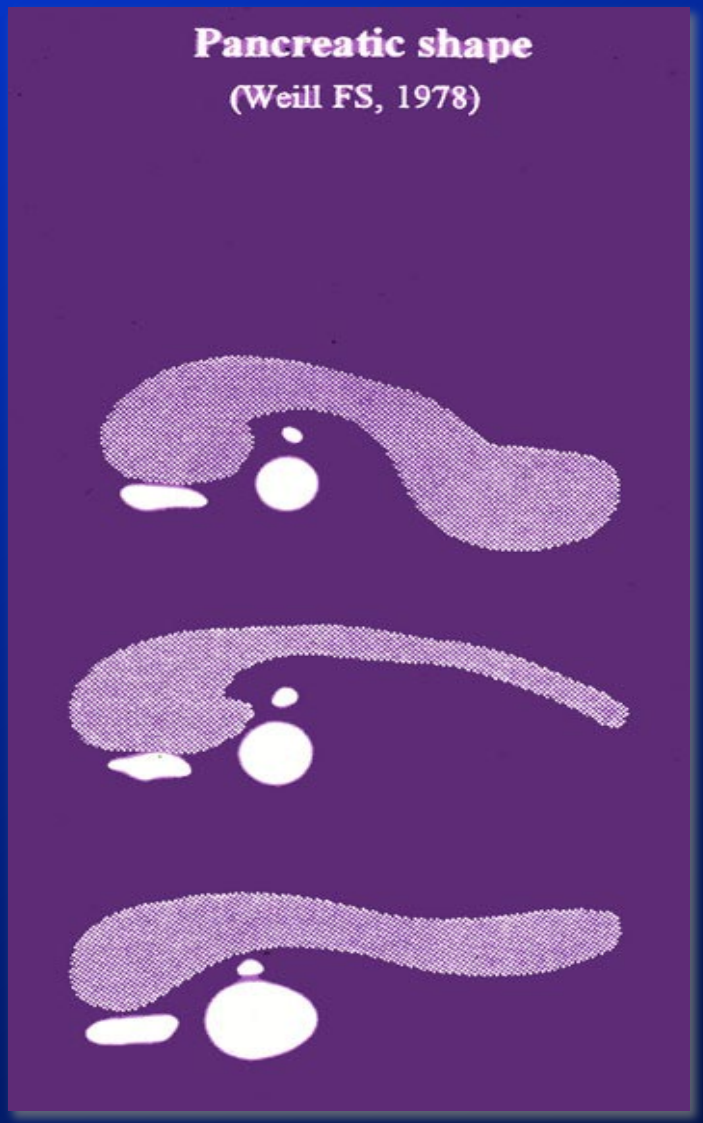


Pancreatic size and shape

- Antero-posterior diameter - considerable variation - decreasing with increasing age
  - Head - 25 mm
  - Body - 15 mm
  - Tail - 35 mm

DeGraff C et al. Radiology 1978

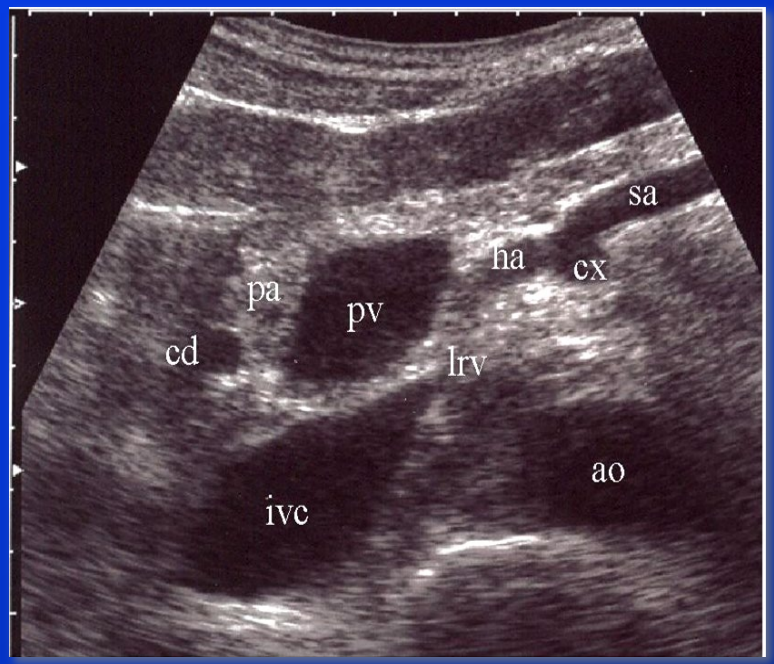
Niederau C et al. Radiology 1983



Scanning Technique

- Patient in supine position
- Start with curvilinear scanhead 3-5 MHz
- Transversal, oblique and sagittal scanning
- Problem:
  - Air in stomach, duodenum, or colon
- Solution:
  - Let the patient sit or stand
  - Let the patient drink 150-300 ml of fluid
- Examine the tail through the spleen !

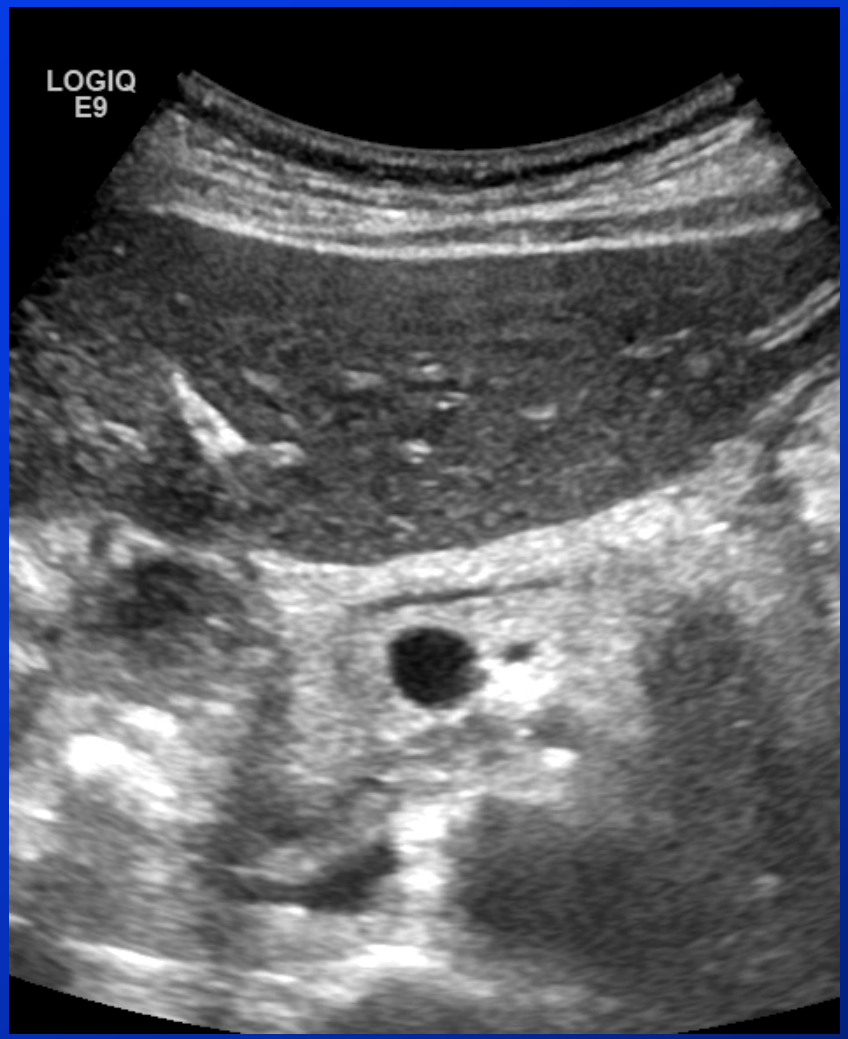
Pancreatic Sonoanatomy

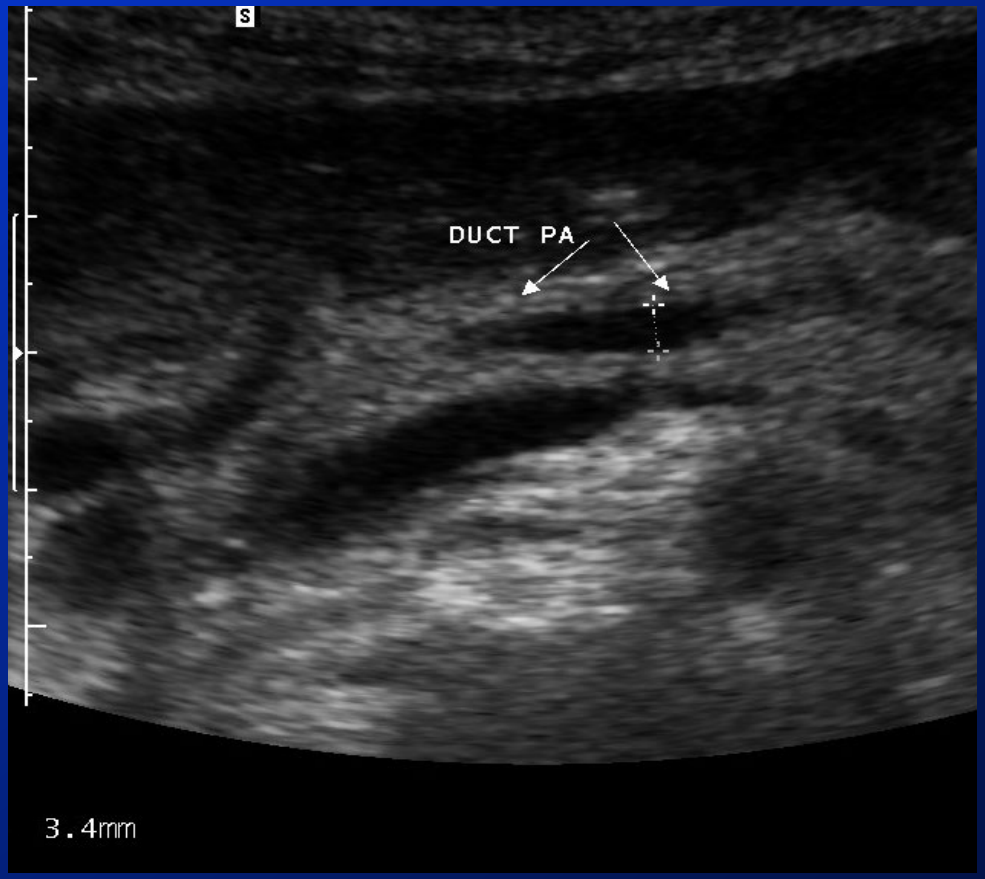


- ”Pancreas is most easily defined by its surrounding blood vessels”

Elderly persons have more echogenic pancreas

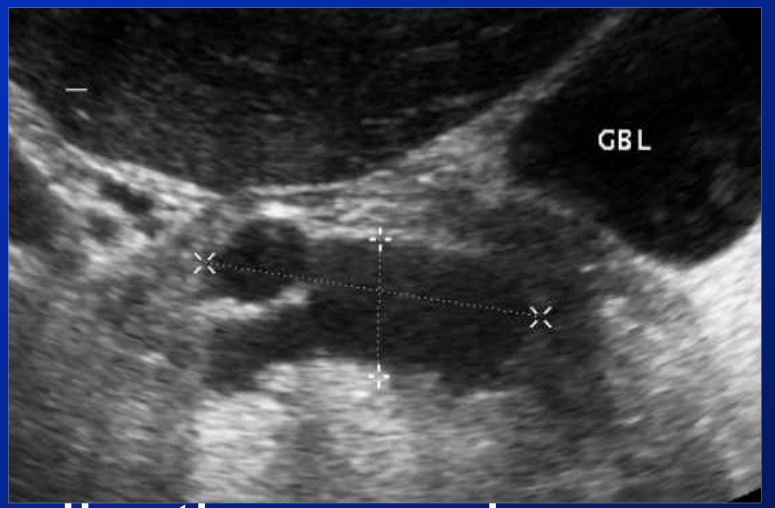
Ductus Pancreaticus



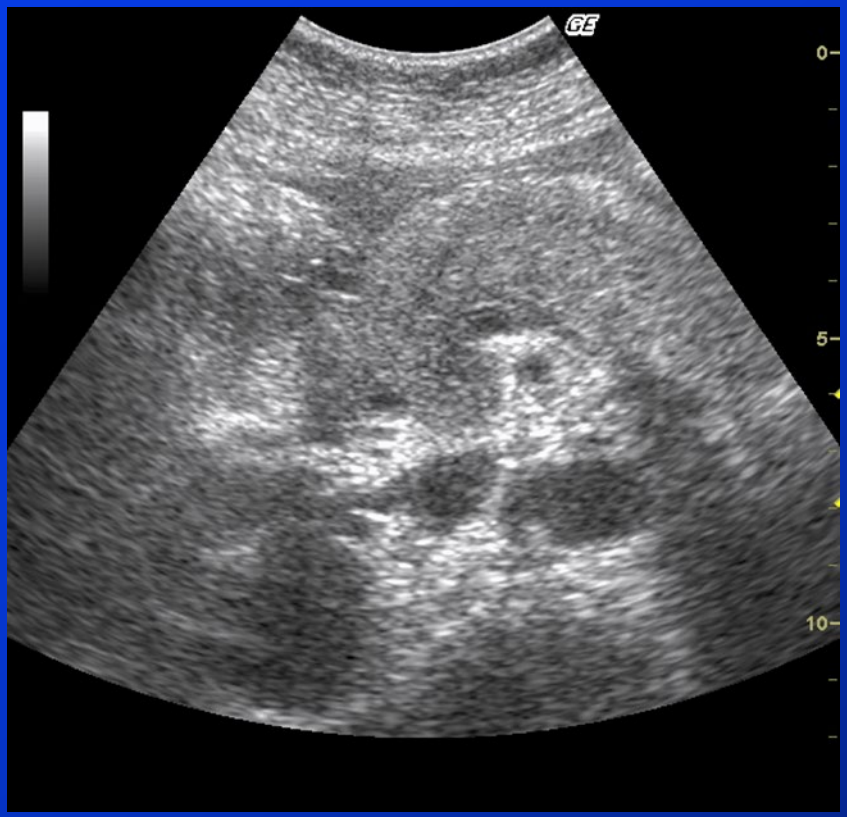


Acute Pancreatitis

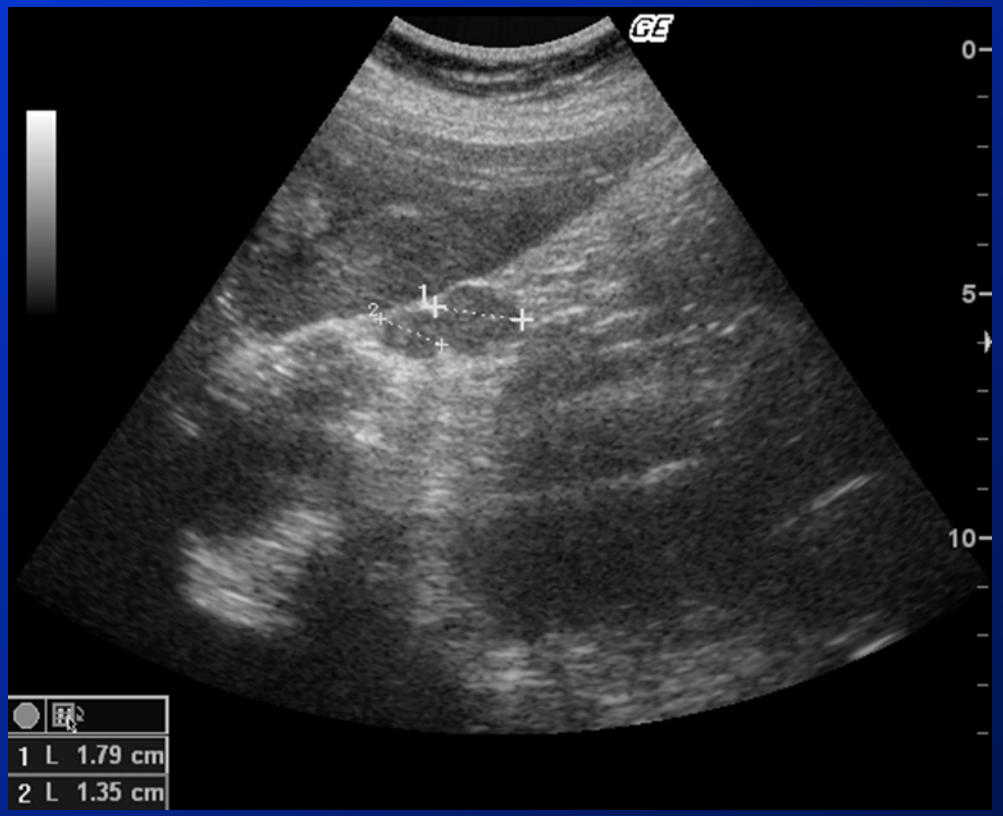
- Oedema, diffuse or focal, in peripancreatic fat
- Poorly defined margins
- Hypoechogenic texture
- Free intraperitoneal fluid
- Compression of veins
- Fluid migration to pleura, mediastinum and pericardium
- CT is the best method in acute pancreatitis



Acute Pancreatitis

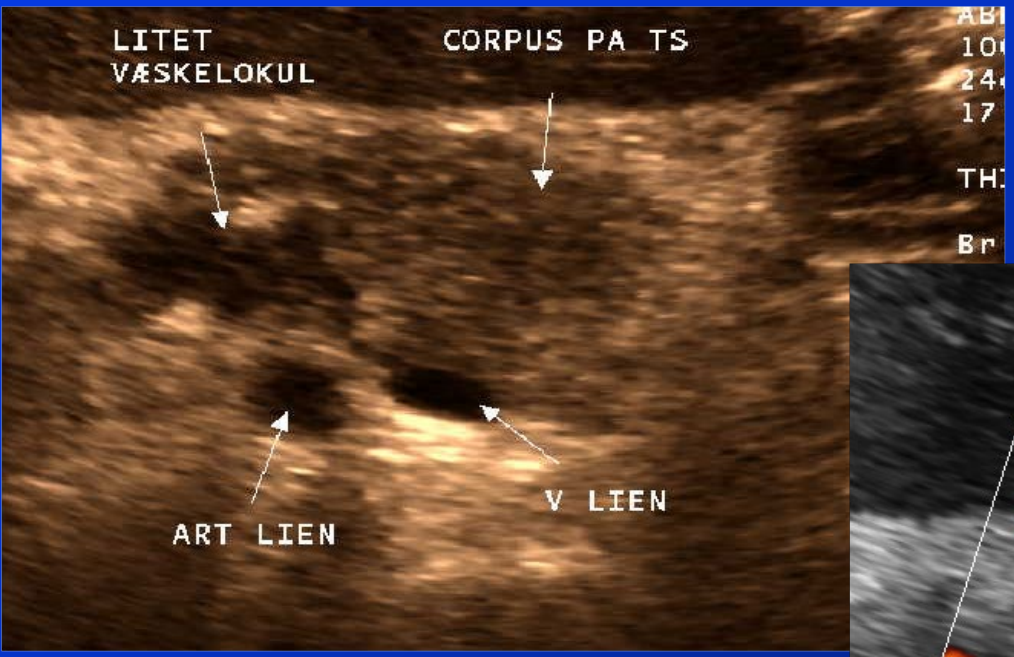


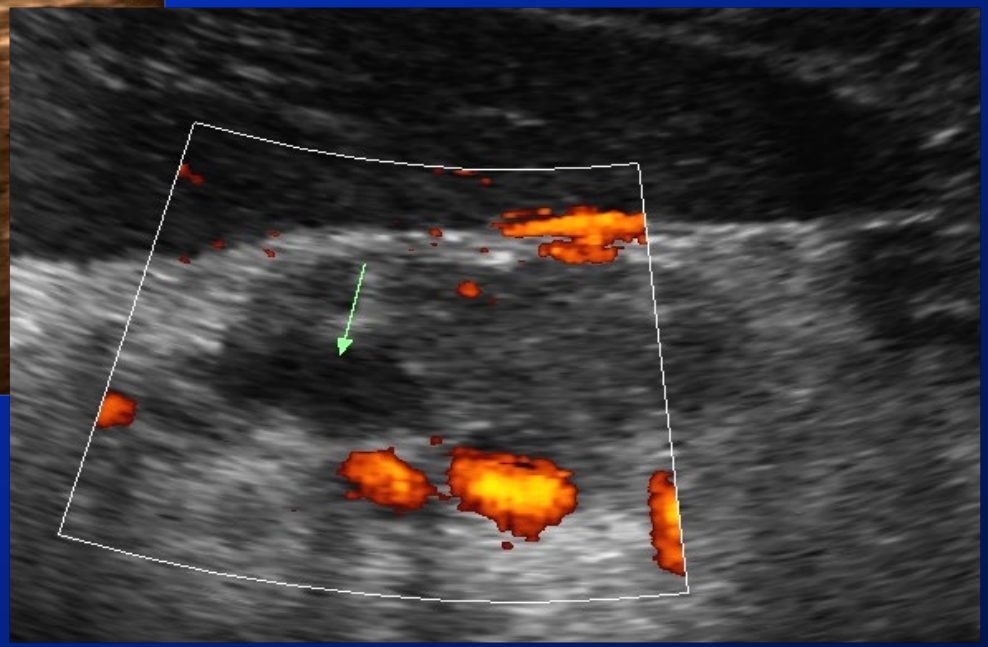
Enlarged pancreas



Enlarged Lymphnodes

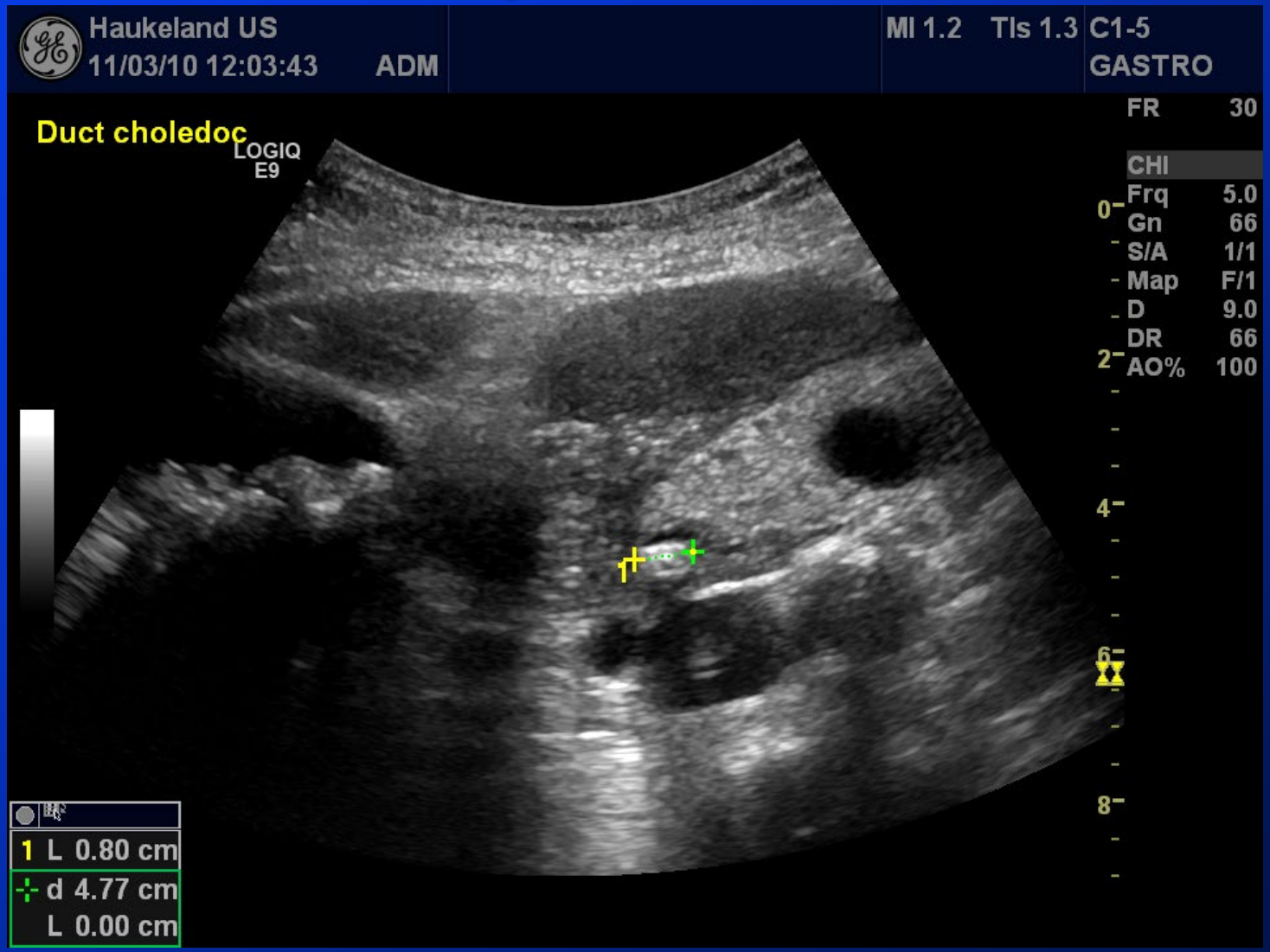
Transabdominal ultrasound in acute pancreatitis





Fluid collections

Look for the cause of acute pancreatitis!



Chronic Pancreatitis

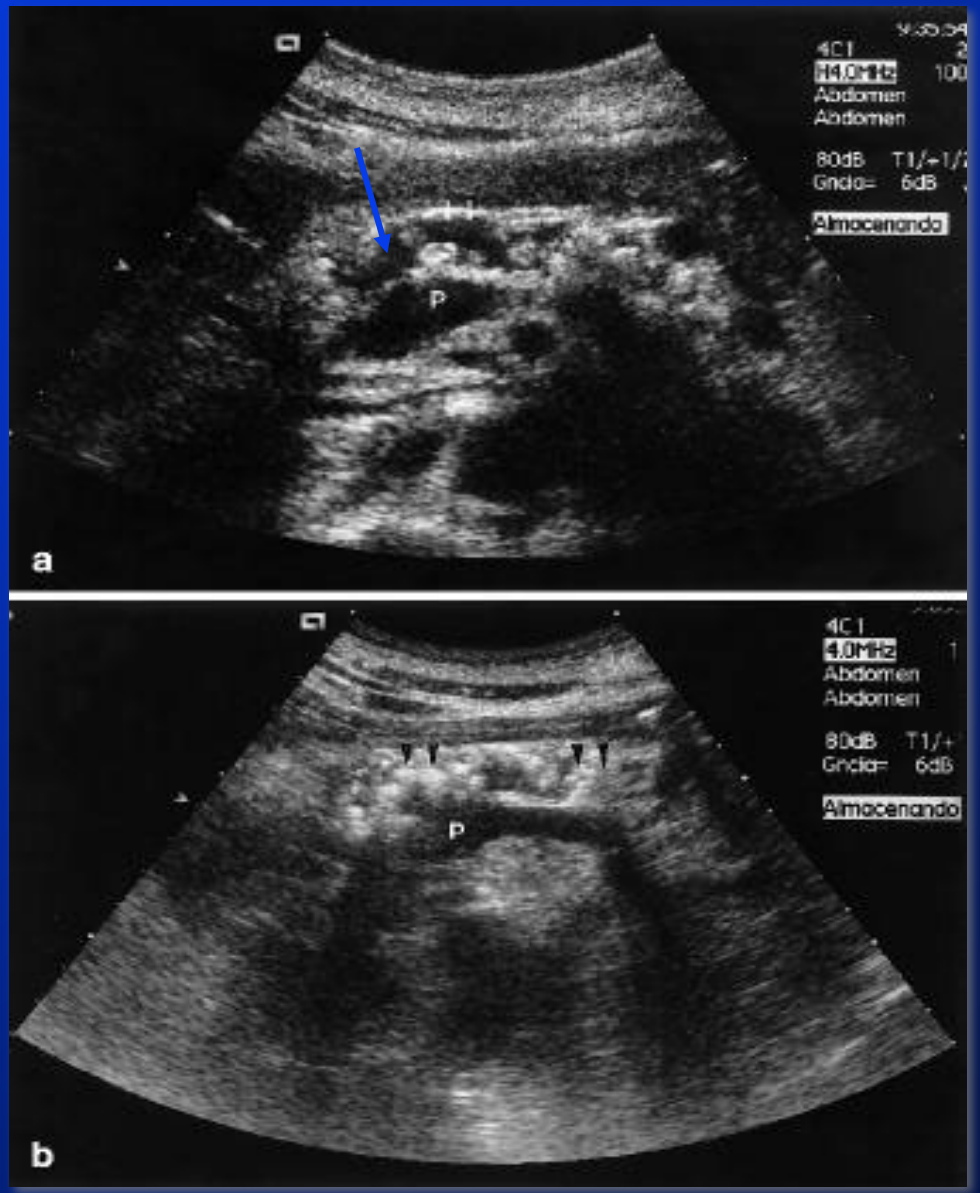
- Heterogeneous and nodular texture
- Non-enlarged pancreas, often atrophic
- Irregular corders and ductal systems
- Hyperechoisk pattern
- Deformation of retropancreatic veins
- Calcifications (parenchyma and ducts)
- Hypoechoic areas: “acute on chronic” pancreatitis

Chronic pancreatitis

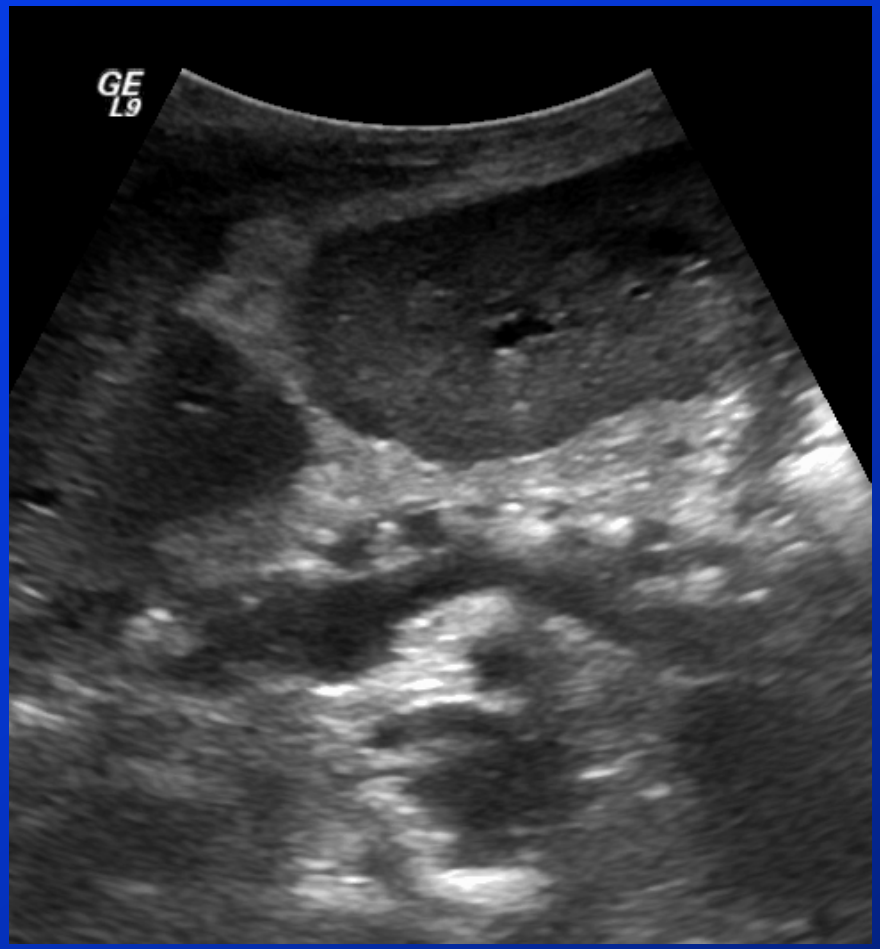
- Observe
  - Dilated pancreatic duct with calculi

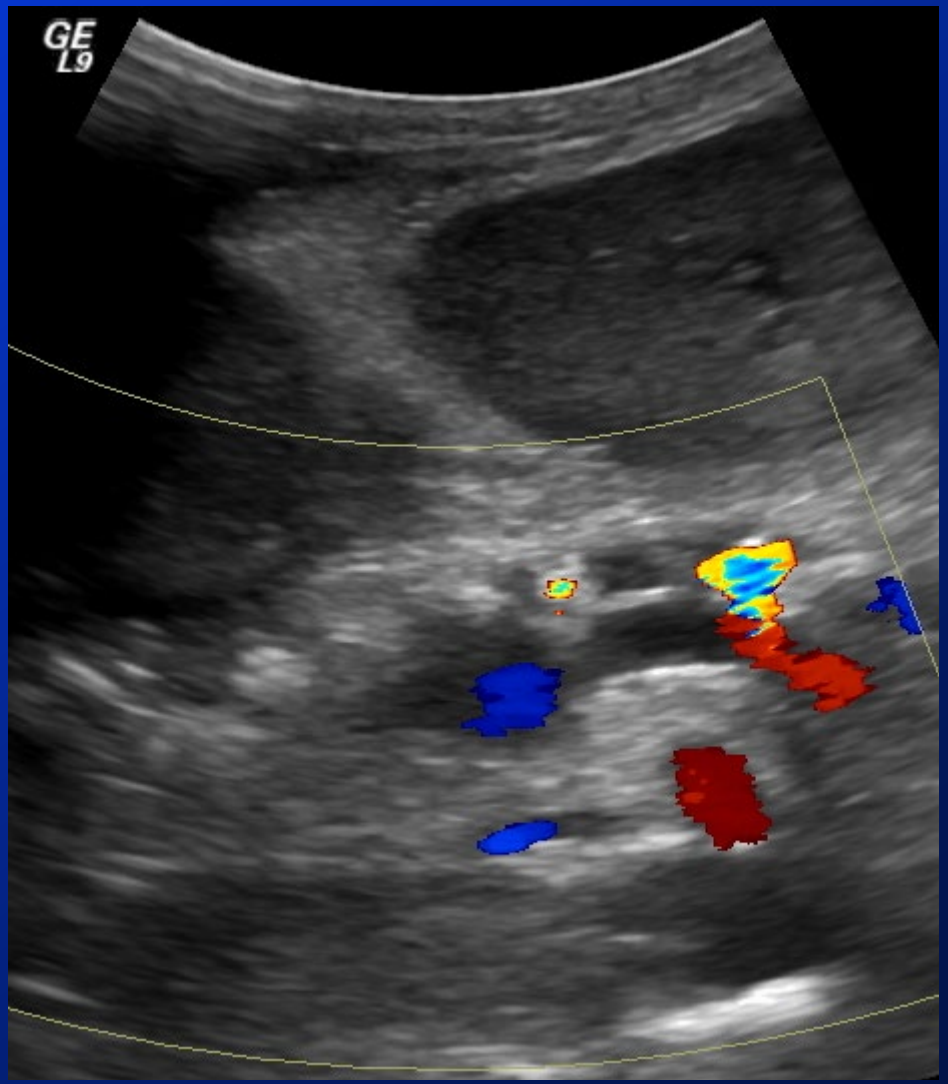
    (white arrowhead)
  - Massive calcifications

    (black arrowheads)



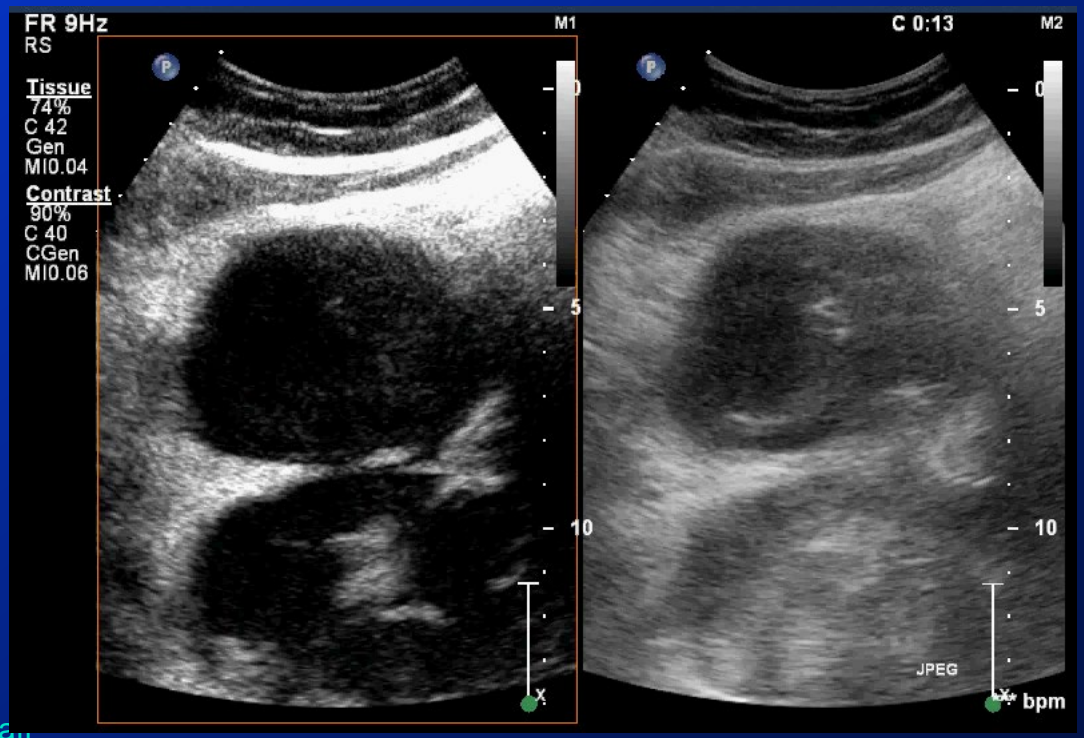
Chronic Pancreatitis – Twinkling artifact



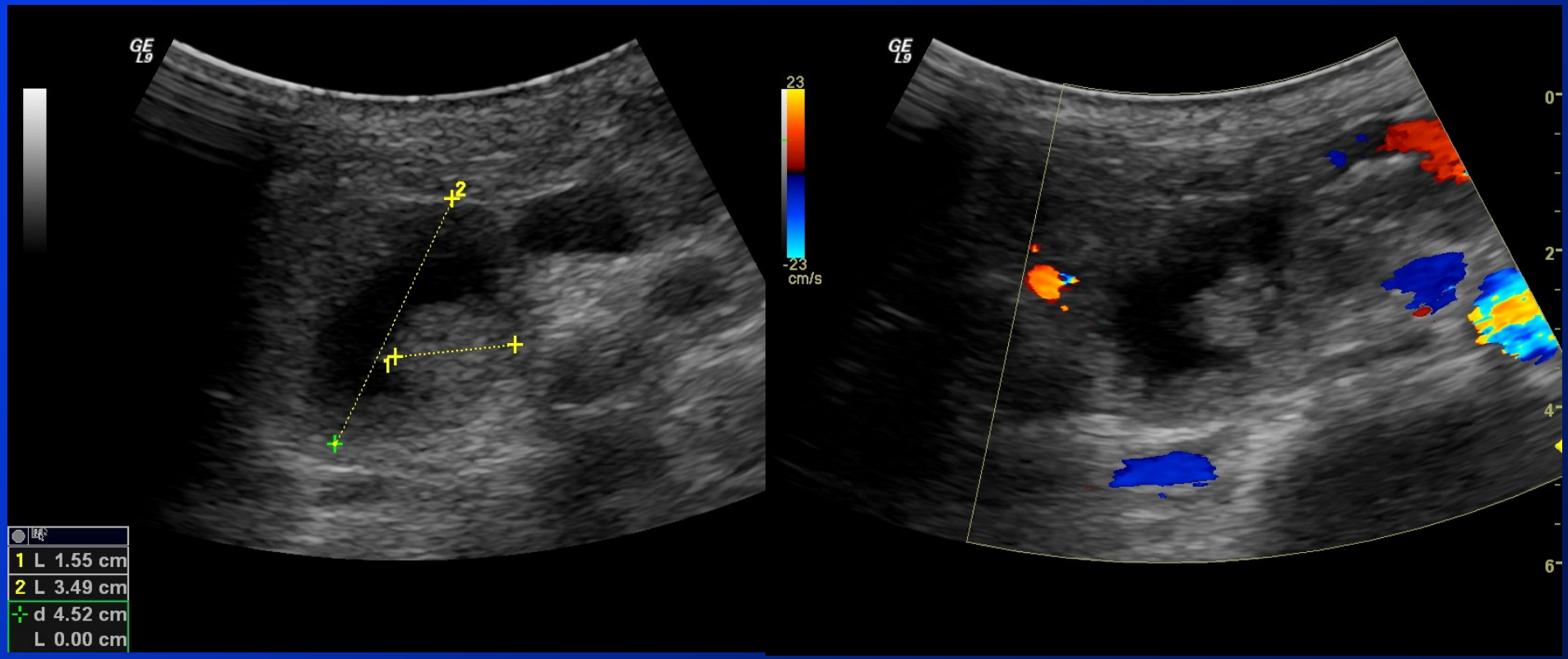


Pancreatic pseudocyst

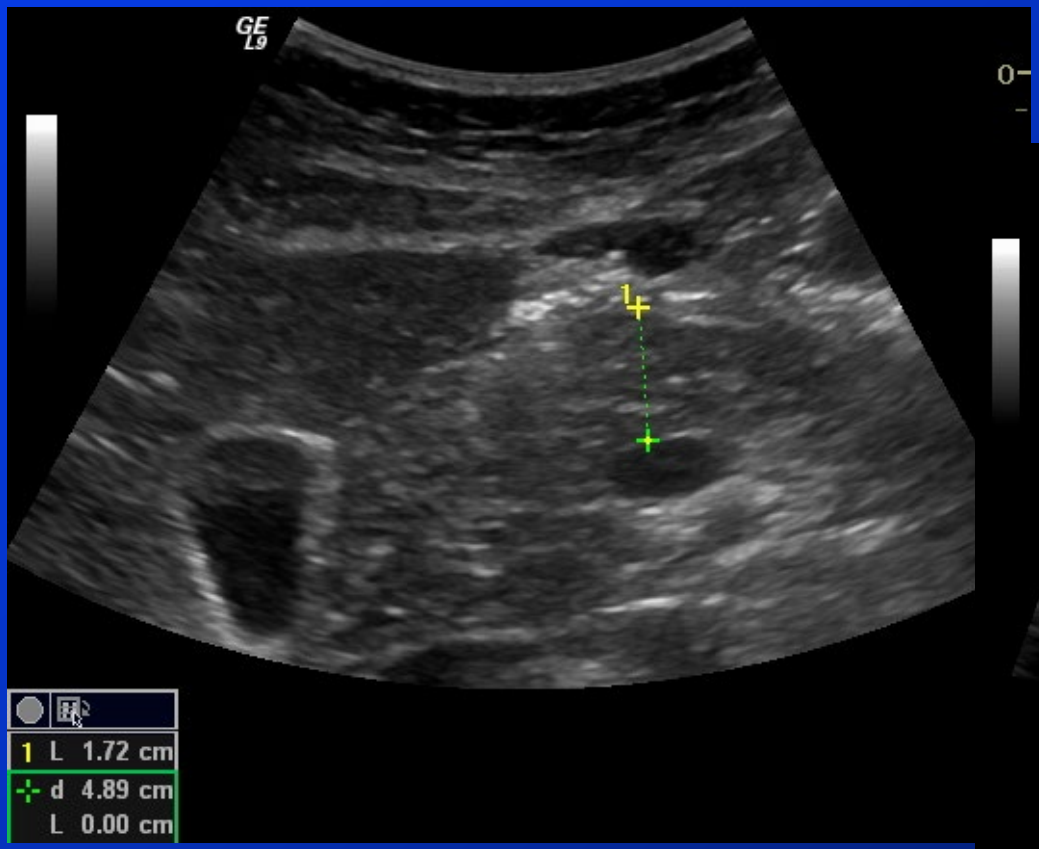
- A pancreatic pseudocyst is a circumscribed collection of fluid with no capsule rich in pancreatic enzymes, blood, and necrotic tissue, typically located in the lesser sac of the abdomen

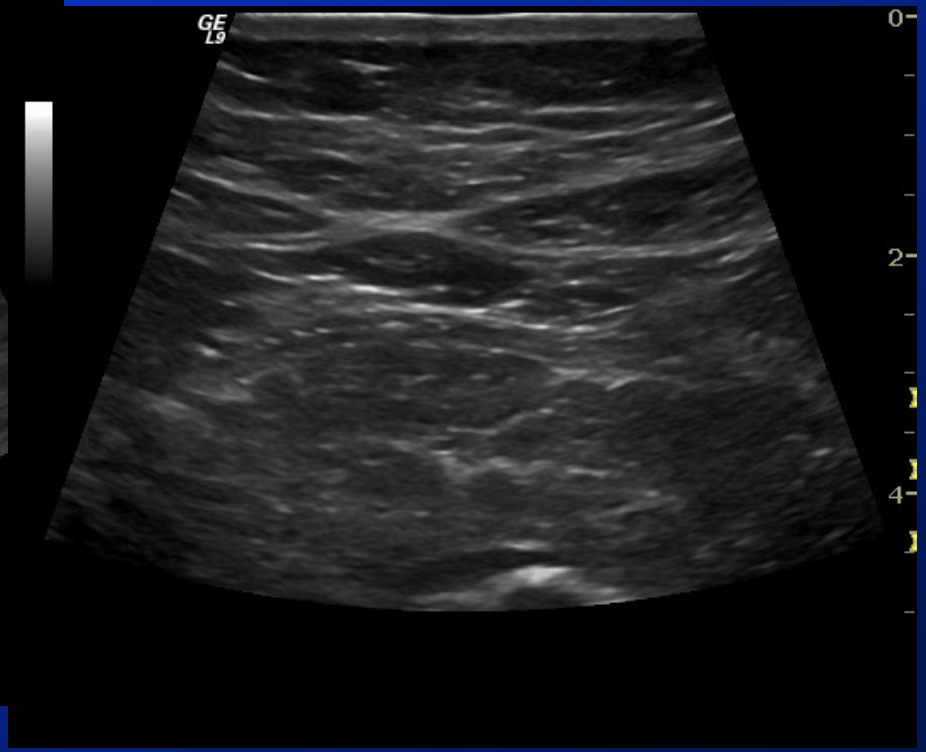


Extreme duct dilatation in chronic pancreatitis with IPMN
Male, 71 years



Autoimmune Pancreatitis





AIP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Abdomen
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CHI
Frq 4.0
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Map F/1
D 11.0
DR 66
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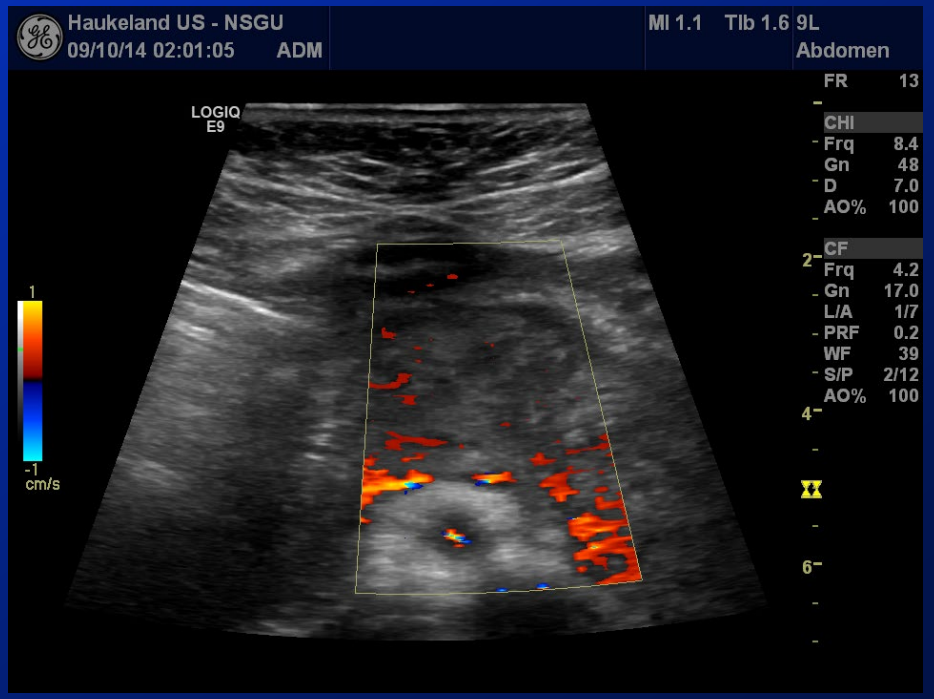
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AO% 100
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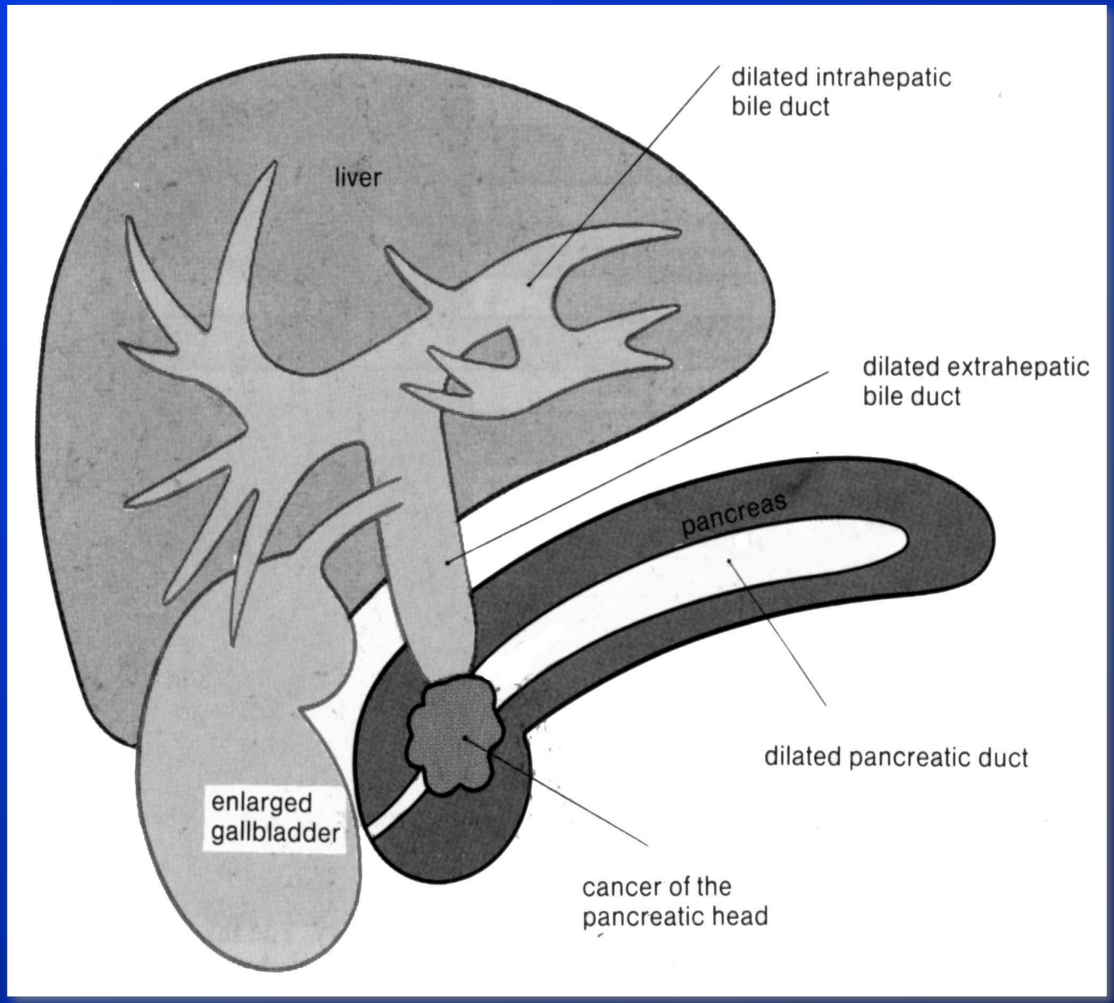
Frq 4.2
Gn 17.0
L/A 1/7
PRF 0.2
WF 39
S/P 2/12
AO% 100
1
-1
cm/s
2
4
6

Pancreatic tumors

- True cysts
- Cystadenomas
- Cystadenocarcinomas
- Adenocarcinomas
- Lymphomas
- Endocrine tumors
  - Insulinomas
  - Gastrinomas

Pancreas Cystadenom

Tumor in the pancreatic head

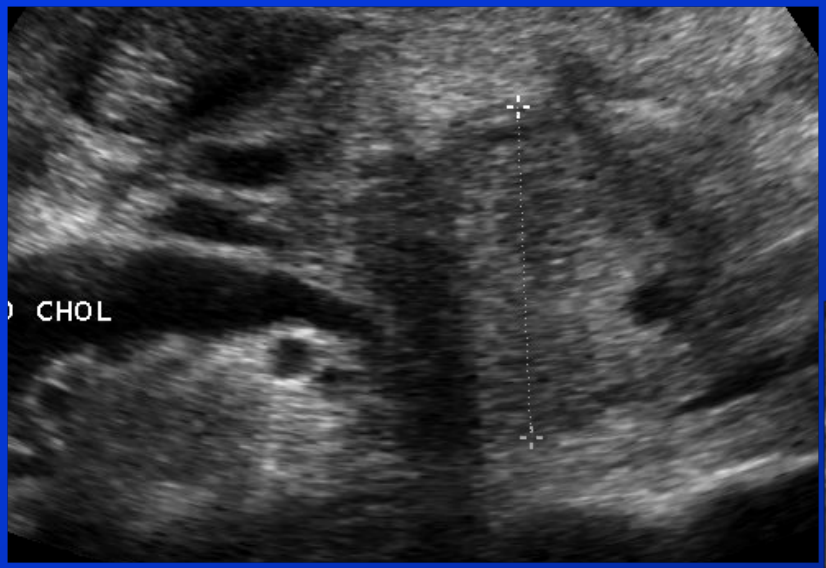


Pancreatic cancer

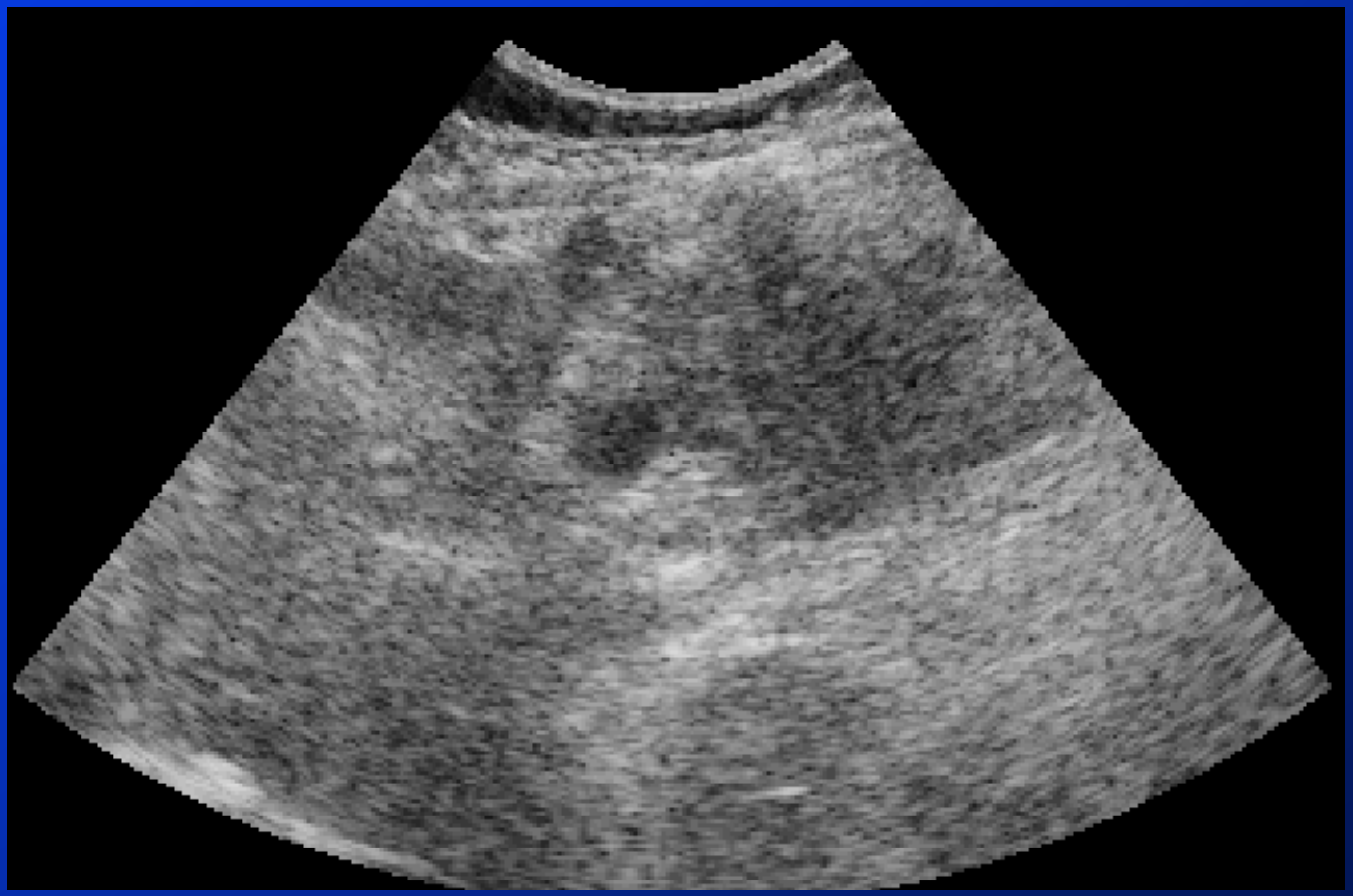
- Pancreatic adenocarcinoma represents 95% of all pancreatic carcinomas
- Head 61%
  - Here US may detect tumors as small as 1.0 cm or even smaller when both duct systems (CD and PD) are dilated (”double duct system”)
- Body 13%
- Tail 5%
- Combination 21%

  - US detect pancreatic cancer with approximately 70 – 95% sensitivity and more than 90% specificity

Cancer of the Pancreas

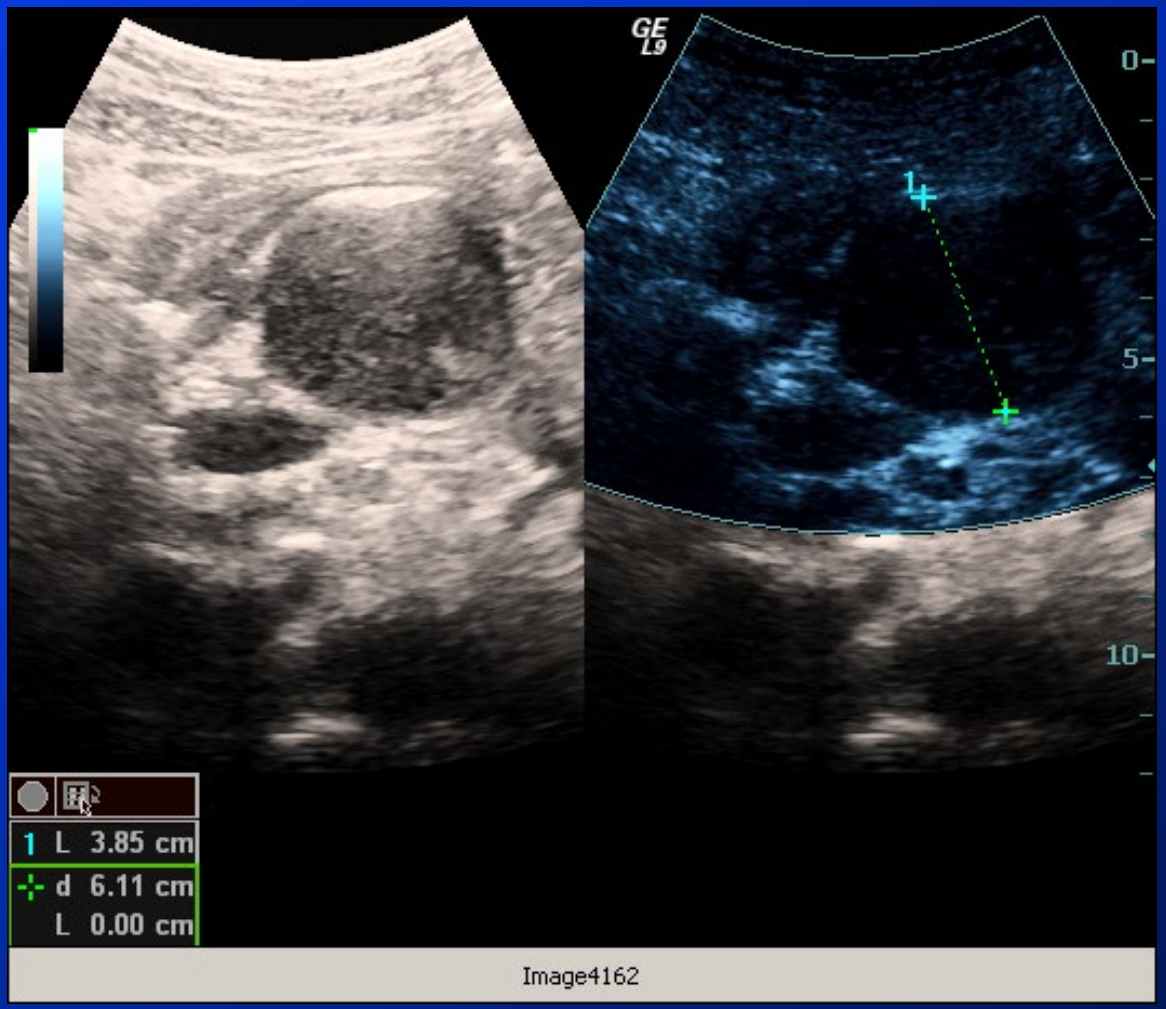


Cancer corporis pancreatis



Pancreatic Cancer

CEUS of Arterial Phase

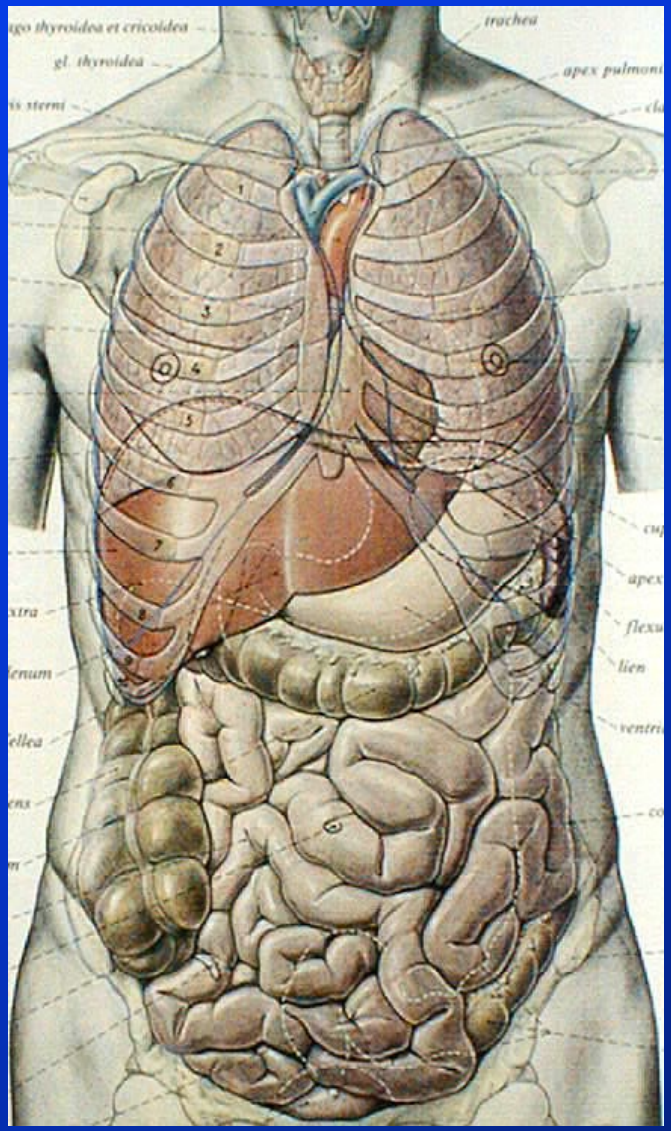


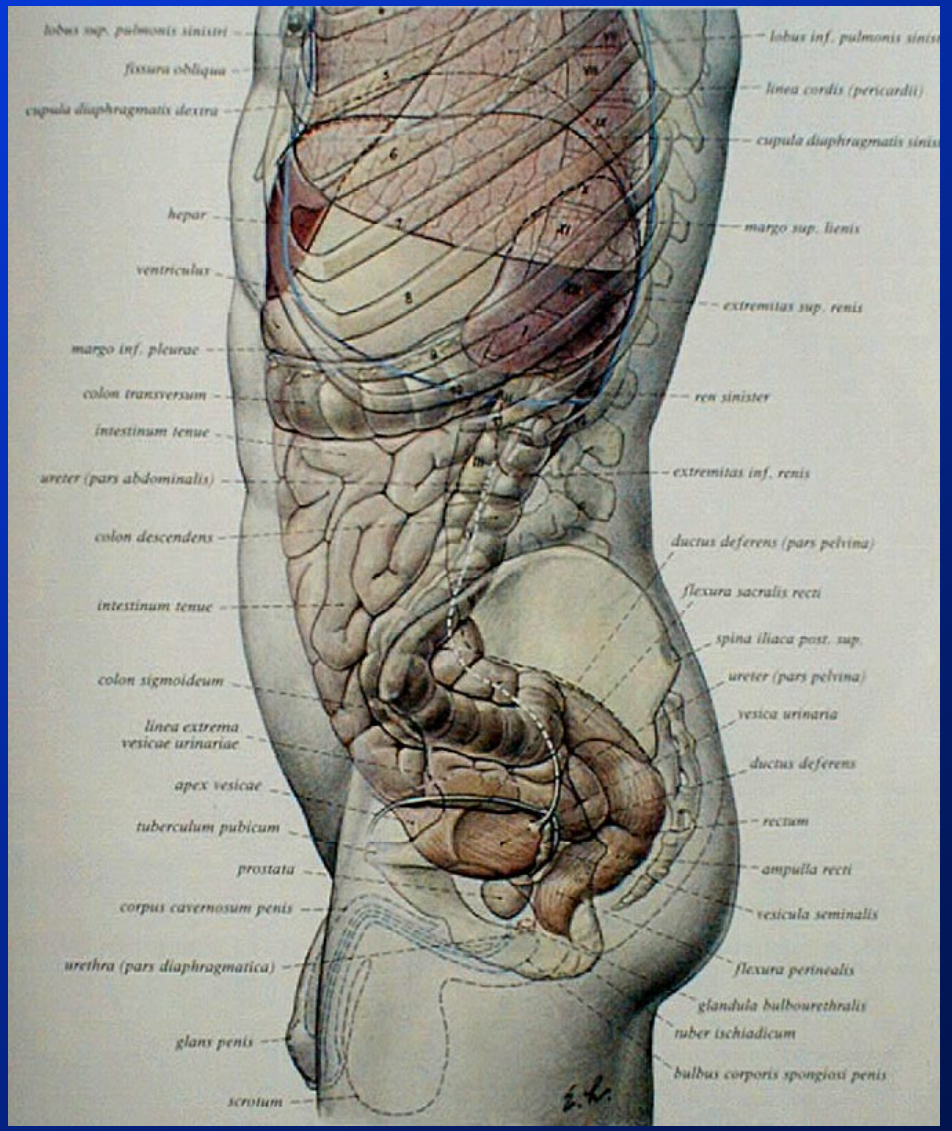
MEN-1 Pancreatic Tumor

Conclusion

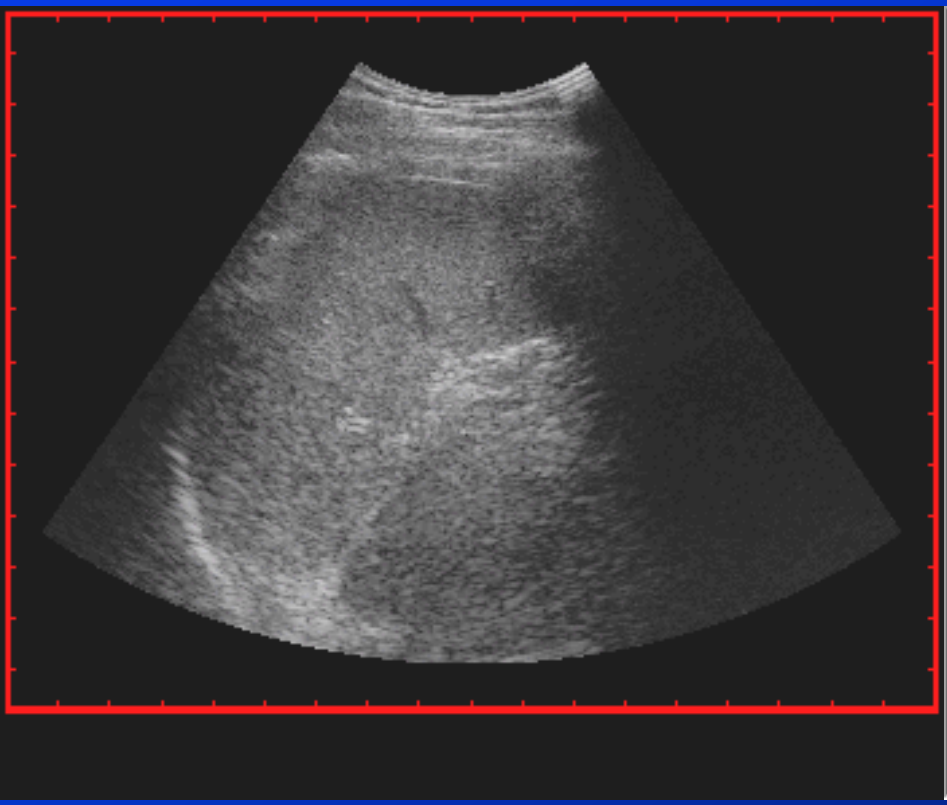
- In most patients, ultrasound enables detection and follow-up of pancreatic inflammatory lesions and focal lesions
- Adding CEUS may help in characterisation of lesions, particularly to detect avascular areas
- CT and/or EUS is often required for a complete work-up of the patient

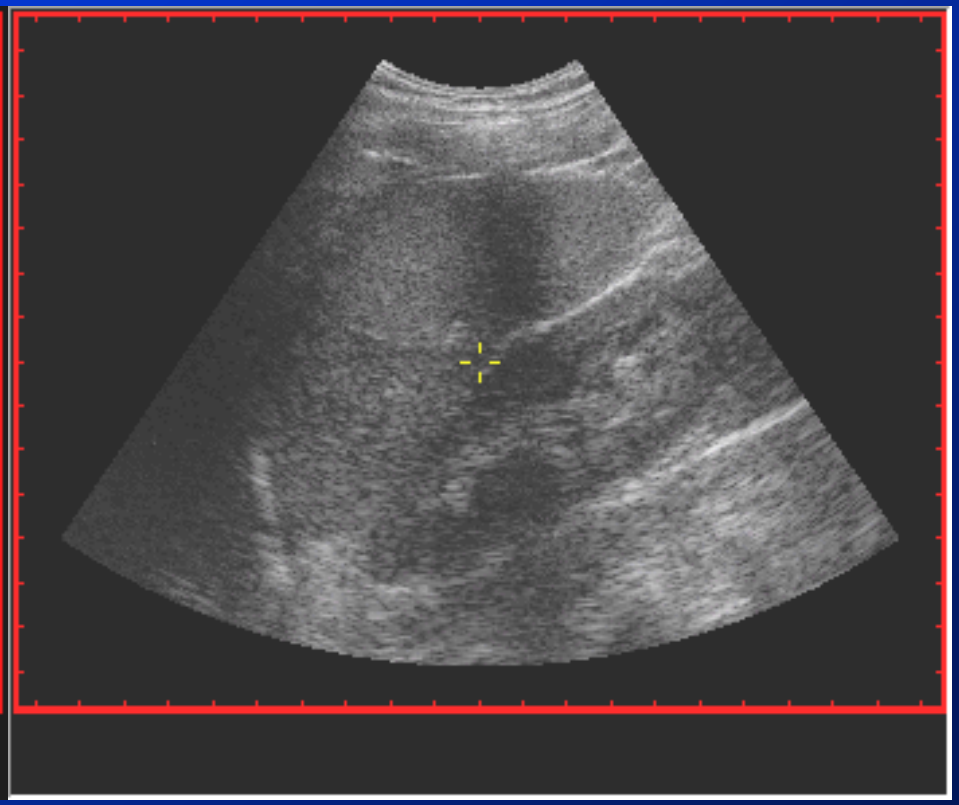
Organ Projection of Spleen





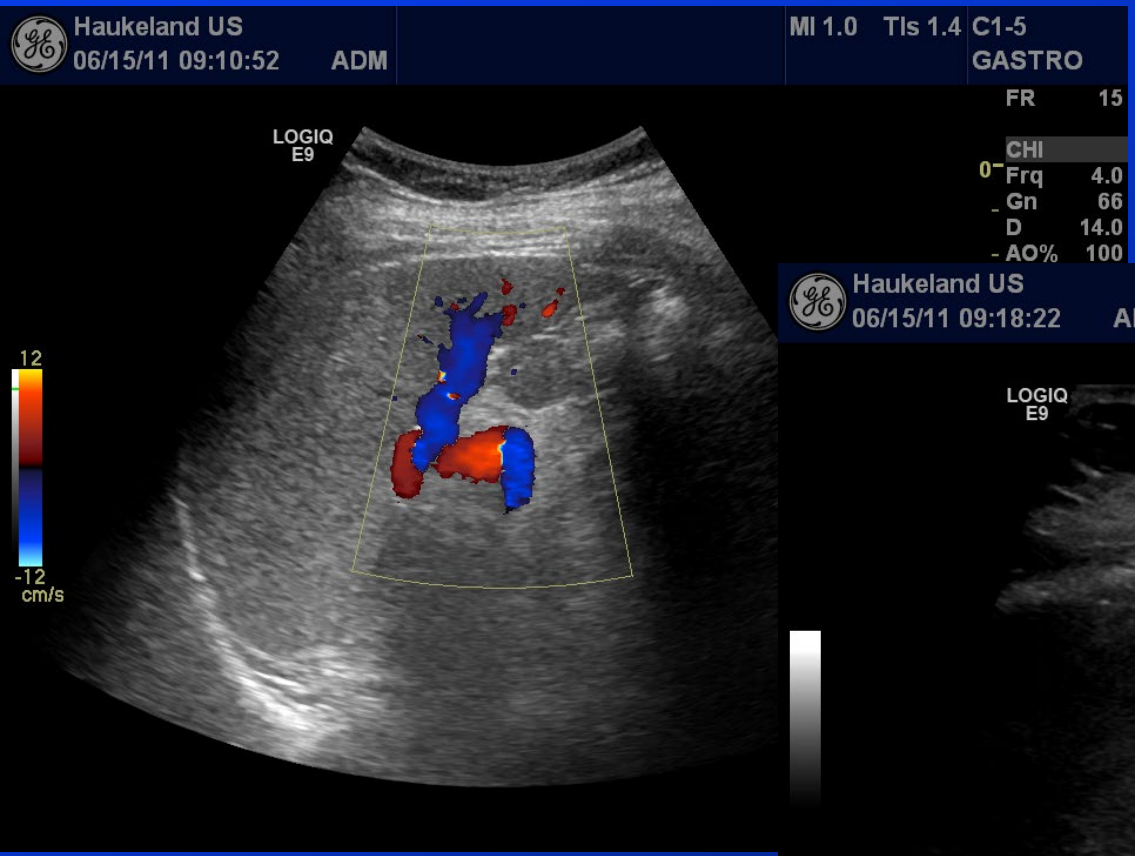
Normal spleen

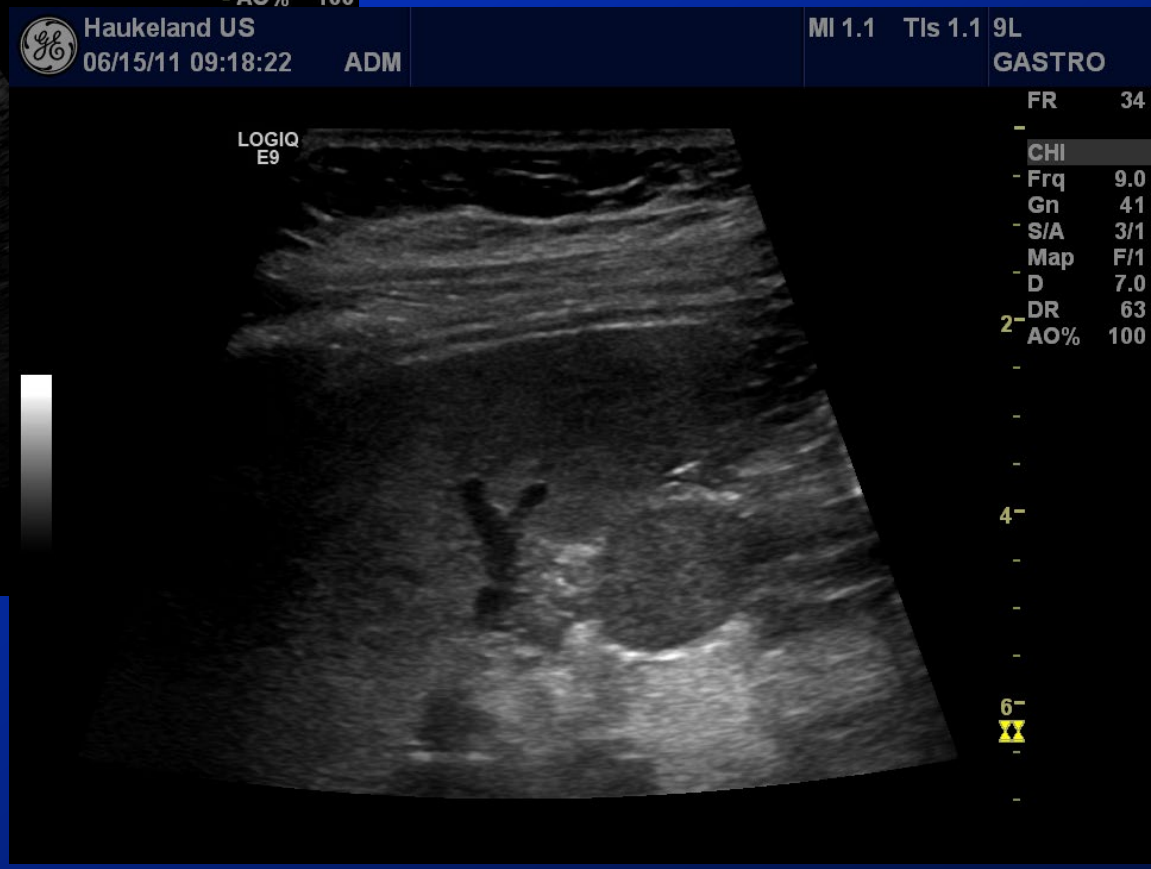


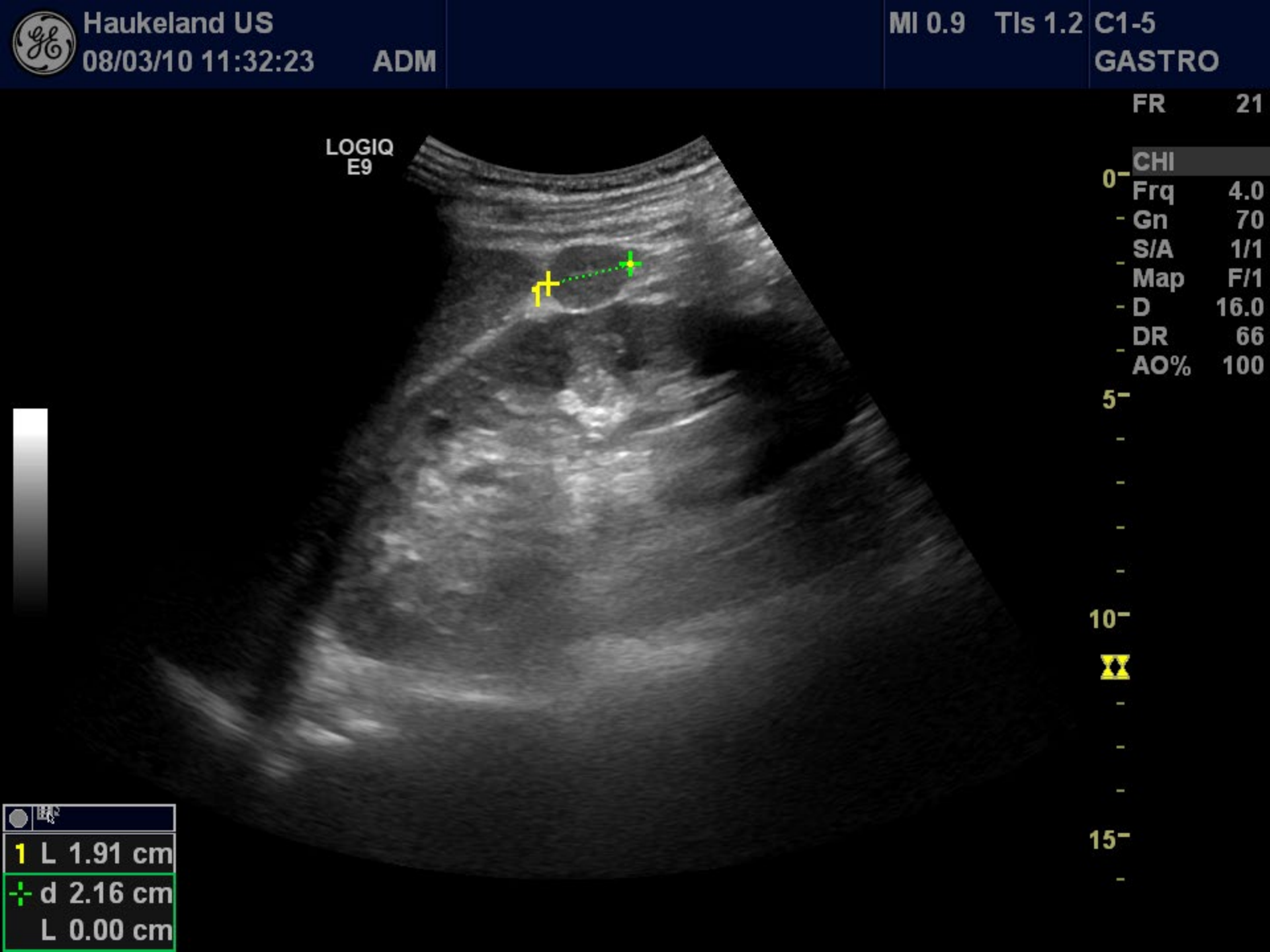


- Maximal ultrasonographic size: 12 x 8 x 4 cm
- The size tend to decrease in high ages
- 2-3 % of normals have accessory spleen

Accessory Spleen






Haukeland US
08/03/10 11:32:23
ADM
MI 0.9
TIs 1.2
C1-5
GASTRO
LOGIQ
E9
FR 21
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Frq 4.0
Gn 70
S/A 1/1
Map F/1
D 16.0
DR 66
AO% 100
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5
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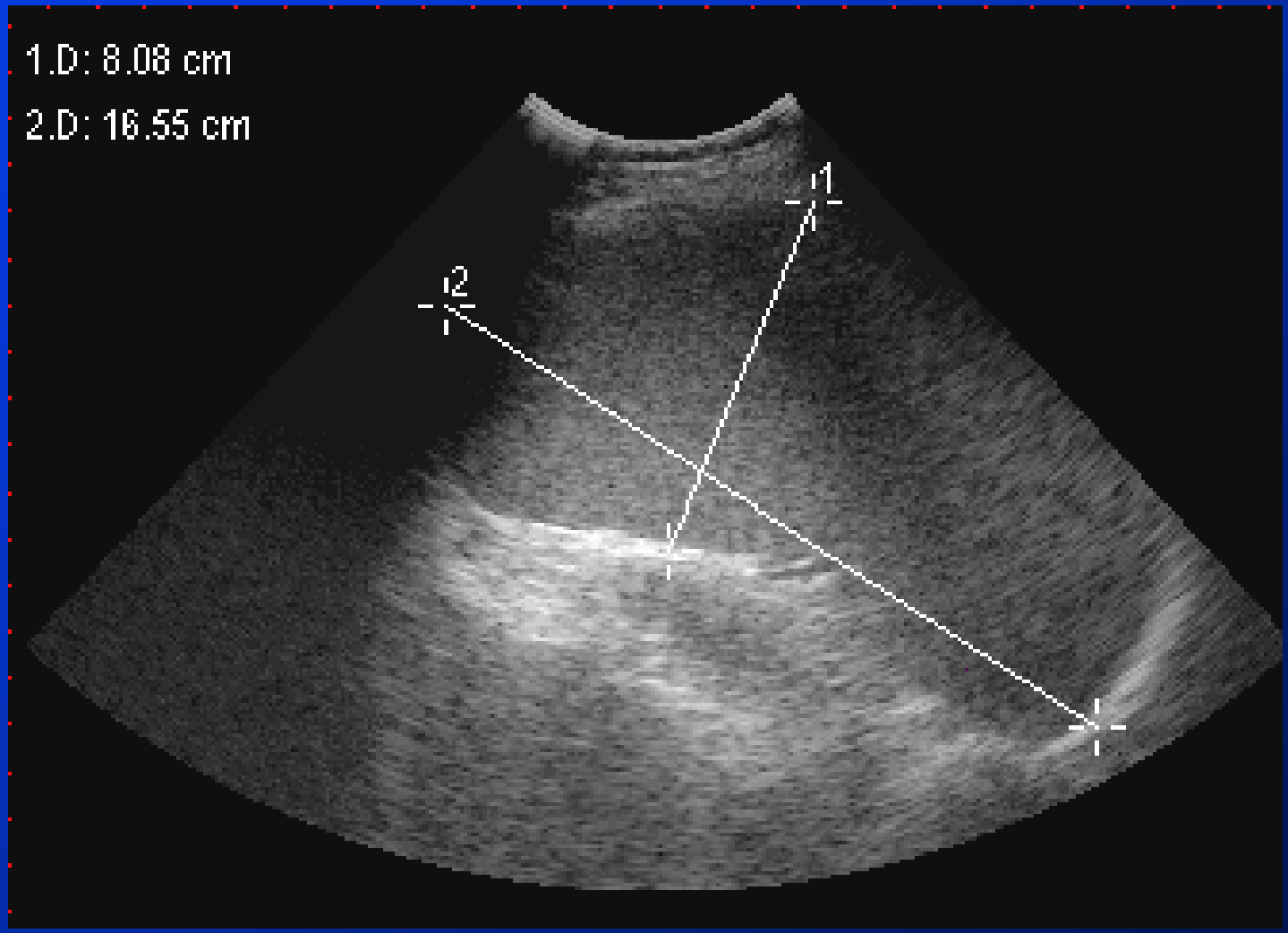
1 L 1.91 cm
d 2.16 cm
L 0.00 cm

Diffuse splenomegaly

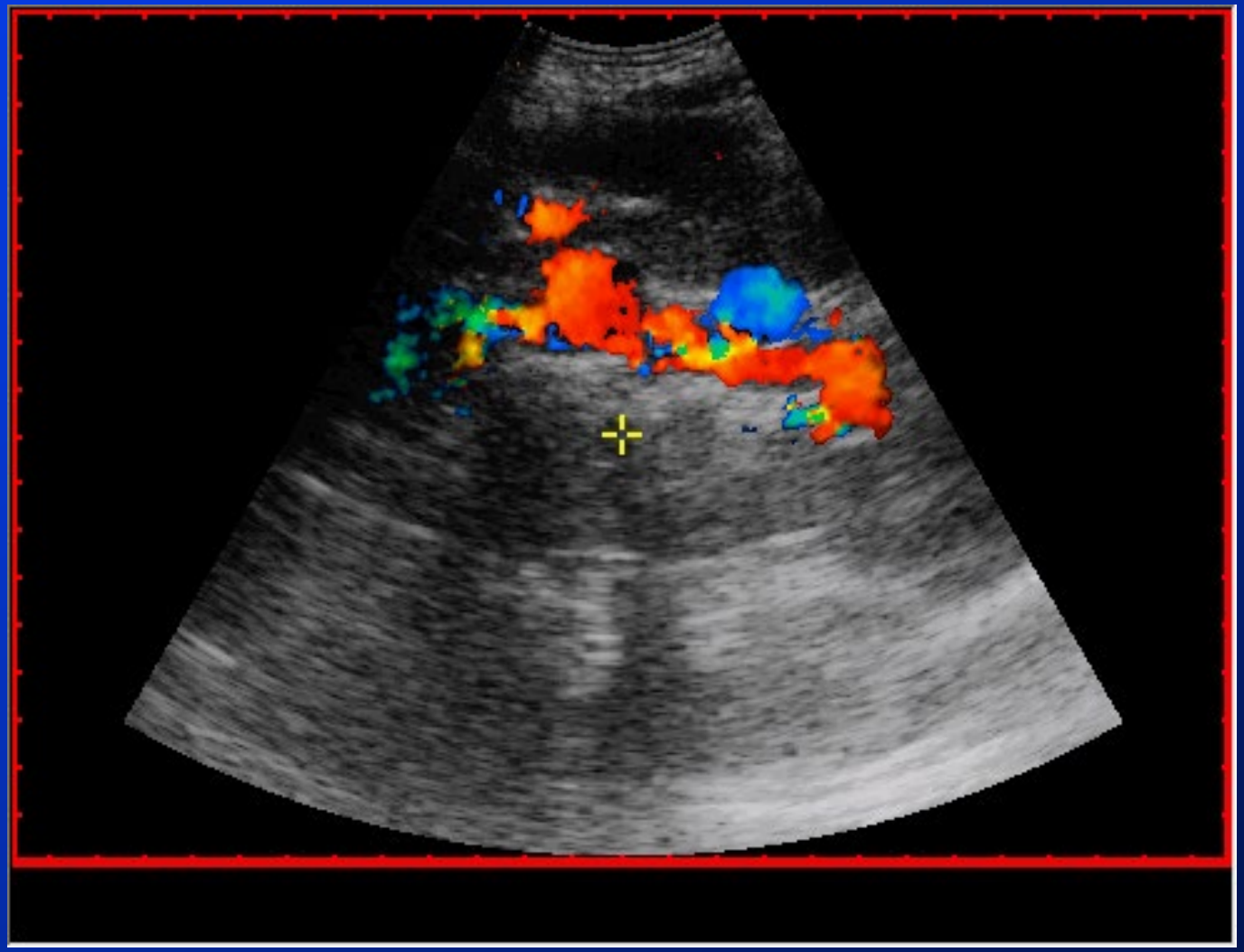
- Inflammation and immunology
  - Infectious: Endocarditis, mononucleosis, tuberculosis, brucellosis, schistosomiasis, CMV, syphilis, histoplasmosis, malaria, HIV
  - Connective tissue diseases: RA, SLE, Felty`s s.
  - Sarcoidosis
- Blood disorders
  - Neoplasms: Lymphomas, leukemias, histiocytosis, myeloproliferative disorders
  - Hemolytic anemia, hemoglobinopathies
- Congestive splenomagaly
  - Cirrhosis, portal or splenic vein thrombosis
- Metabolic diseases
  - Gaucher, Niemann-Pick, Amyloidosis

Splenomegaly



DX: Mononucleosis

Portal Hypertension

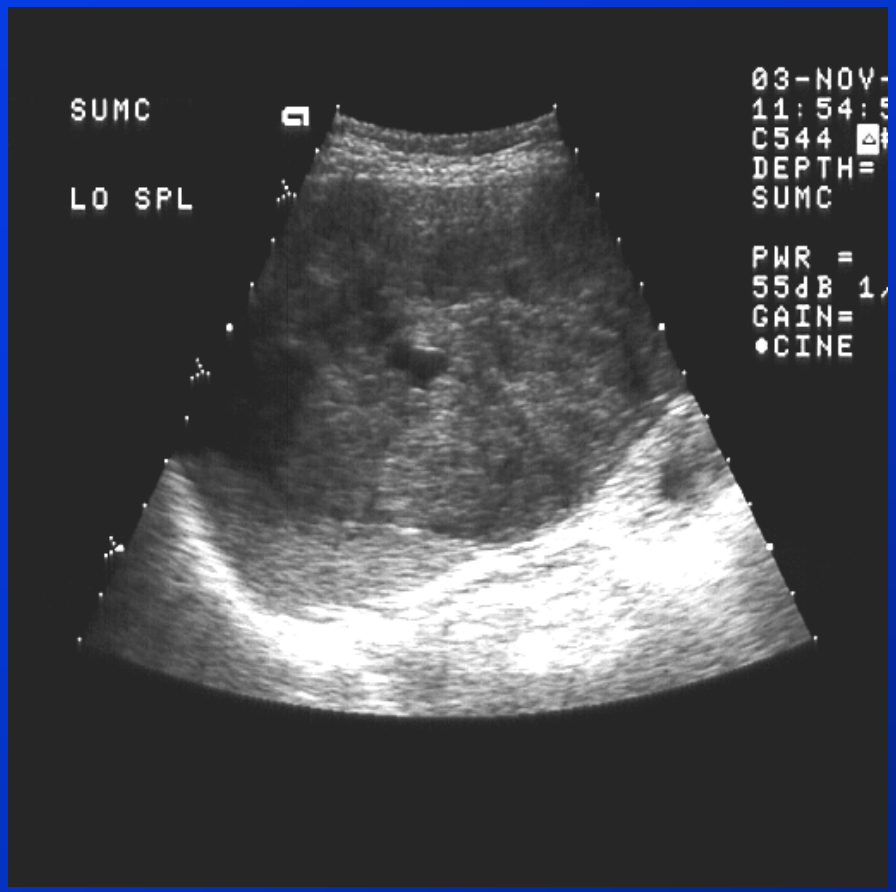


Neoplasms of the Spleen

- Hemangiomas
  - Most frequent benign lesion
- Cystic lesions
  - Congenital (may contain cholesterol debris)
  - Post-traumatic lesions (residual hematoma)
    - 4 times more common than true cysts
  - Pancreatic pseudocysts
  - Ecchinococcus-cyst (usually multilocular)
- Lympoma
- Primary angiosarcoma
- Metastasis
  - Rare, melanoma is most frequent, then ovaries
  - Usually hypoechoic, but hemorrhagic necrosis within tumor can appear hyperechogenic

Metastasis to the Spleen

HISTORY: 47-year-old female with known ovarian carcinoma.



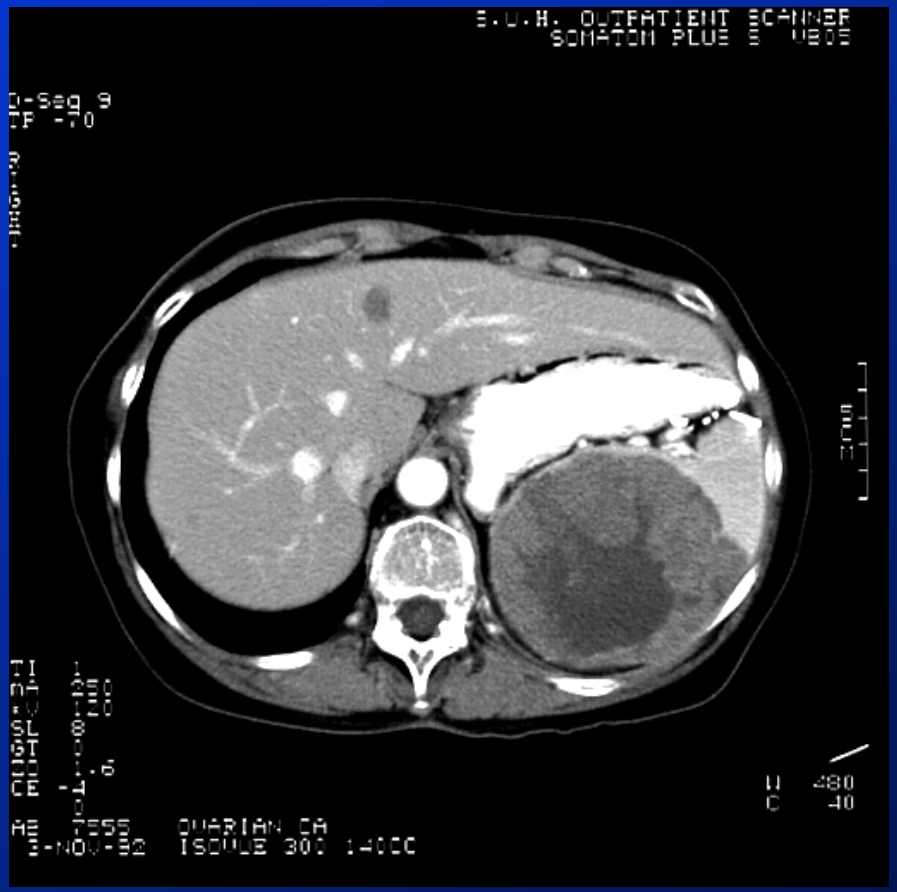


Image 1: A large lesion of mixed echogenicity occupying most of the spleen.
Image 2: Contrast-enhanced CT scan demonstrating a large low attenuating splenic lesion with areas of decreased attenuation centrally, probably related to necrosis.

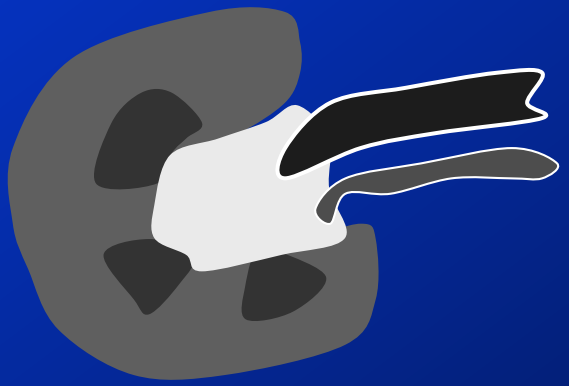
Vascular Lesions of the Spleen

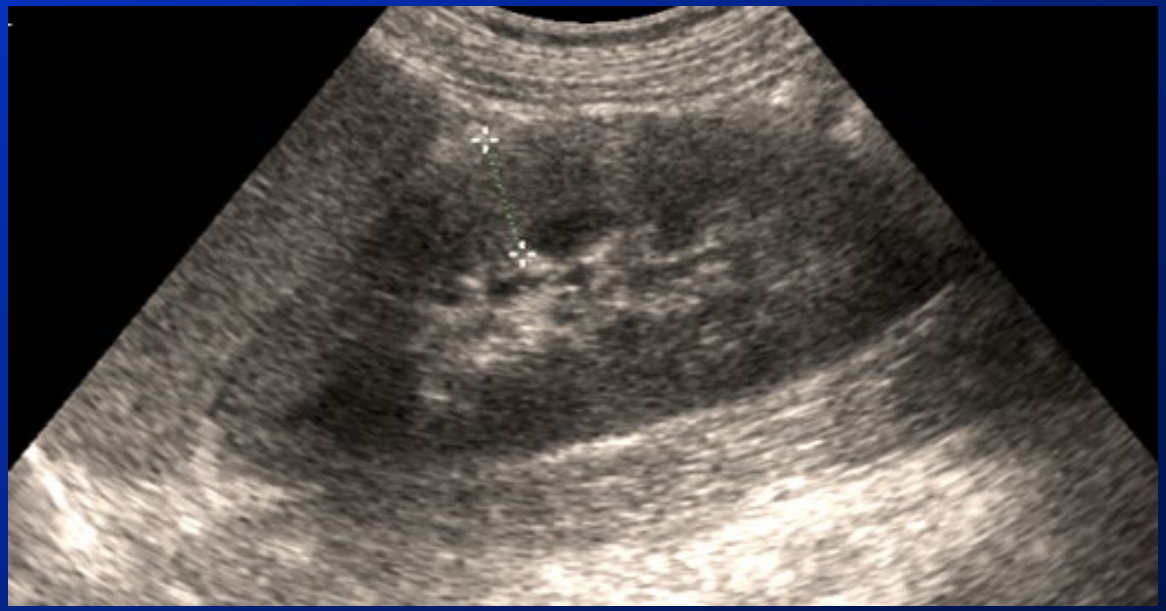
- Infarction
  - Wedge-shaped, often peripheral
  - Usually hypo-echoic
  - Septic infarcts may turn into a rounded lesion
- Aneurysm
  - Often related to atherosclerotic disease
  - Lesions larger than 1 cm should be followed
- Subcapsular hematoma
  - Often following trauma or massive splenomagaly
  - Look for discontinuity of the capsula and locations of free fluid

Infarction of the Spleen

Renal Ultrasound

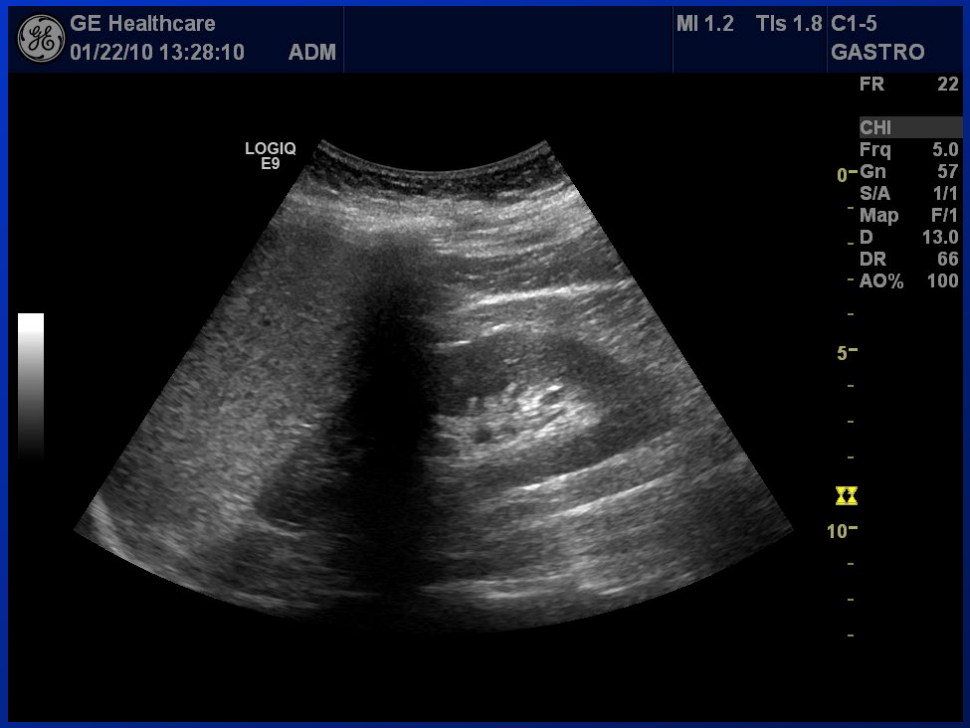
- **Indications:**
- Flank pain
- Haematuria
- Suspected renal mass
- Kidney failure
- Recurrent infection
- Fever unknown origin
- Anomalies
- Transplanted kidney
- Abdominal ultrasound



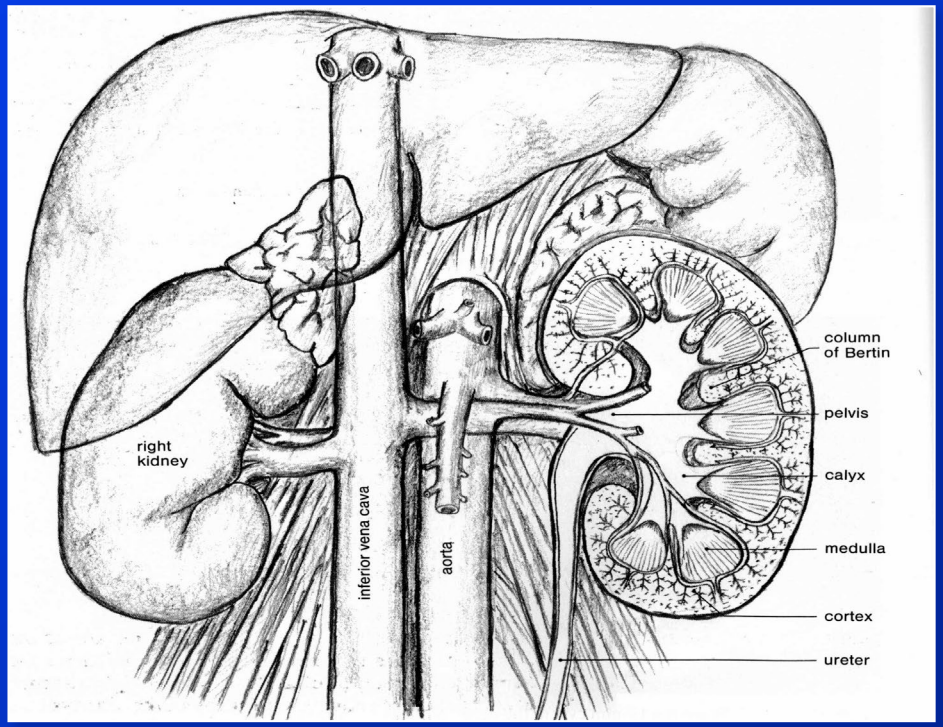


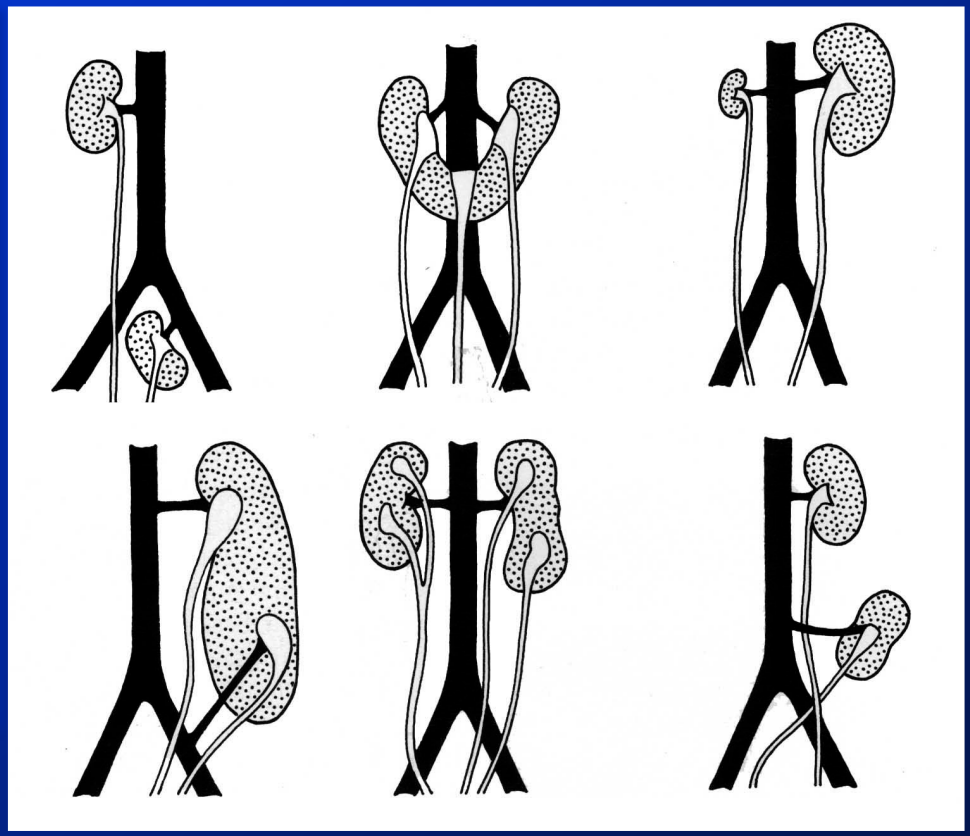
Station 4

- Long and short axis of the kidney from intercostal and subcostal lateral scanning
- Comparing echogenicity of the kidney with the liver



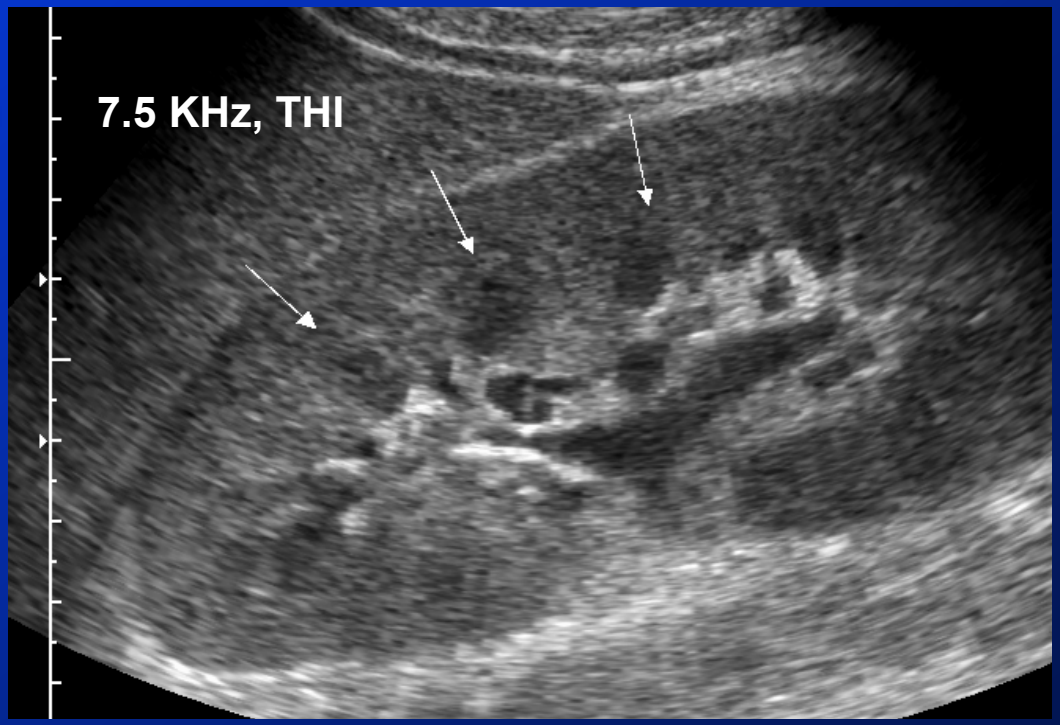
RENAL ANATOMY





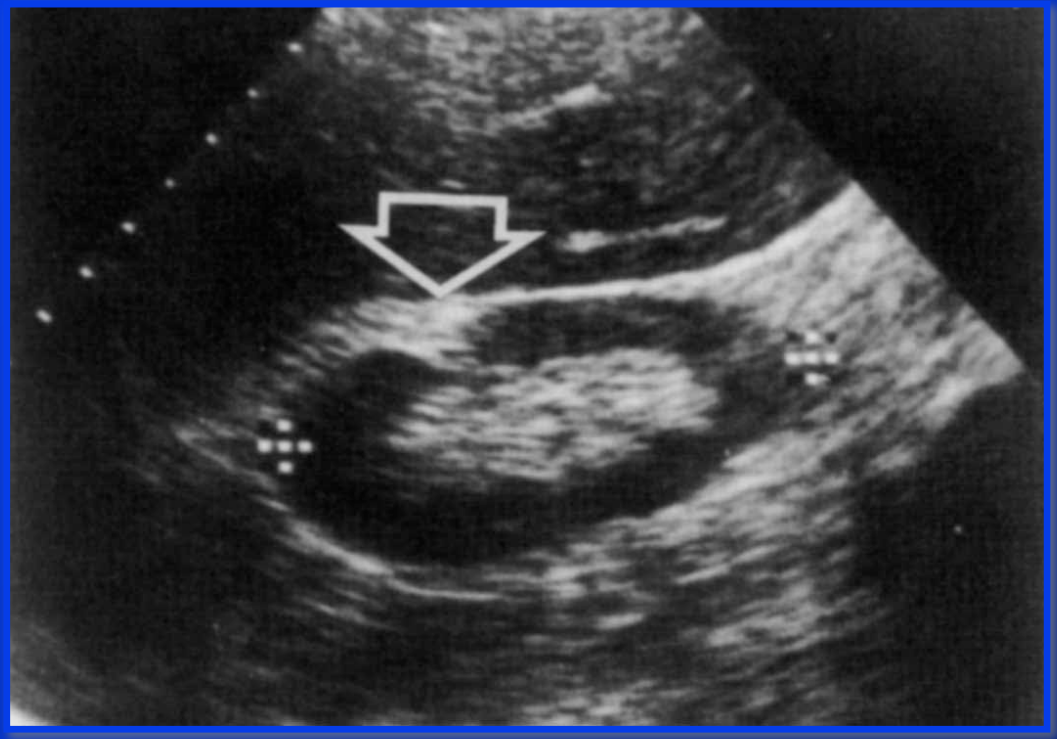
Sonoanatomy

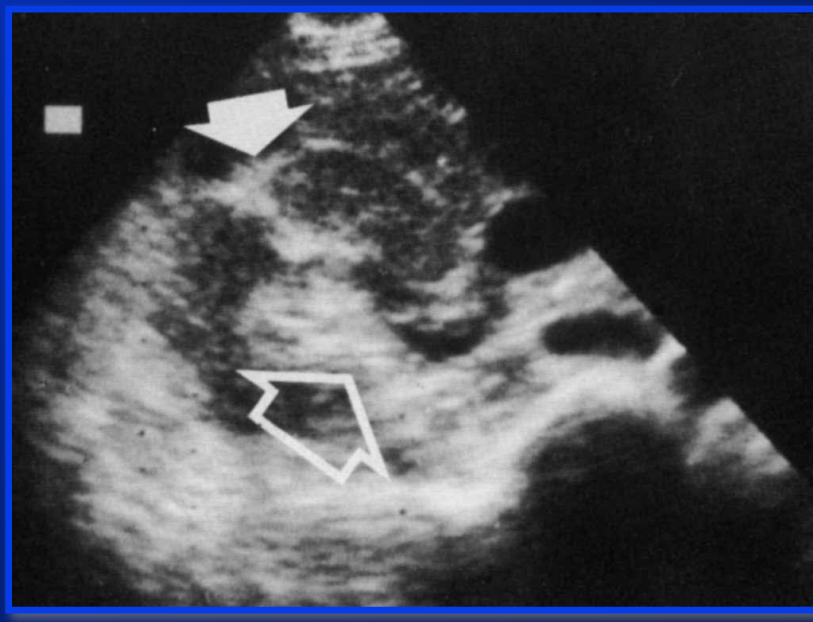
- Ovoid structure
- >10 mm length
- Parechymal width: >10 mm
- Marked ”corticomedulary differentiation”
- Parenchyma darker echogenicity than liver
- Normal variations
  - ”Junctional parenchymal defect”
  - ”Foetal lobulation”
  - ”Dromedary hump”
  - Sinus lipomatosis



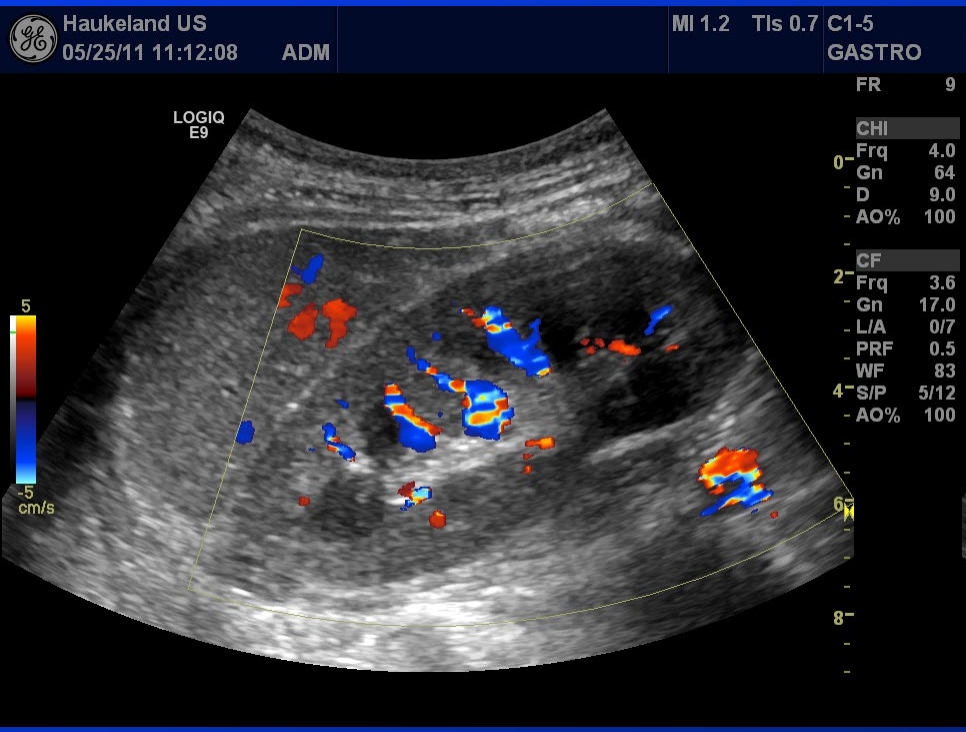
Parenchymal bridge

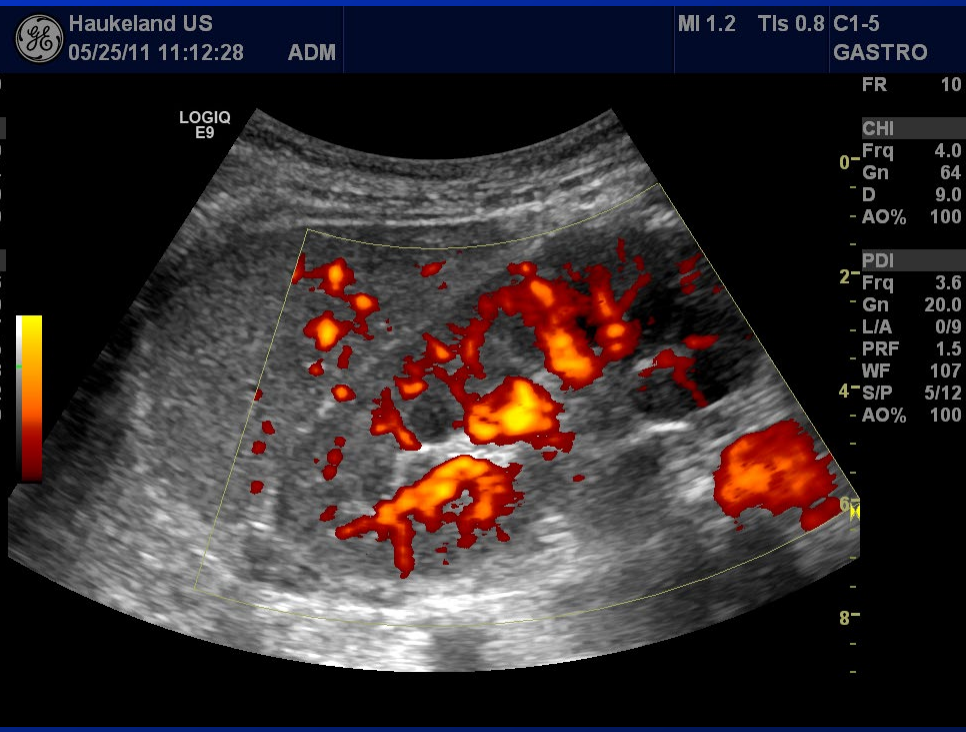
Scar of the kidney





Doppler of the Kidneys





B Flow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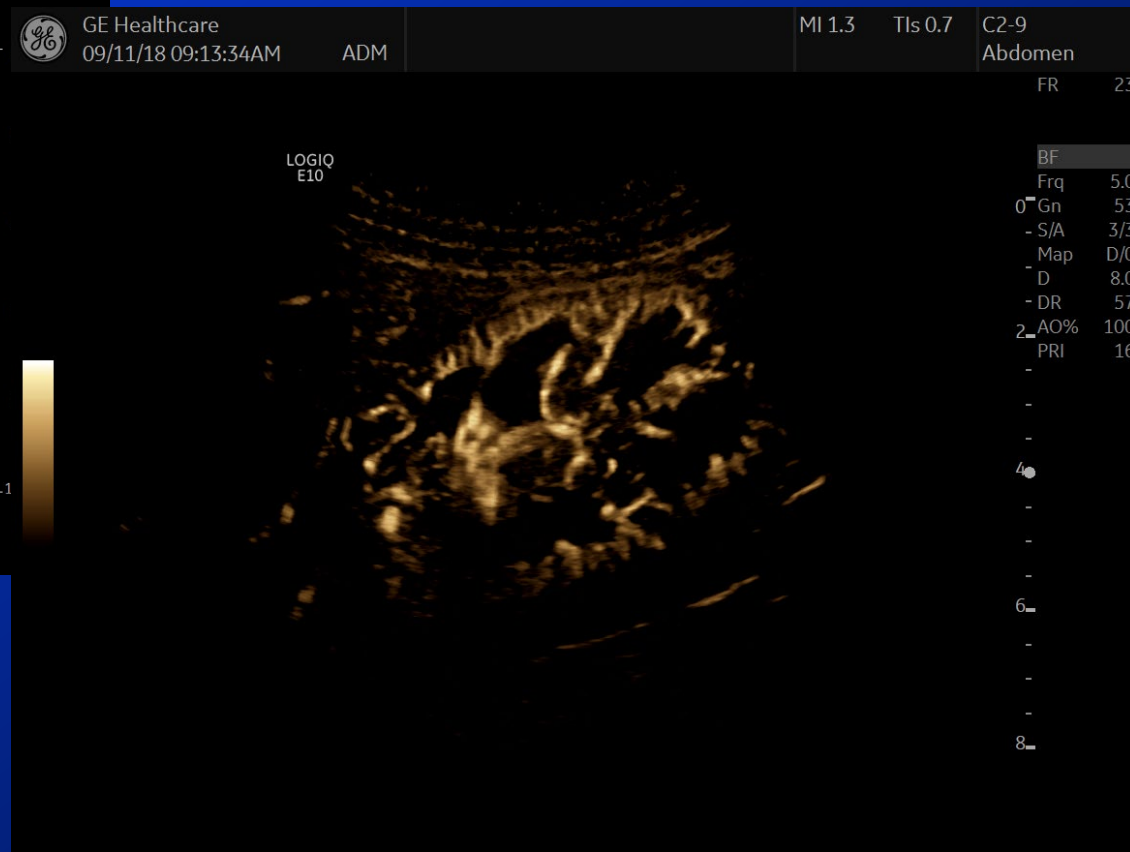
TIs 0.8
C2-9
Abdomen
FR 50
LOGIQ
E10


GE Healthcare
09/11/18 09:13:34AM
ADM
MI 1.3
TIs 0.7
C2-9
Abdomen
FR
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BF
Frq
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Map
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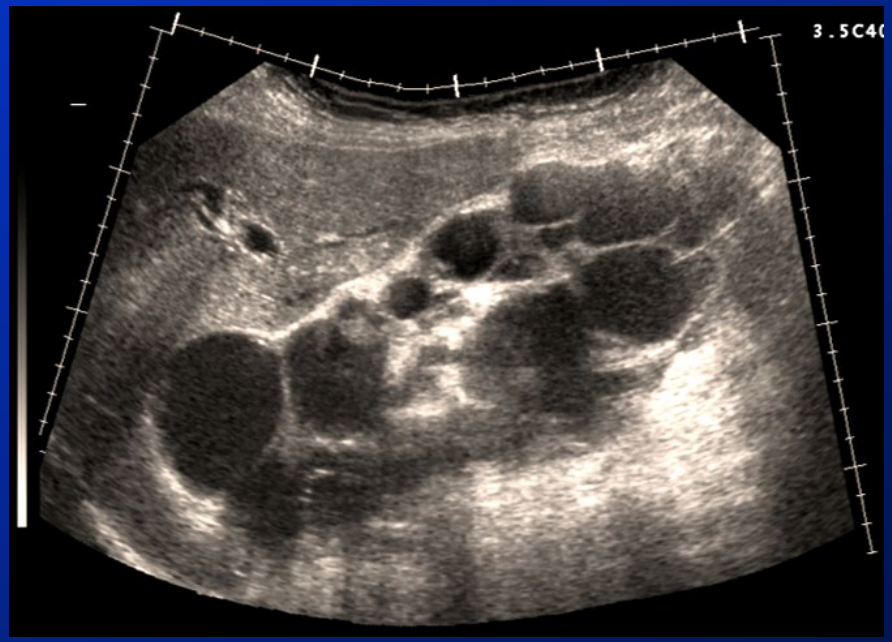
PRI

PATHOLOGY

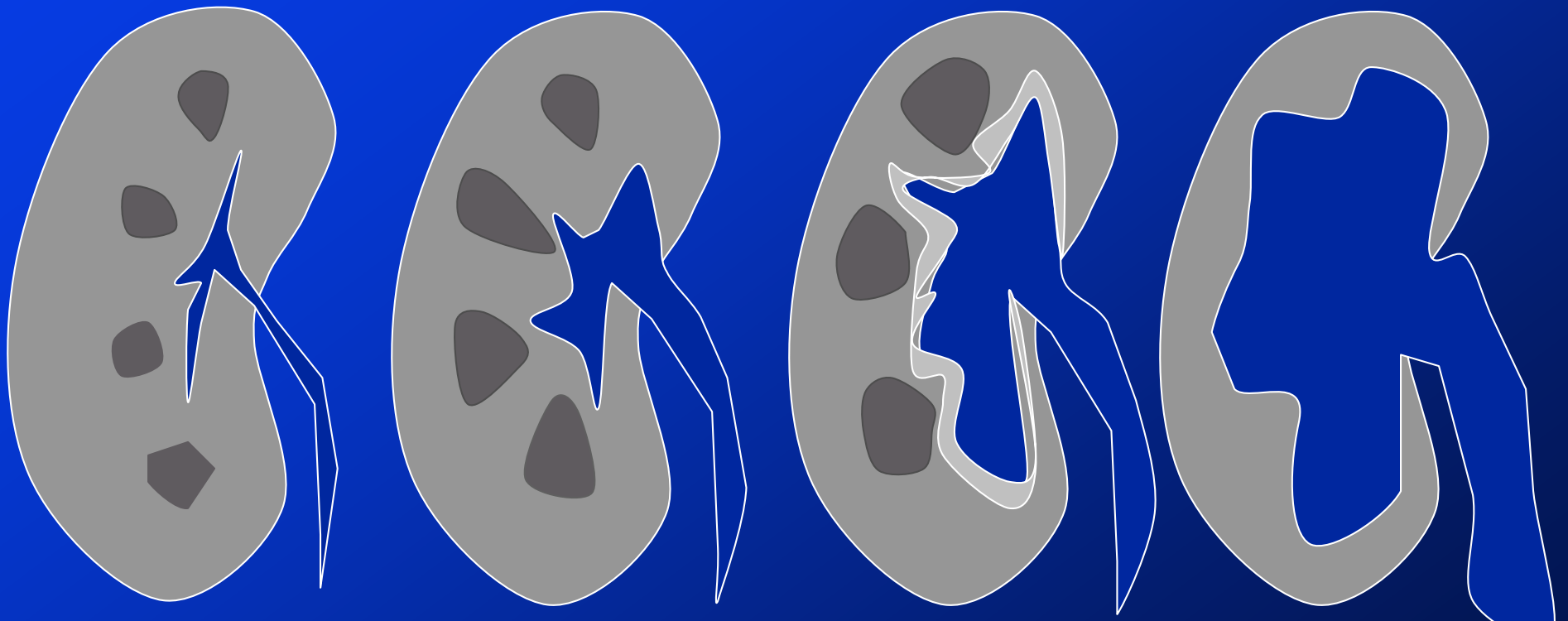
- Hydronephrosis
- Nephrolithiasis
- Parenchymal diseases
- Infection
- Expansive processes
- Transplantation
- Trauma



HYDRONEPHROSIS

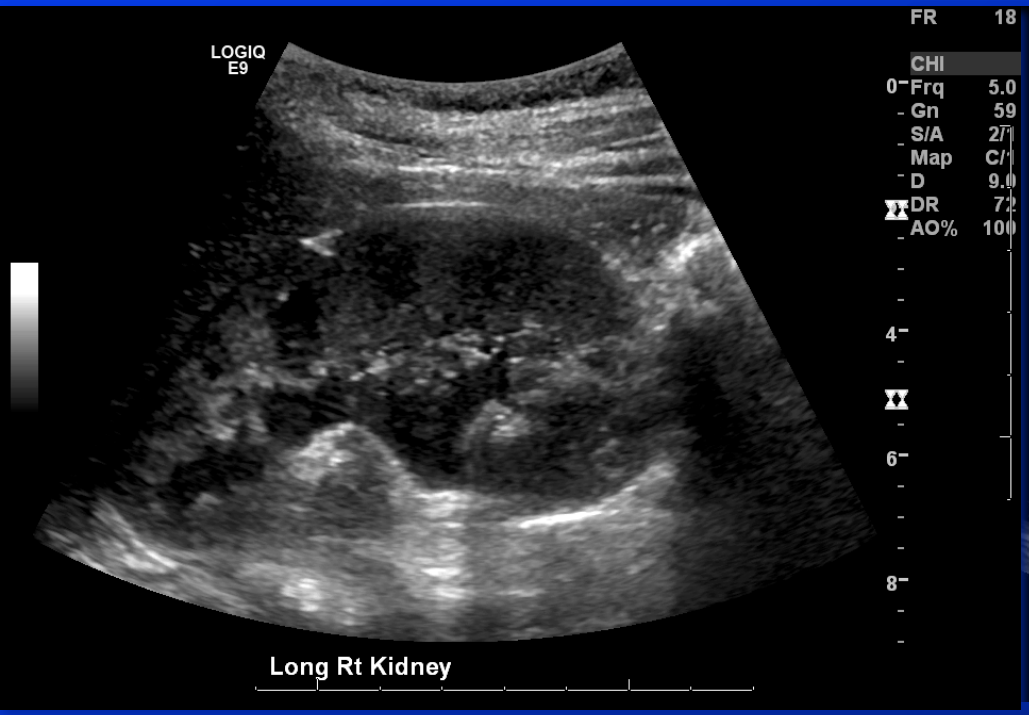
- Physiological
  - Full U-bladder
  - Pregnancy
- Pathological
  - Congenital
    - Reflux, valves, stenosis, ectopies, uretherocele, megacalyces/uretheres
  - Obstruction
    - Strictures after infection/trauma, prostate hyperplasia, malignancy, stones, retroperitoneal fibrosis, obstipation in children, post-operatively
  - Infection

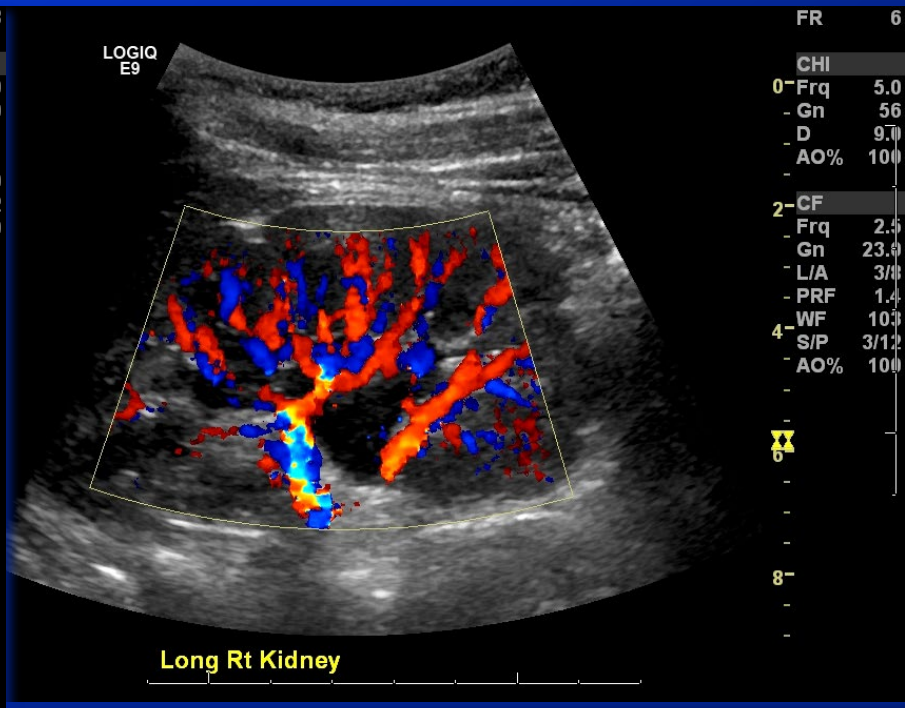
Range of Hydronephrosis



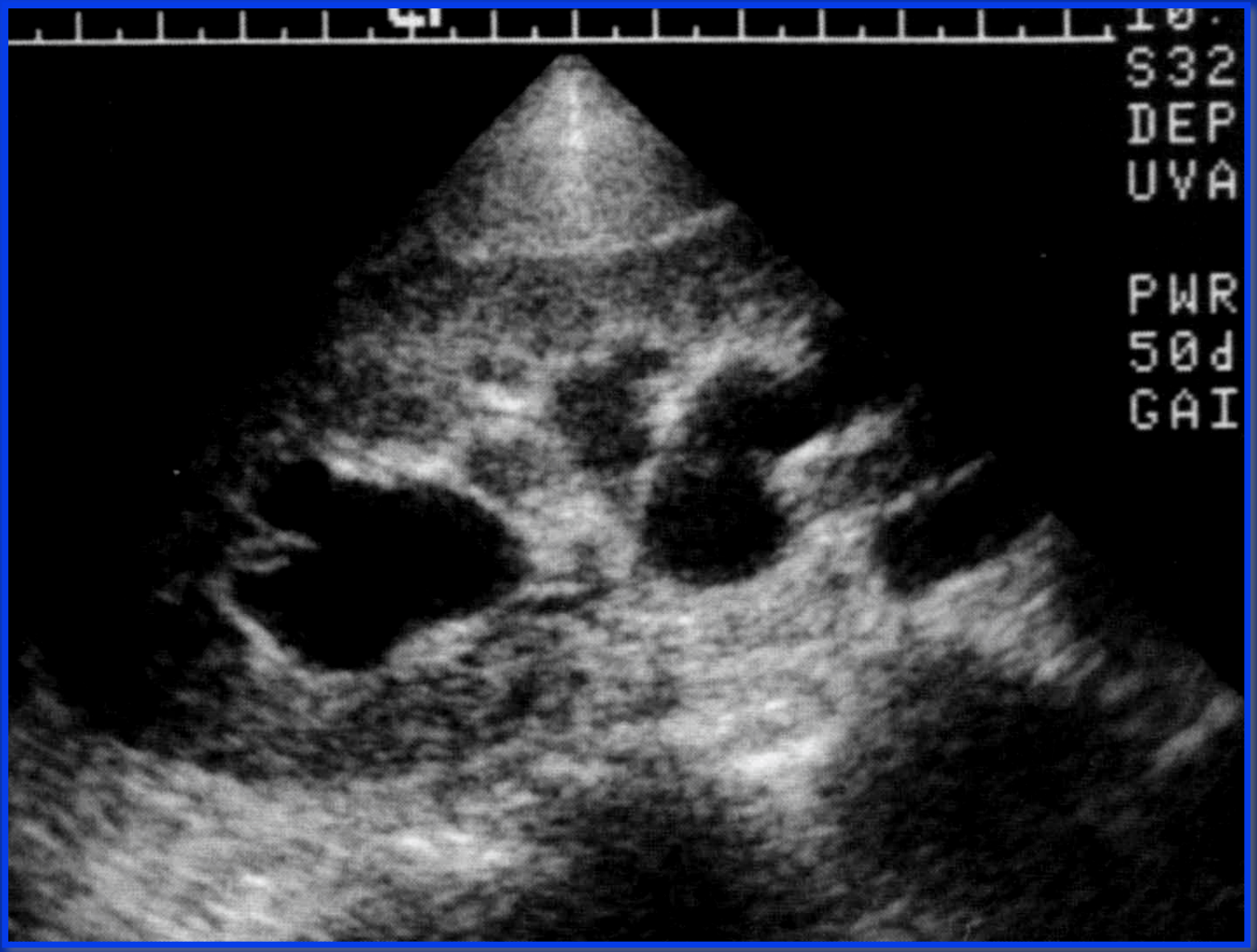
Hydronephrosis

Use the Doppler !

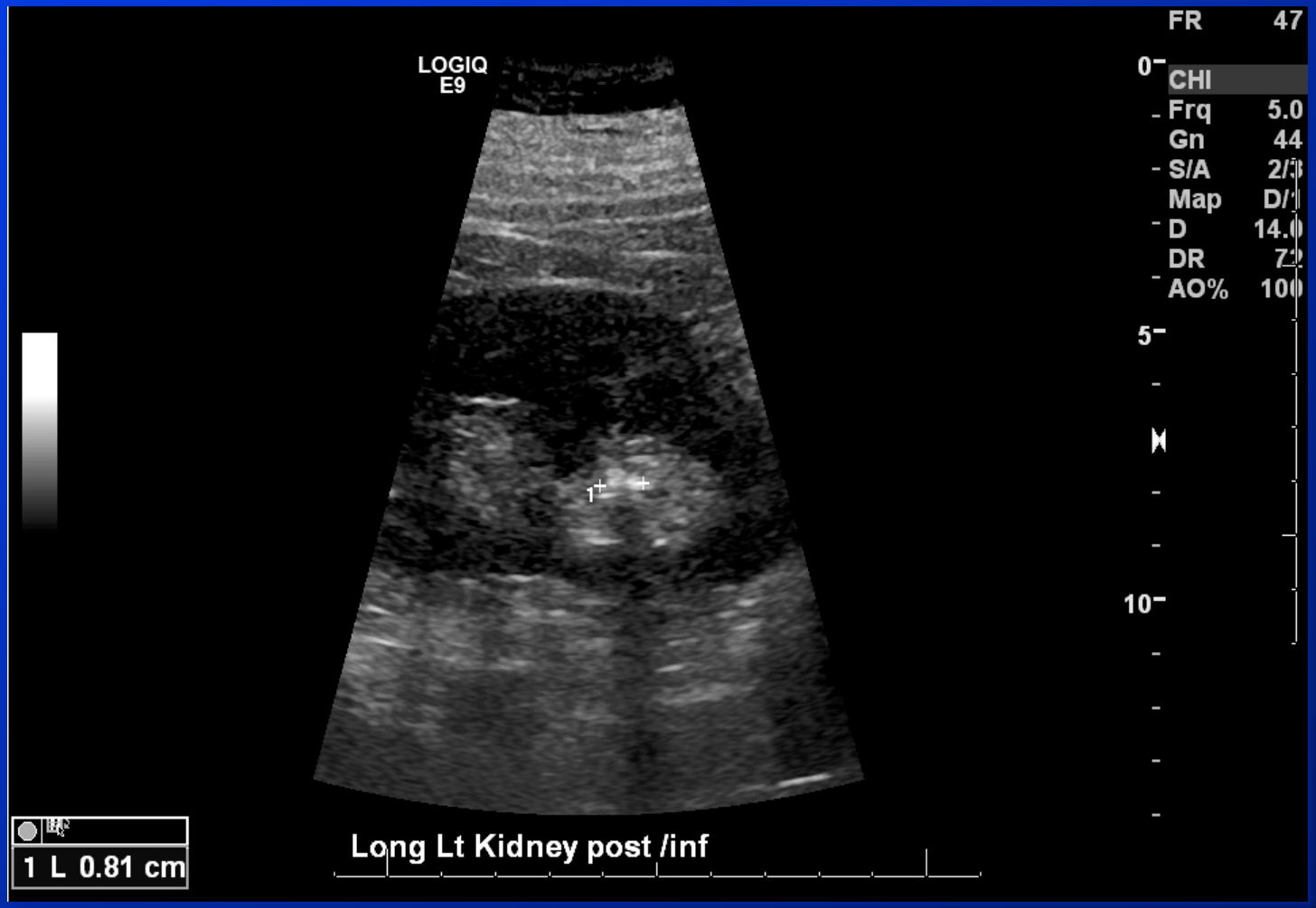




Hydronephrosis



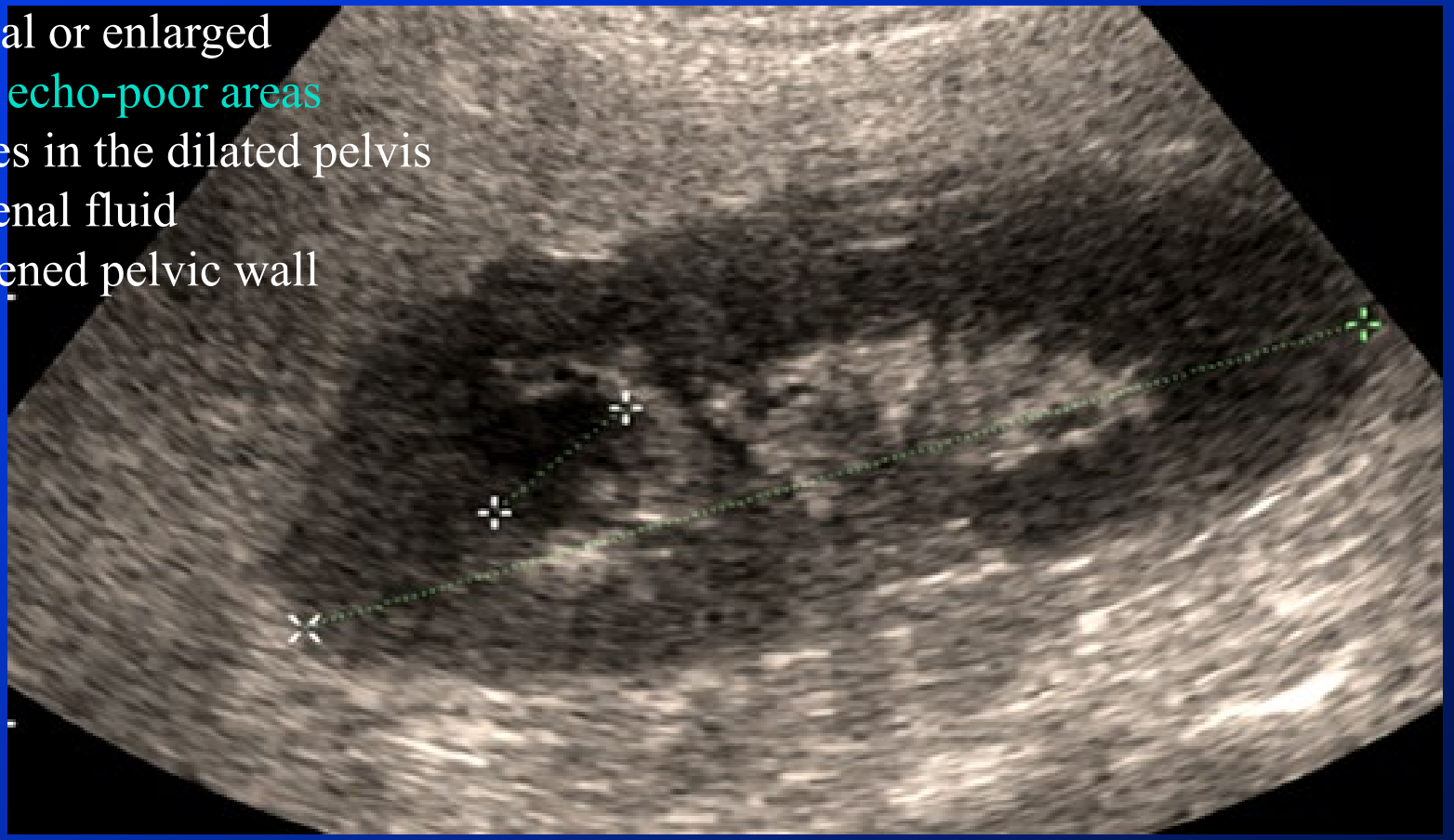
Kidney stone



Acute Pyelonephritis

ultrasound findings:

normal or enlarged
focal echo-poor areas
echoes in the dilated pelvis
perirenal fluid
thickened pelvic wall



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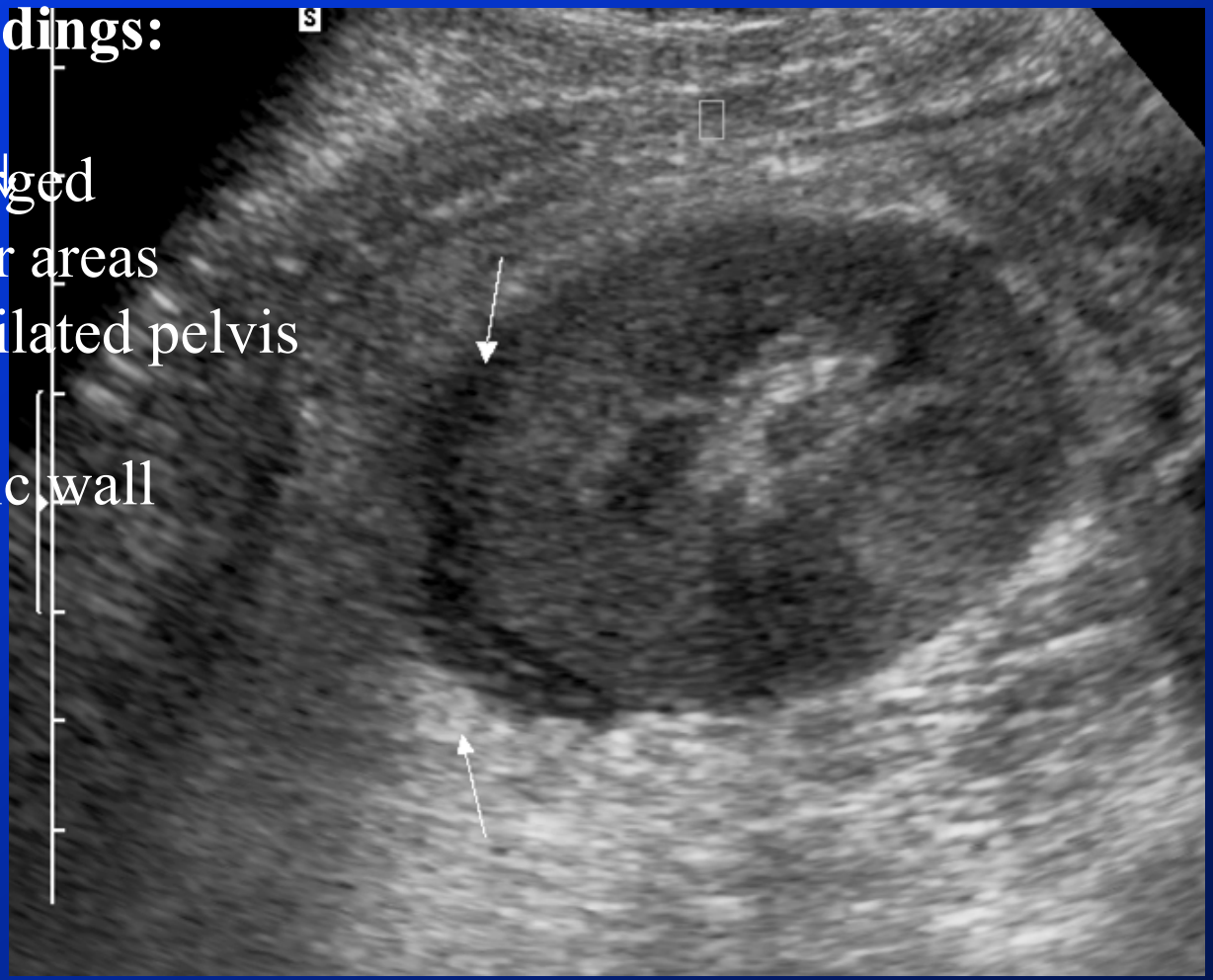
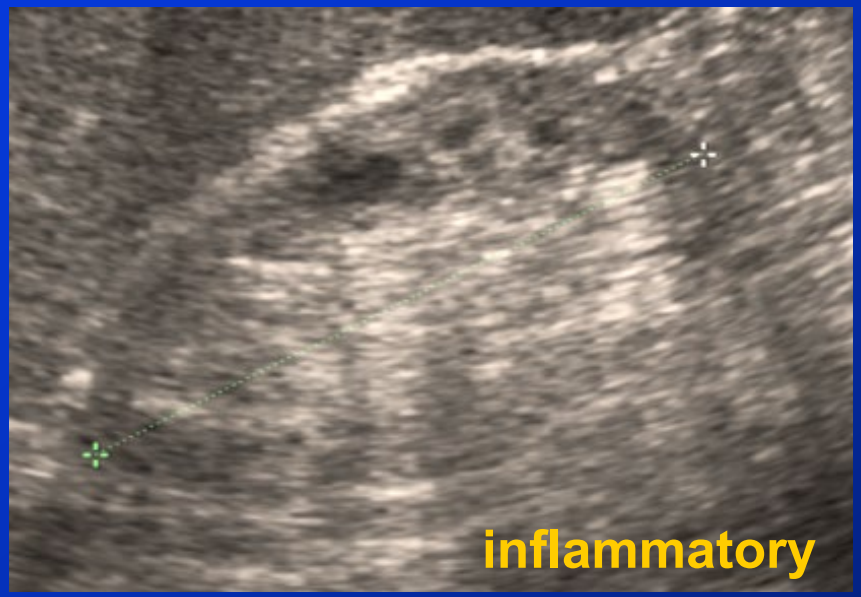
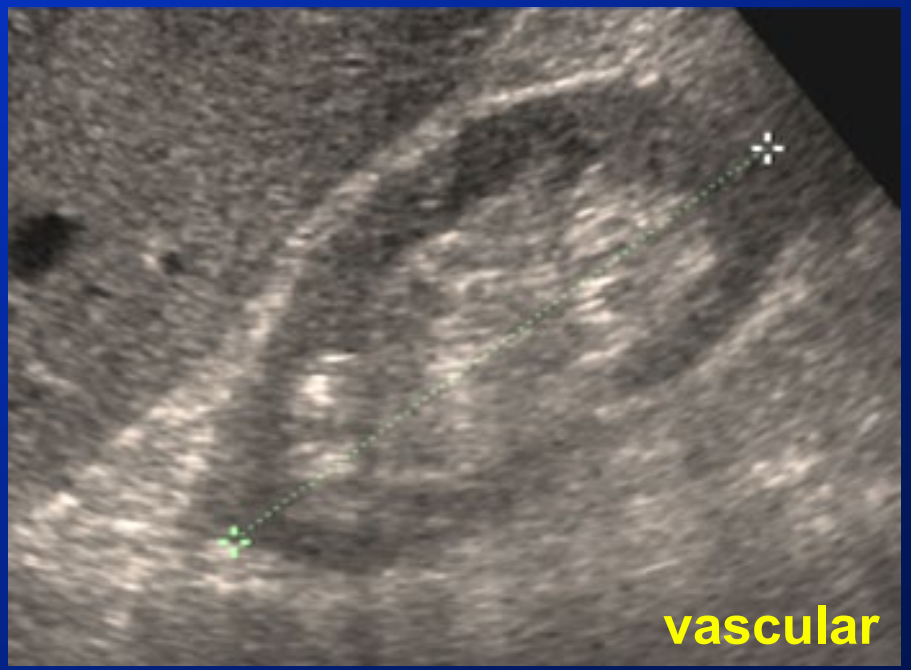


Chronic pyelonephritis

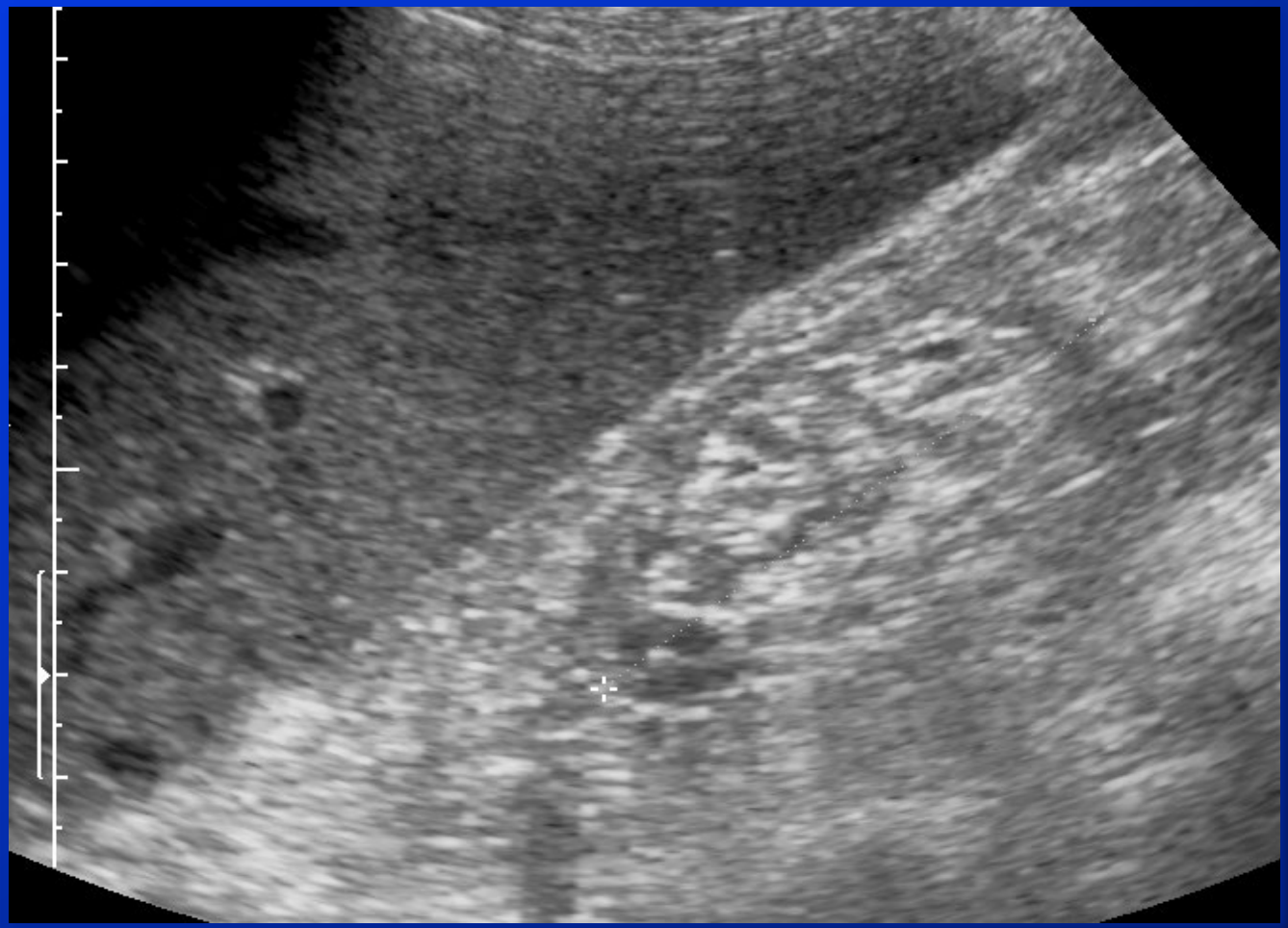
ultrasonic appearance:

- small kidney
- small echo-rich parenchyma
- blurred border between parenchyma and central complex
- scars





Final stage of chronic renal disease: Atrophy or „Putty kidney“



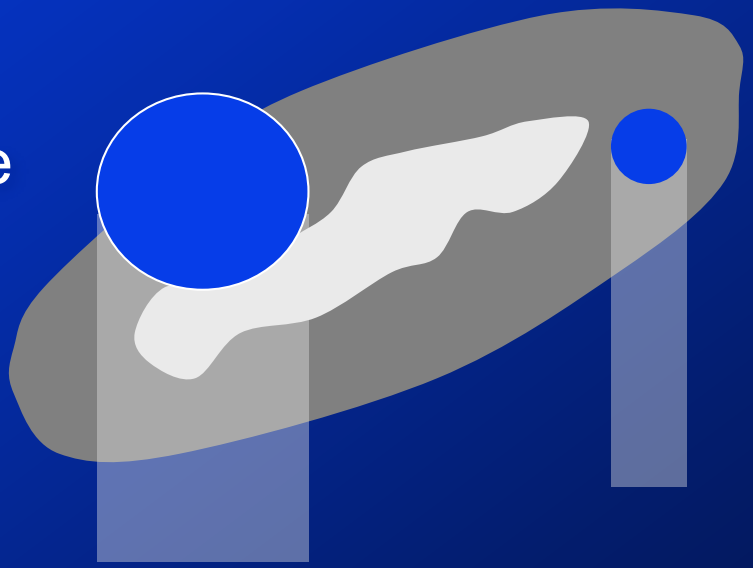
Kidney tumors

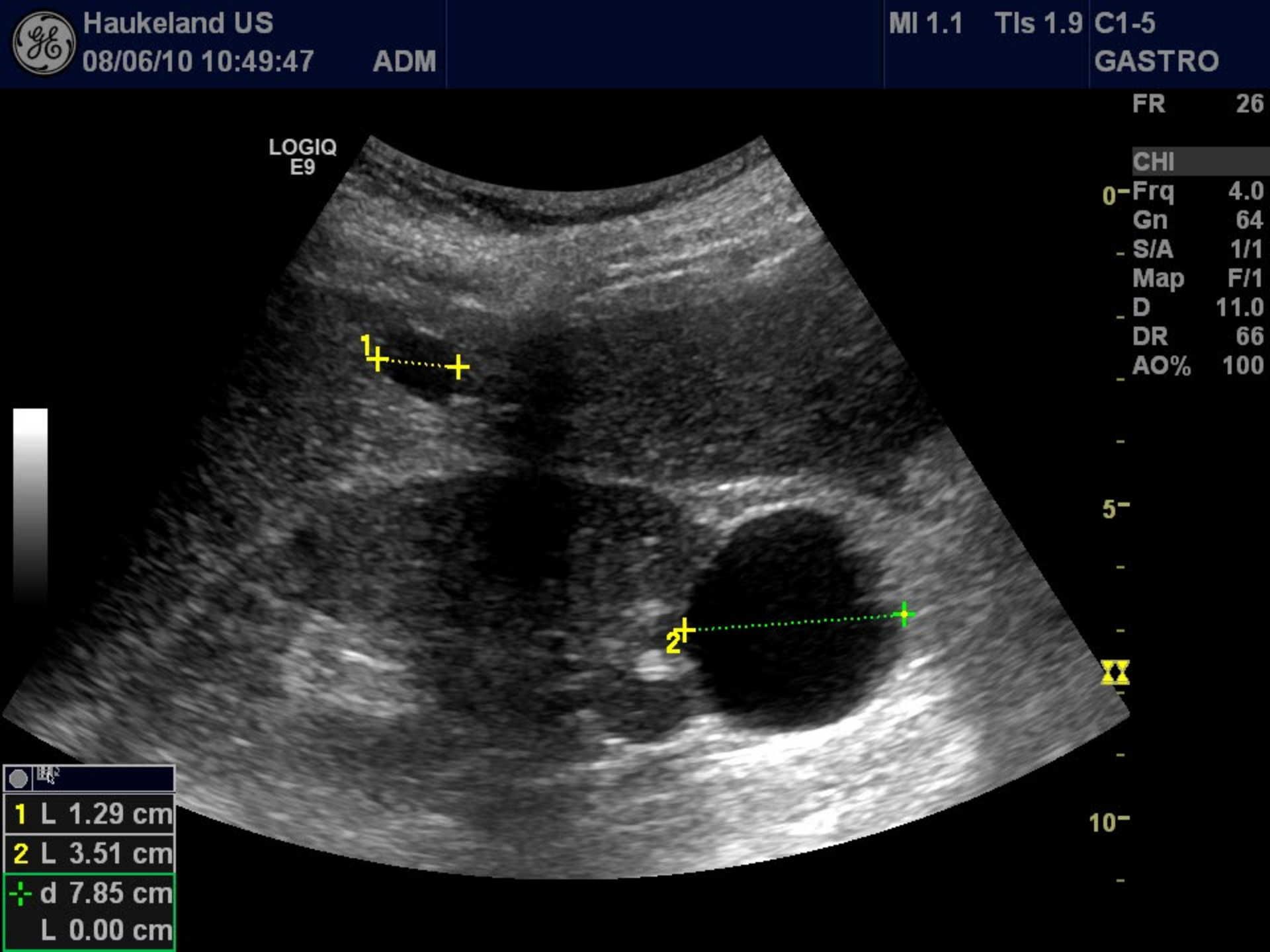
- A: Benign
  - Cysts
  - Angiomyolipoma
  - Oncocytoma
  - (Pseudotumor)
- B: Malignant
  - Carcinoma (RCC)-80%
  - Adenoma (10%)
  - Urothel-carcinoma
  - Lymphoma
  - Metastasis

Renal cysts

Simple renal cyst

- Very common! (> 50% of people > 50)
- Clearly defined smooth wall
- Echo-free
- Posterior enhancement
- Hairline septa possible




Haukeland US
08/06/10 10:49:47
ADM
MI 1.1
TIs 1.9
C1-5
GASTRO
LOGIQ
E9
FR 26
CHI
Frq 4.0
Gn 64
S/A 1/1
Map F/1
D 11.0
DR 66
AO% 100
0
5
10
1
2
1 L 1.29 cm
2 L 3.51 cm
d 7.85 cm
L 0.00 cm

BOSNIAK'S CLASSIFICATION

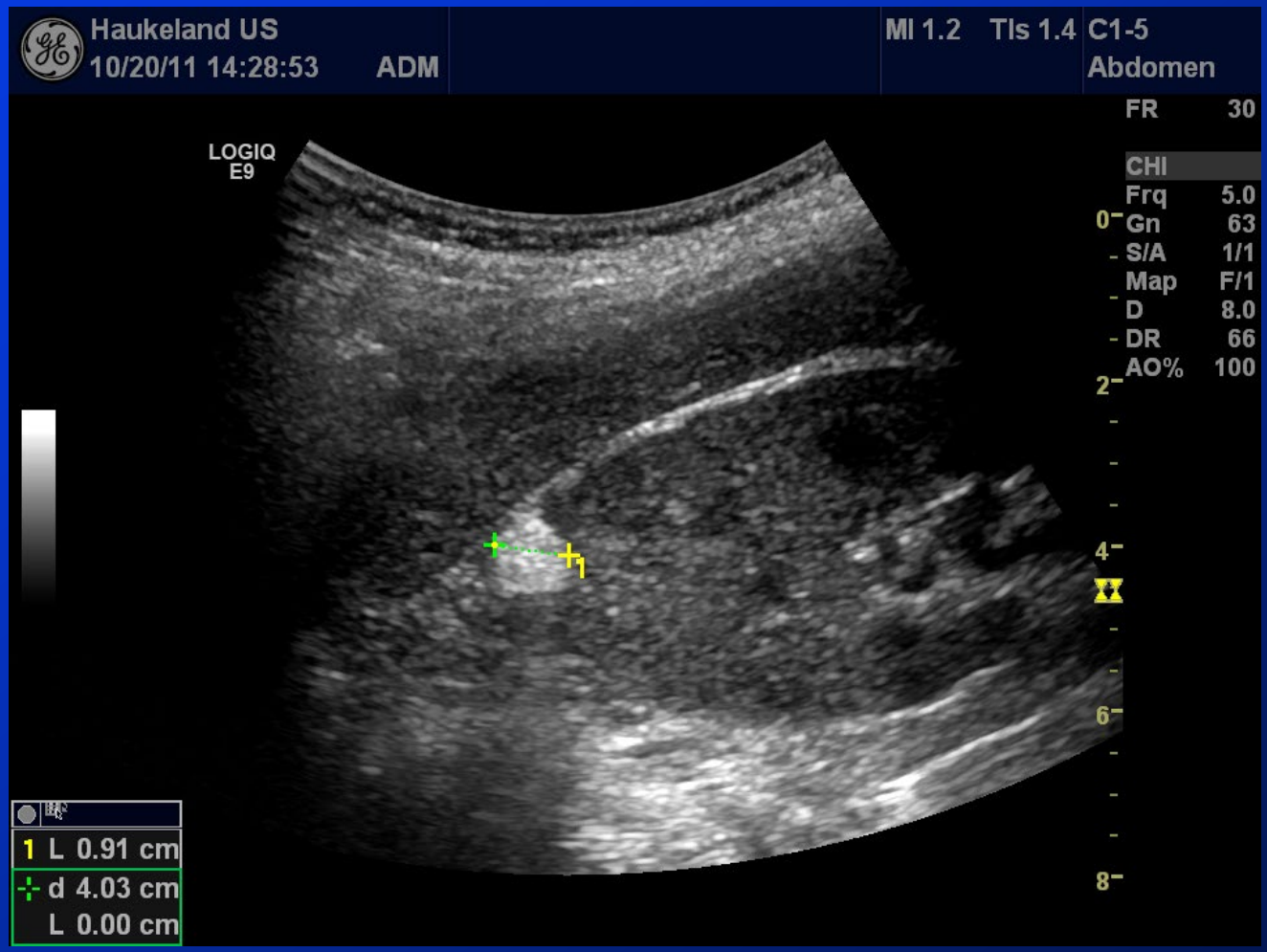
- Type 1:
  - Smooth wall, anechoic, < 20HU at CT. "simple cysts"
- Type 2:
  - Thin septa, small calcifications, evt. hyperdense (< 90HU (blood, proteins).
- Type 3:
  - "Indeterminate". Thick irreg. calcifications, thick septa, irreg. borders
- Type 4:
  - Solid tumors with cystic sections.

ANGIOMYOLIPOMA

- Hamartoma; vessels, fat and smooth muscle
- Isolated 80%:
  - Most in females 40-50 years
  - Often hemorrhage if > 4 cm
- Part of tuberous sclerosis in 20%
  - 50% are bilaterale and multiple
- Benign tumor
- Hyperechogenic tumors without any symptoms

ANGIOMYOLIPOMA

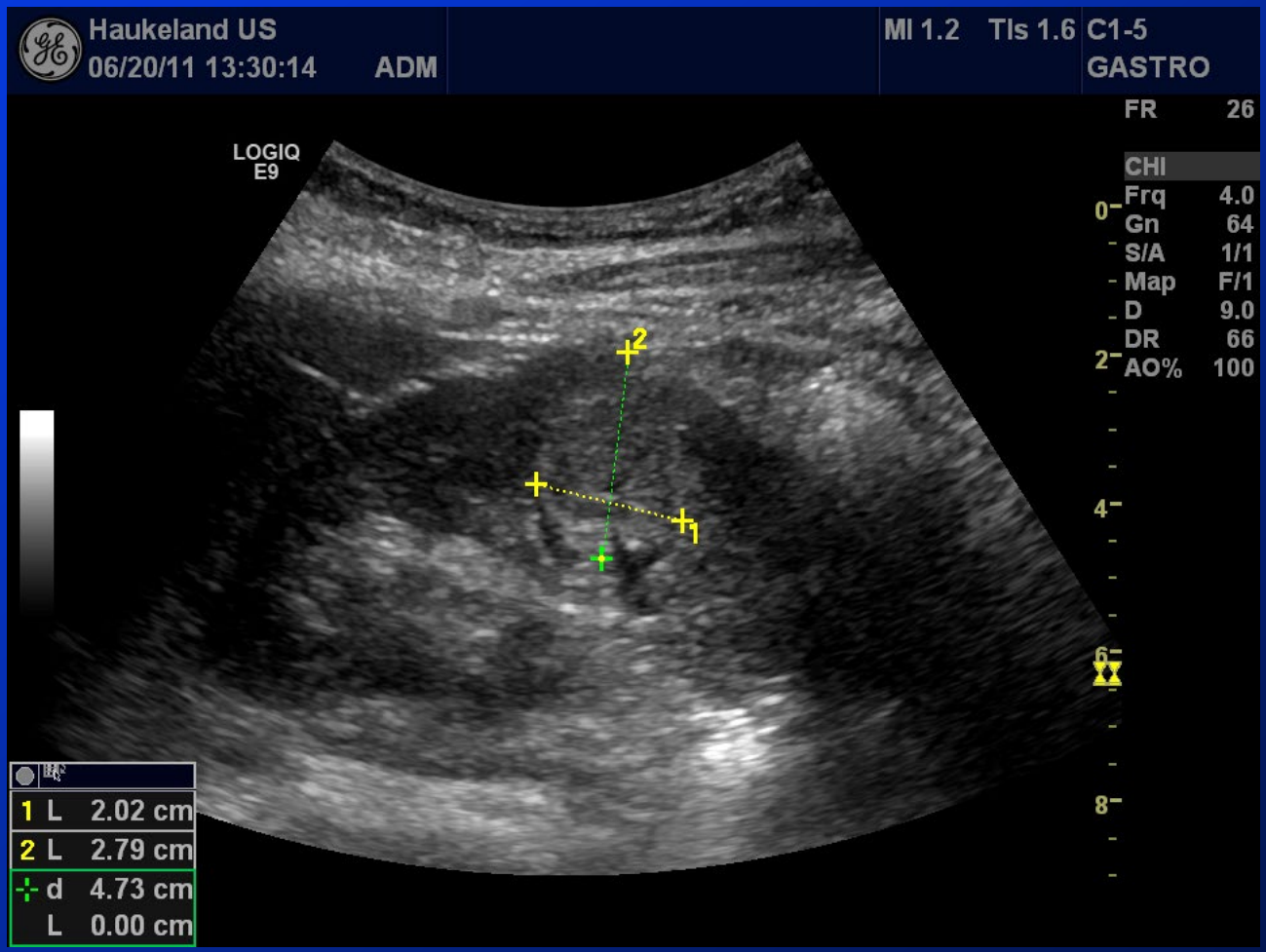
Angiomyolipoma



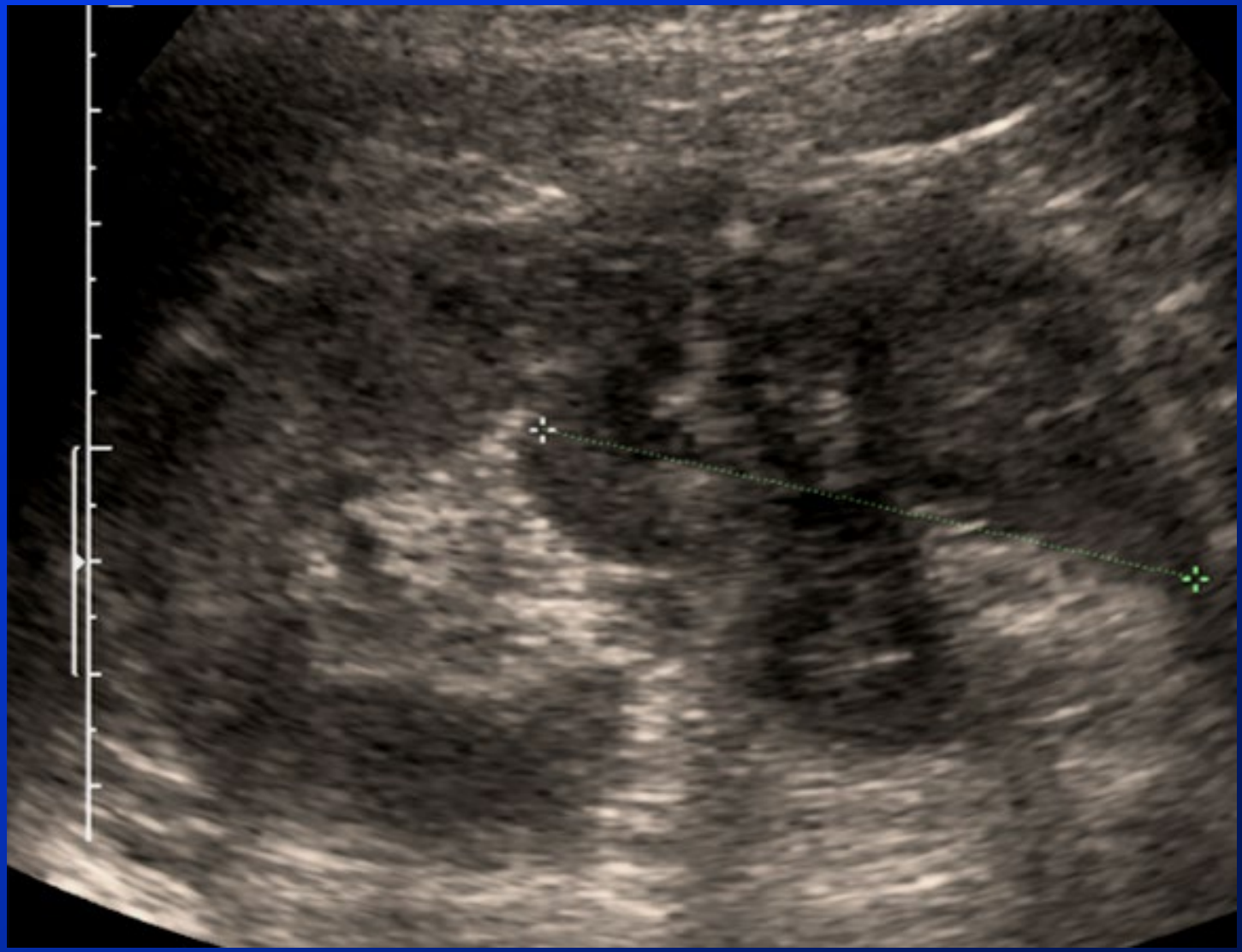
Renal Cell Carcinoma

- 80 % of solid kidney tumors
- Male > Female 3:1
- Incidence: 450/year in Norway
- Increased risk:
  - Hippel-Lindau
  - Chronic dialysis
- 2-3% synchrone tumor in contralateral kidney

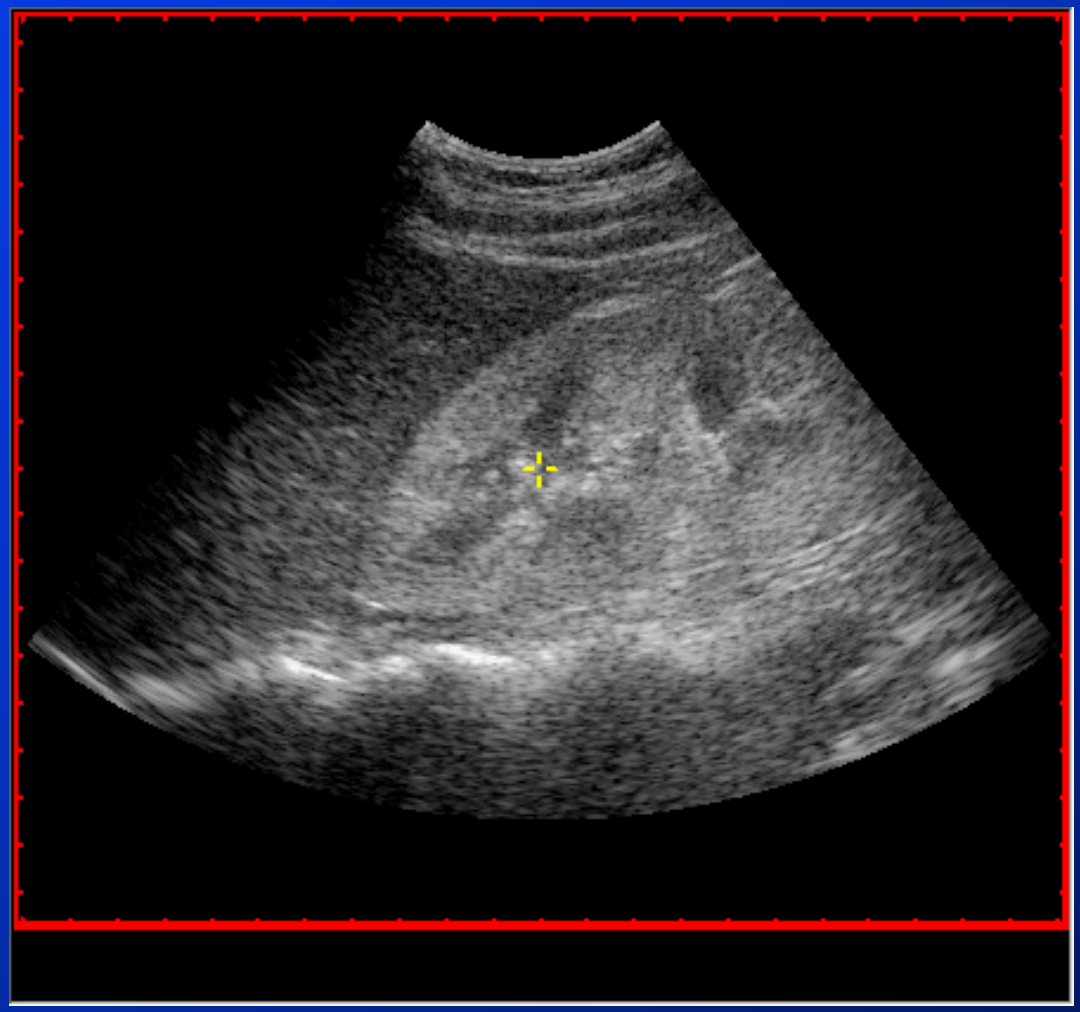
RCC


Haukeland US
06/20/11 13:30:14
ADM
MI 1.2
TIs 1.6
C1-5
GASTRO
LOGIQ
E9
FR 26
CHI
Frq 4.0
Gn 64
S/A 1/1
Map F/1
D 9.0
DR 66
AO% 100
1 L 2.02 cm
2 L 2.79 cm
d 4.73 cm
L 0.00 cm

Renal cell carcinoma



Hyperechogenic kidney



Defroster liquid (Ethylen Glycol) intoxication with oxalat sedimentation

Dangerous or not ?