



Nasjonalt Senter for Gastroenterologisk Ultrasonografi

National Centre for Ultrasound in Gastroenterology
Haukeland University Hospital, Bergen, Norway

Ultrasound of the Pancreas, spleen and kidneys

Odd Helge Gilja, MD, PhD

Professor

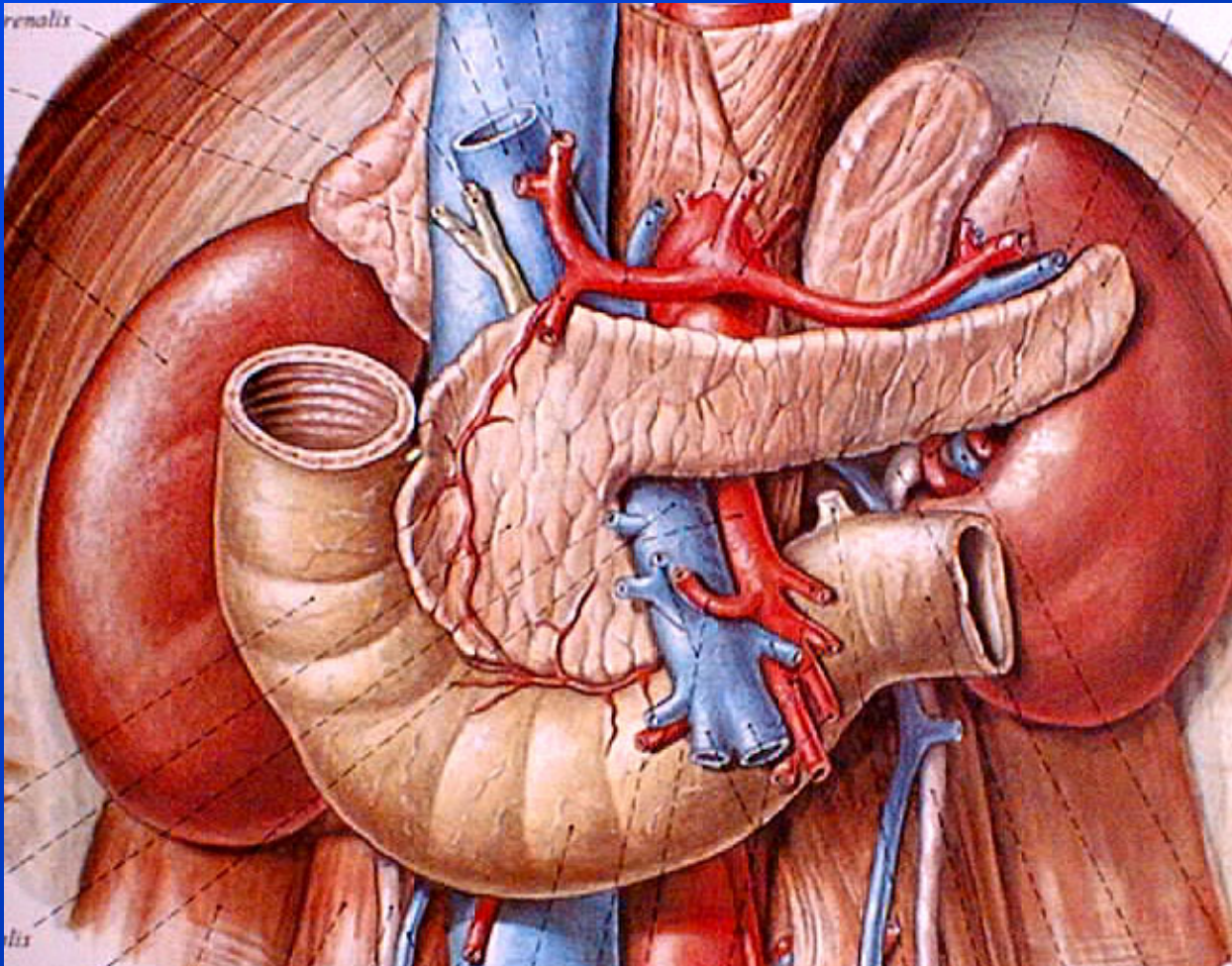
Department of Medicine

Haukeland University Hospital

Bergen, Norway

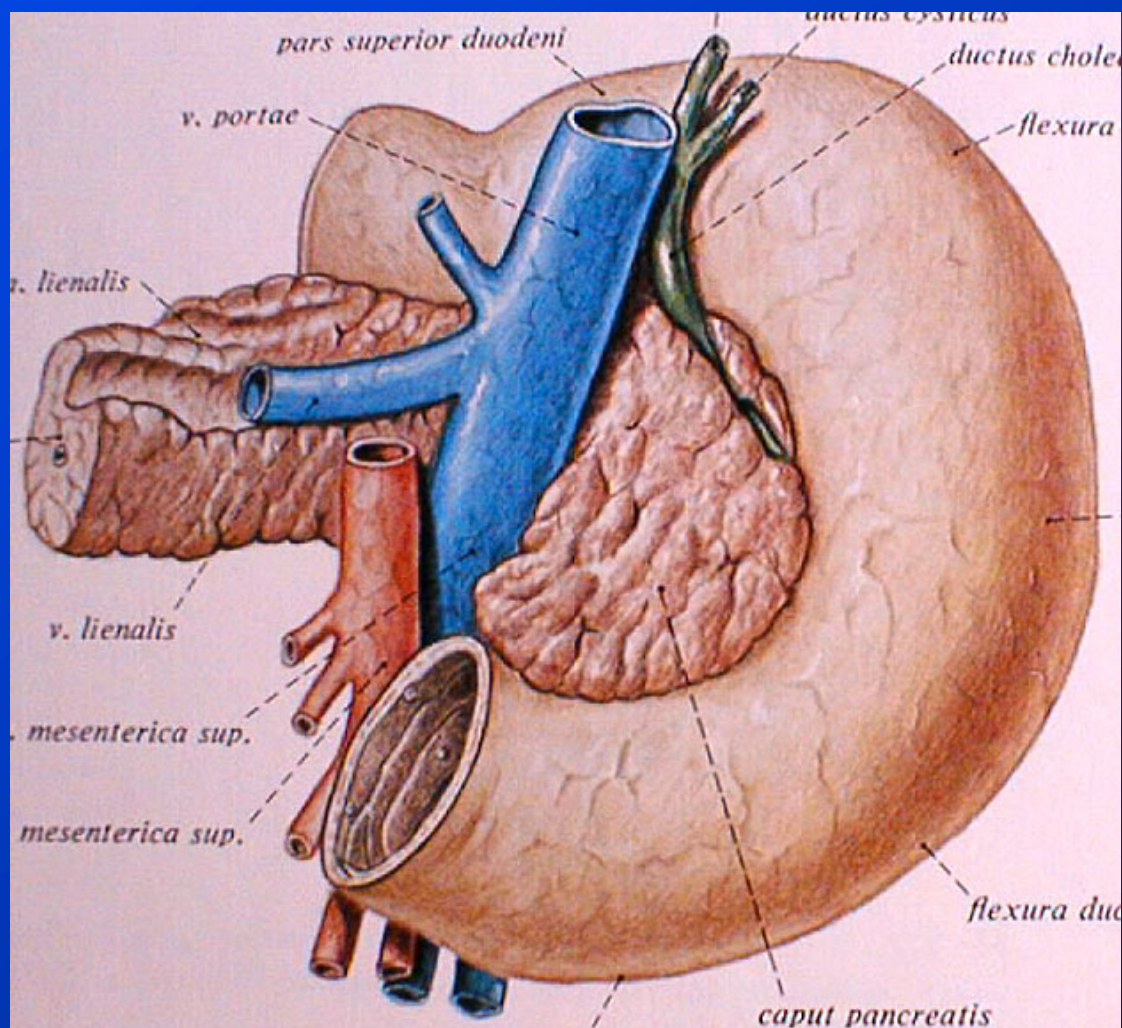


Pancreatic anatomy





Pancreas viewed from behind



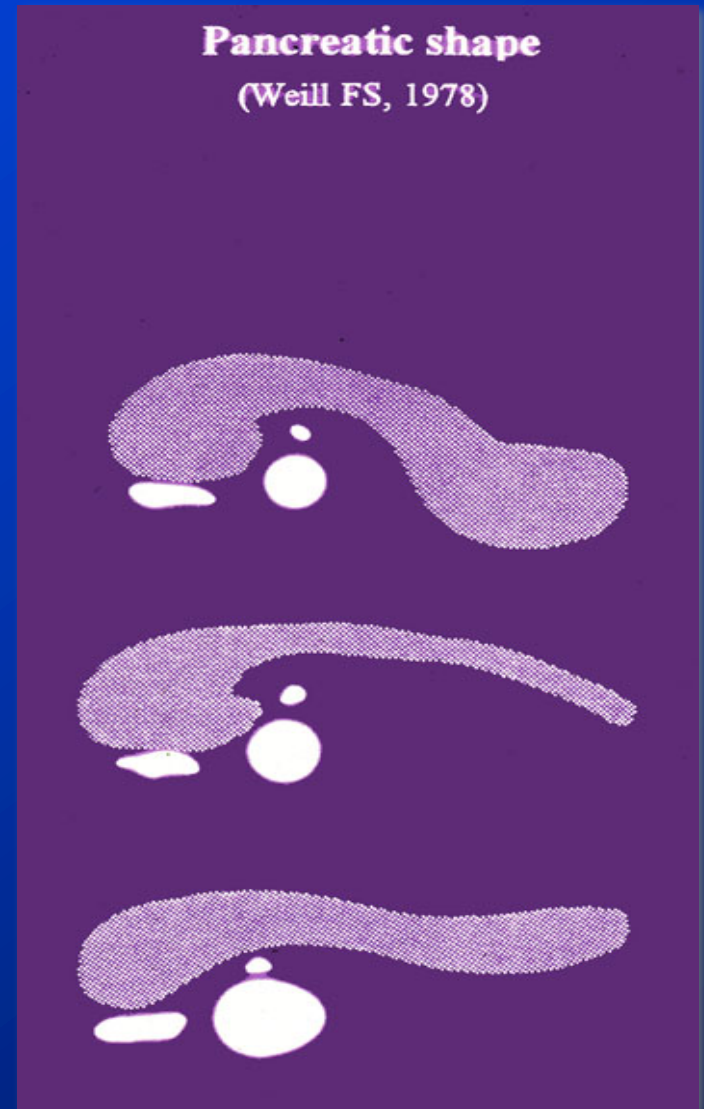


Pancreatic size and shape

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

DeGraff C et al. Radiology
1978

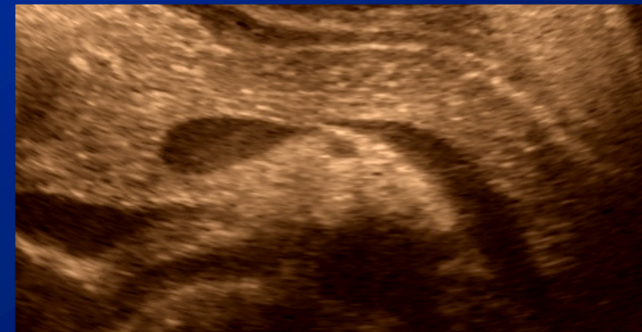
Niederau C et al. Radiology
1983





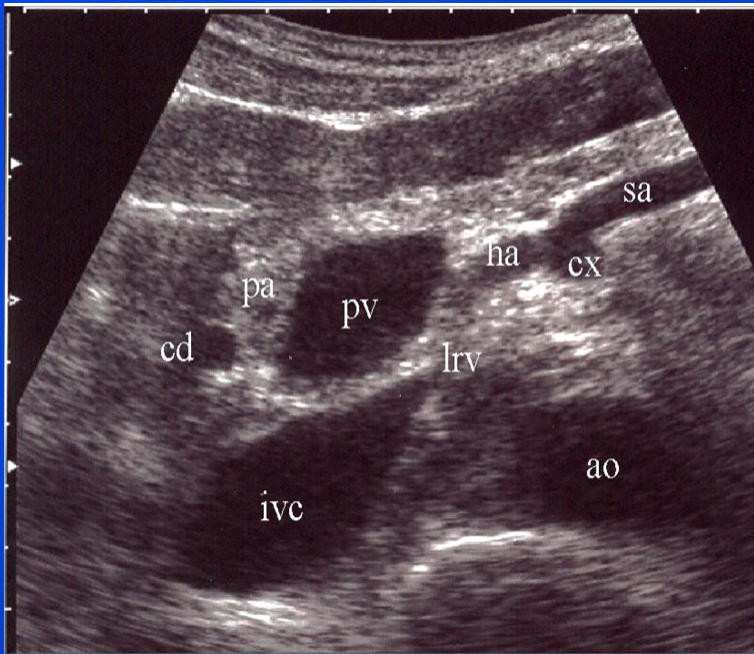
Scanning Technique

- 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



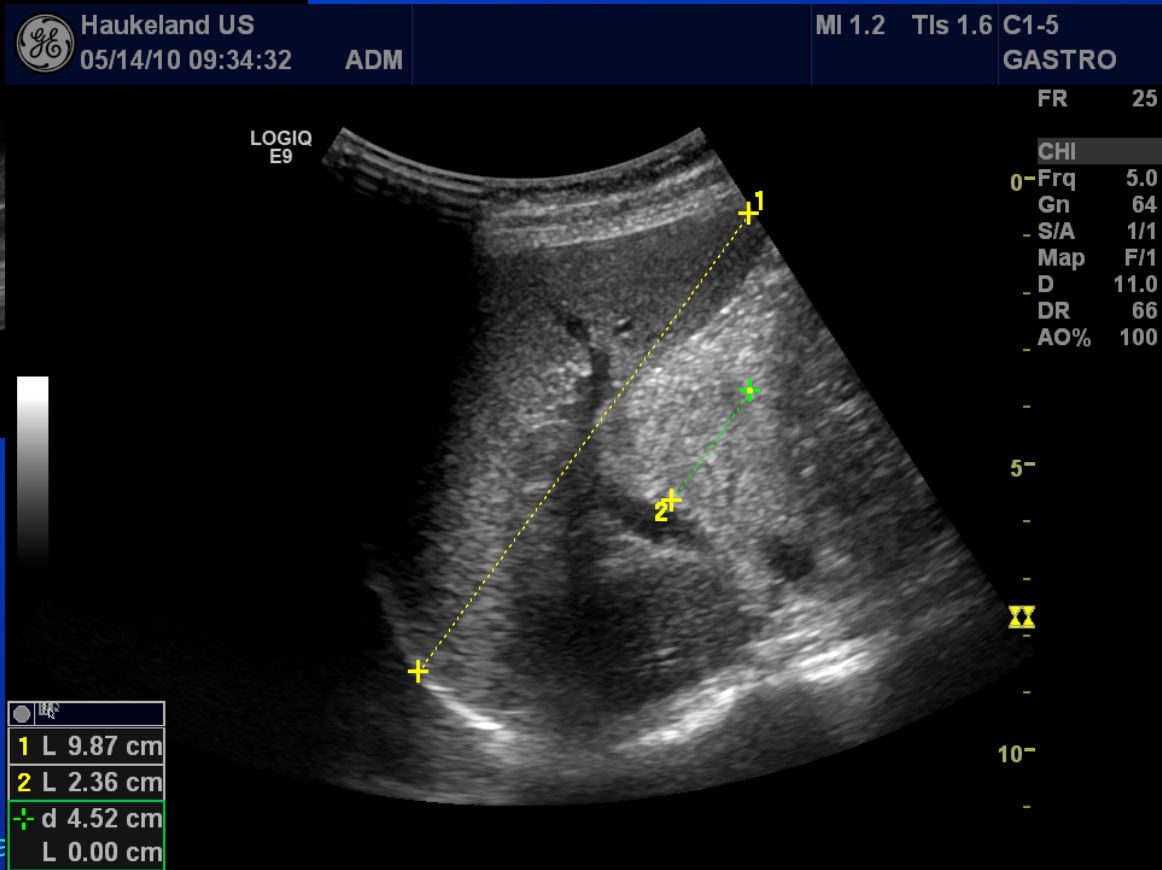


Normal Pancreatic Tail



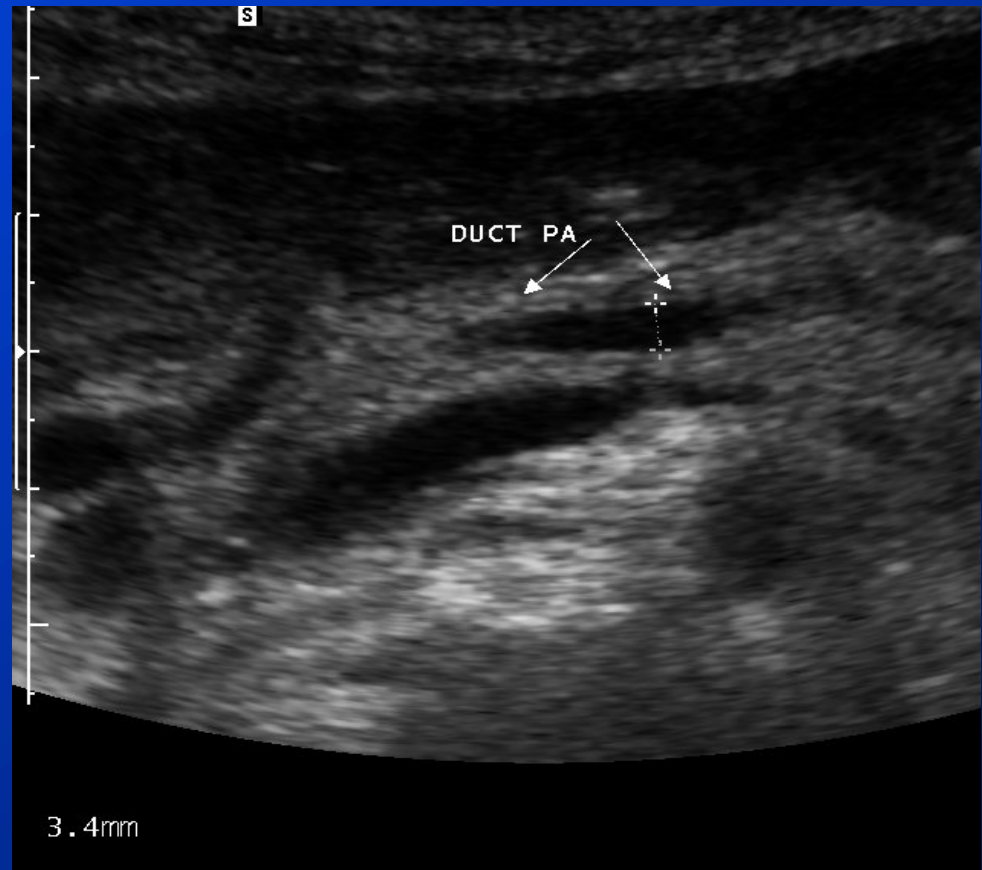
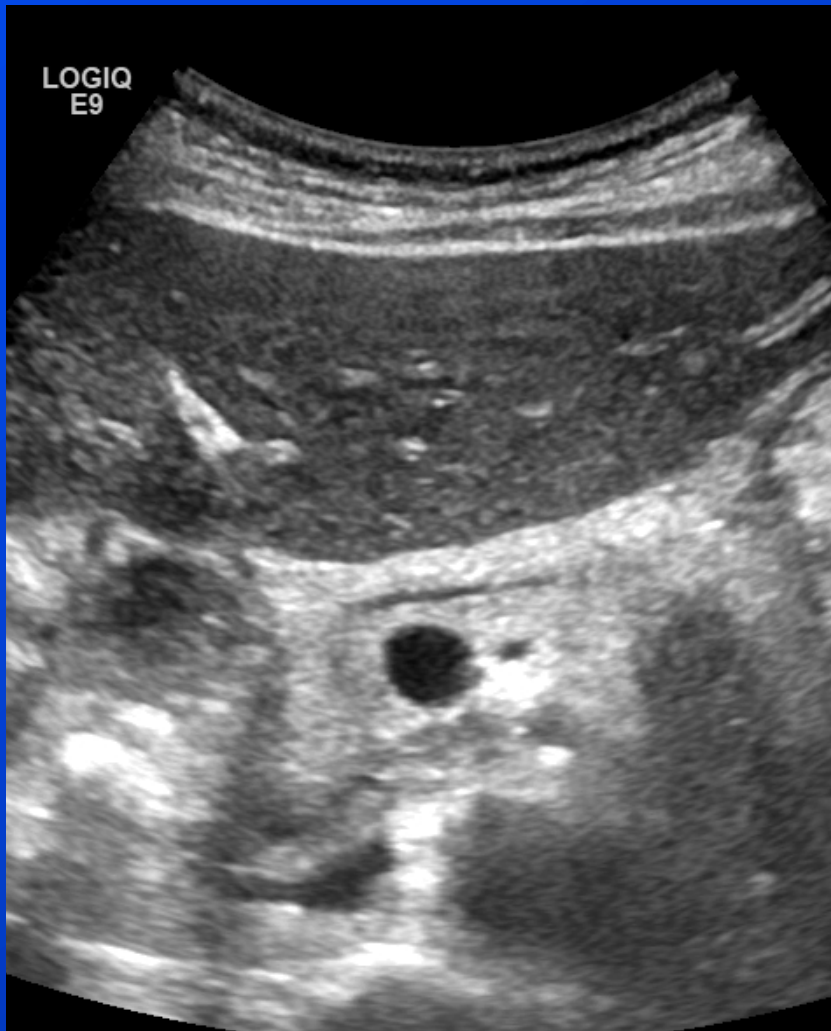


Pancreas viewed through the spleen





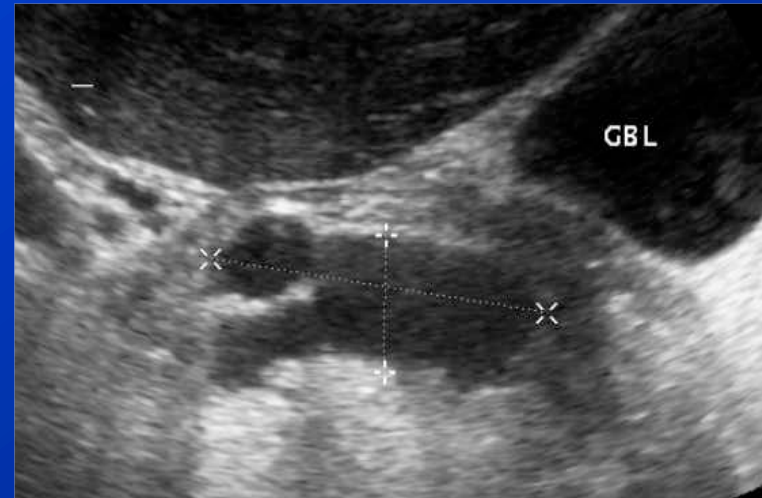
Ductus Pancreaticus





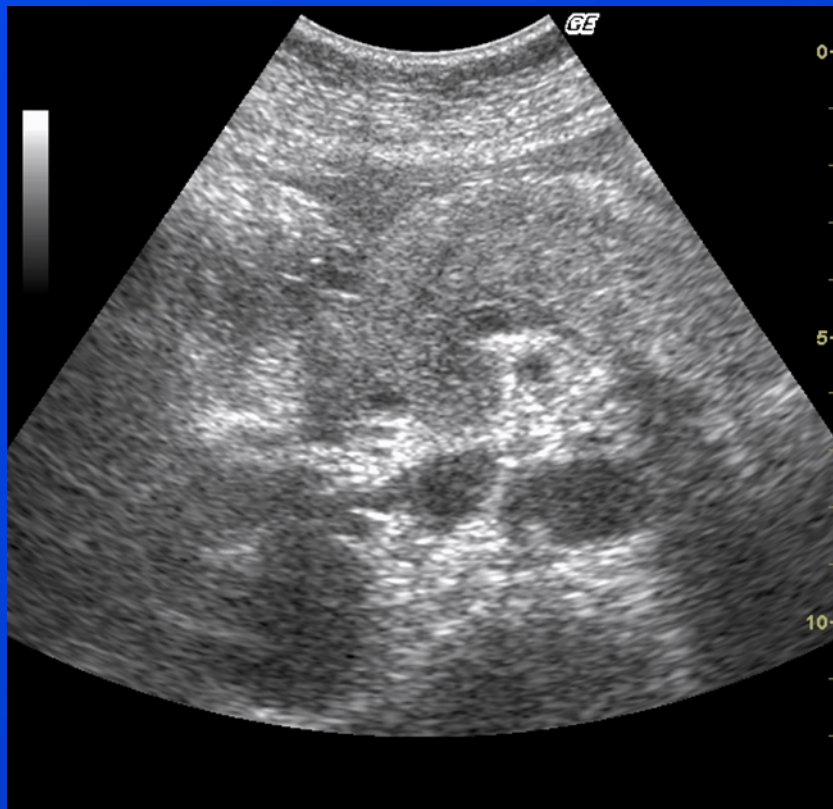
Acute Pancreatitis

- 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

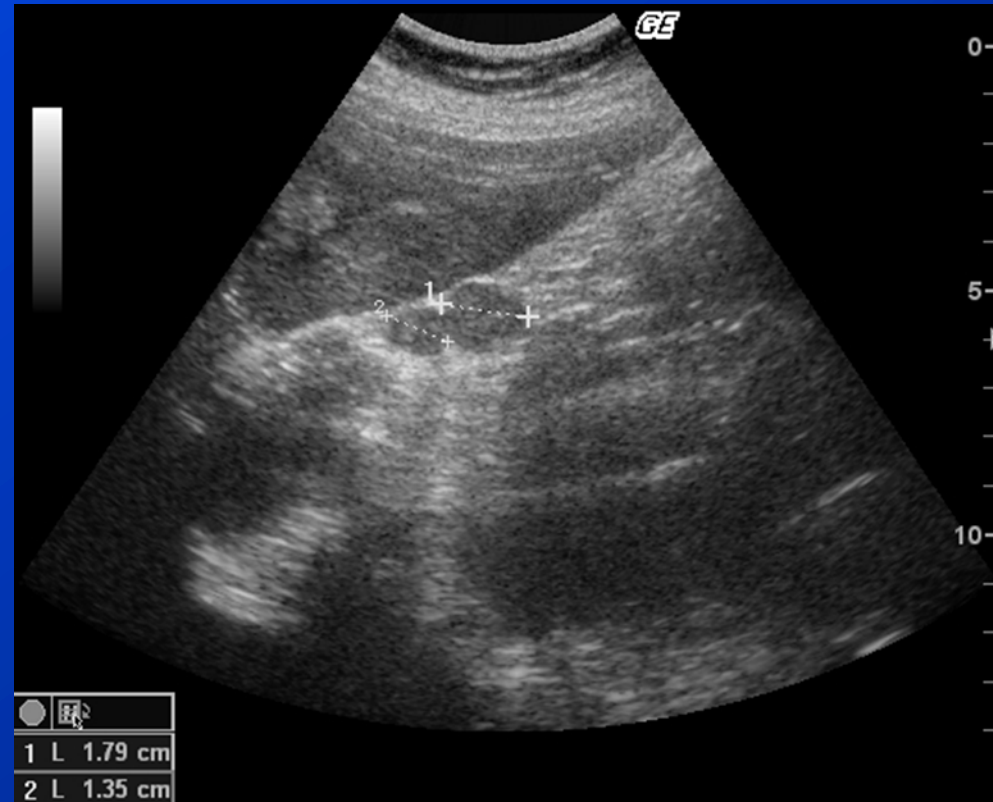




Acute Pancreatitis



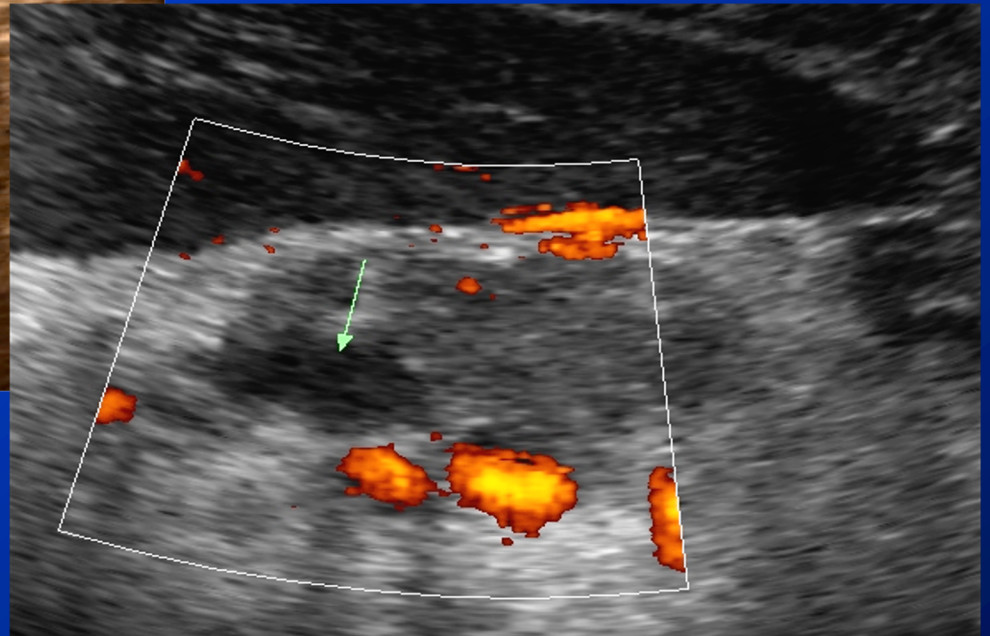
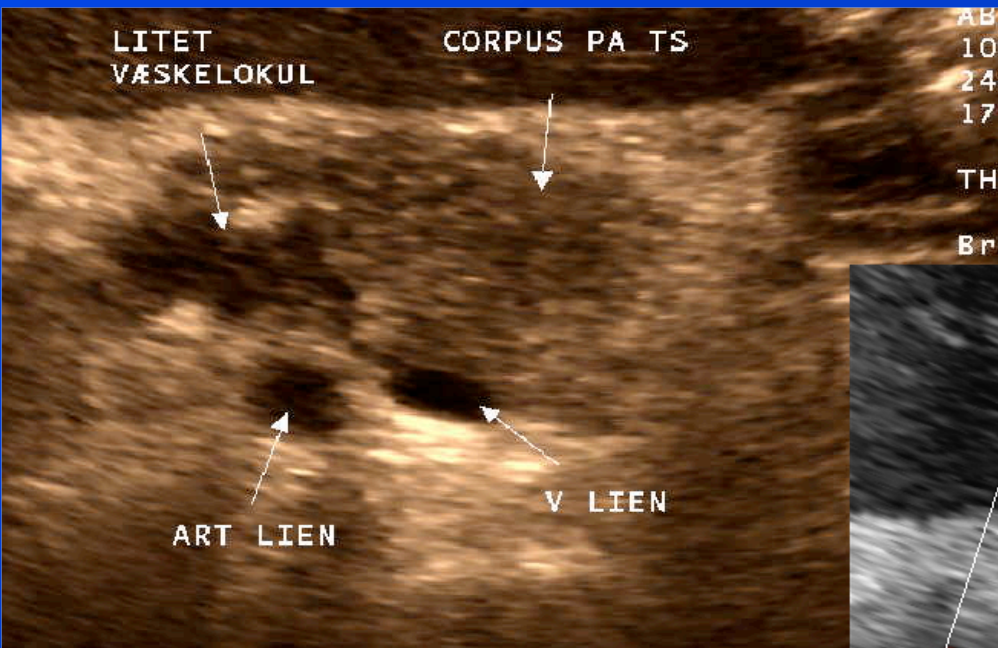
Enlarged pancreas



Enlarged Lymphnodes



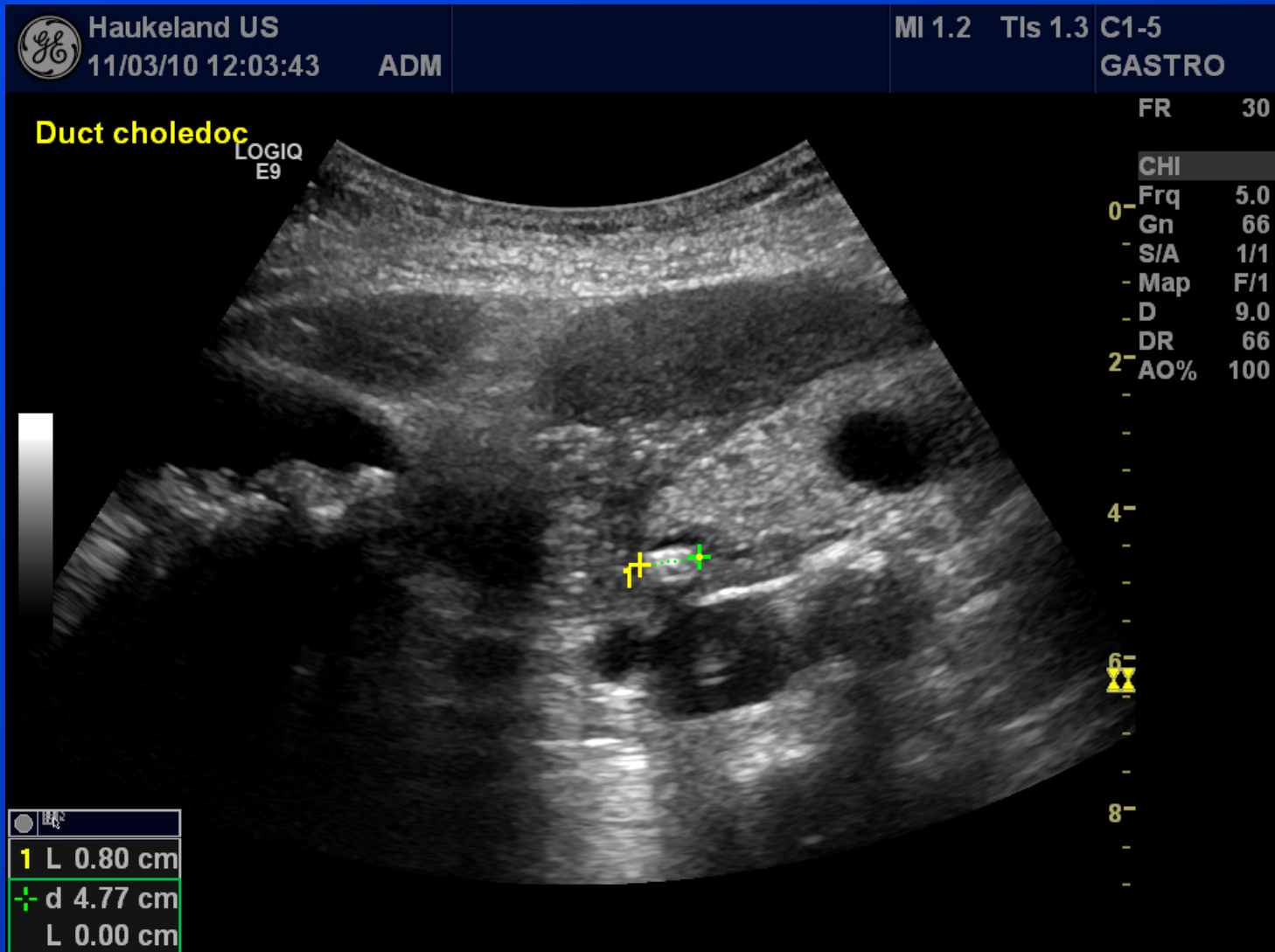
Transabdominal ultrasound in acute pancreatitis



Fluid collections



Look for the cause of acute pancreatitis!





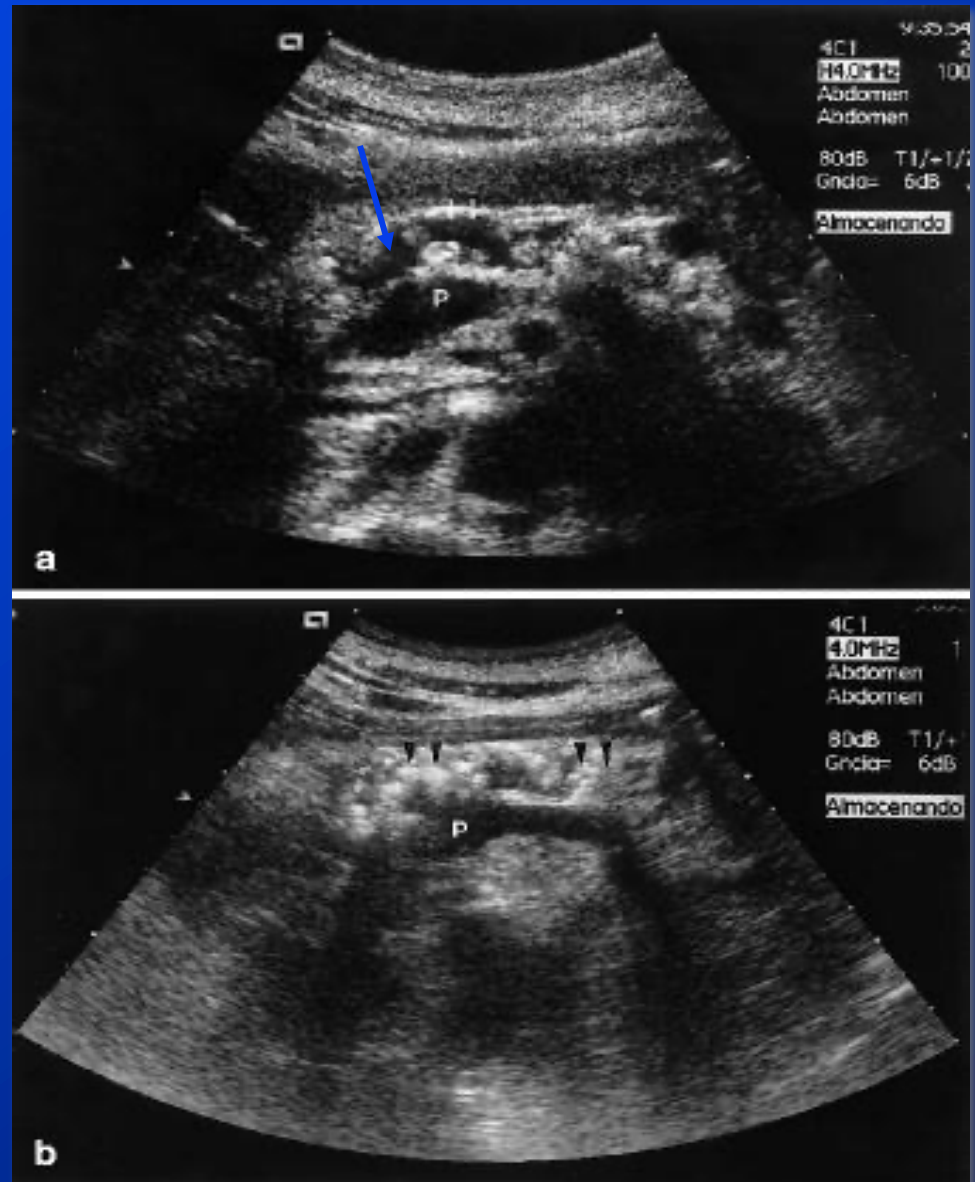
Chronic Pancreatitis

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



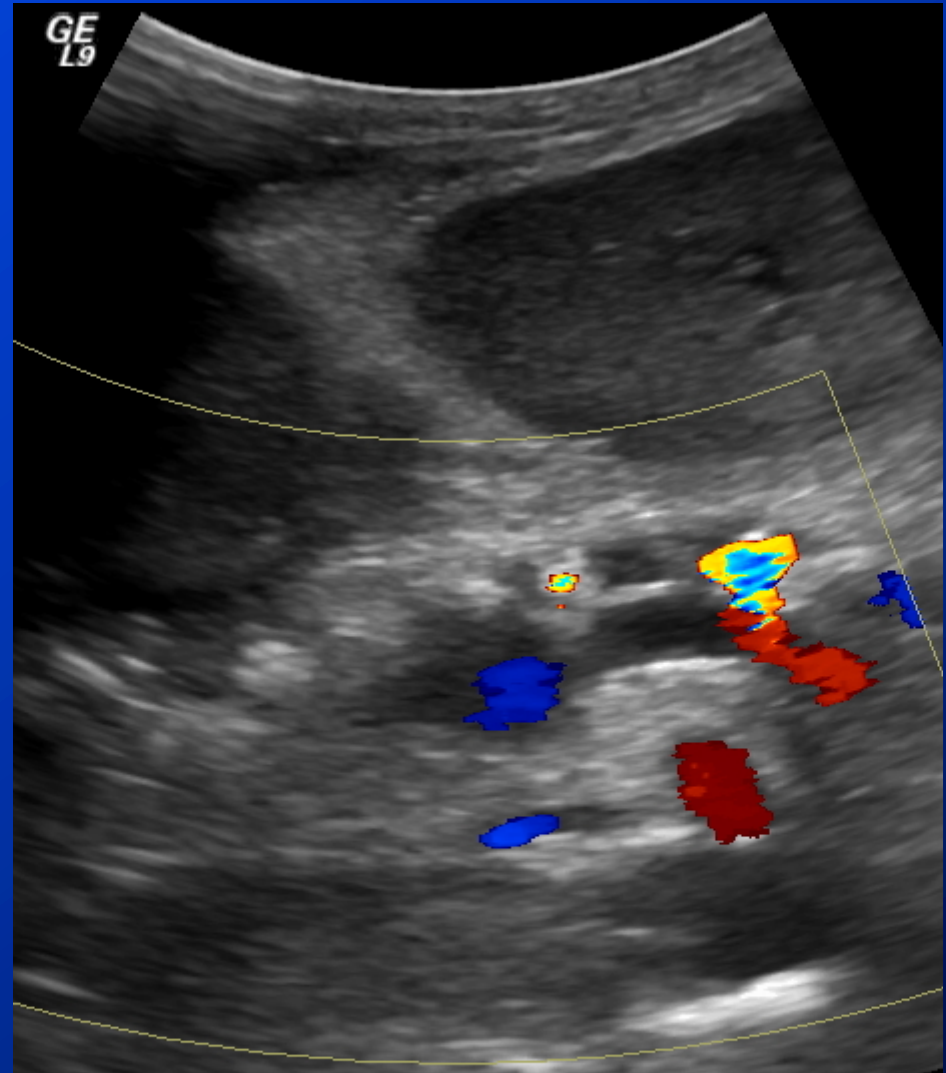
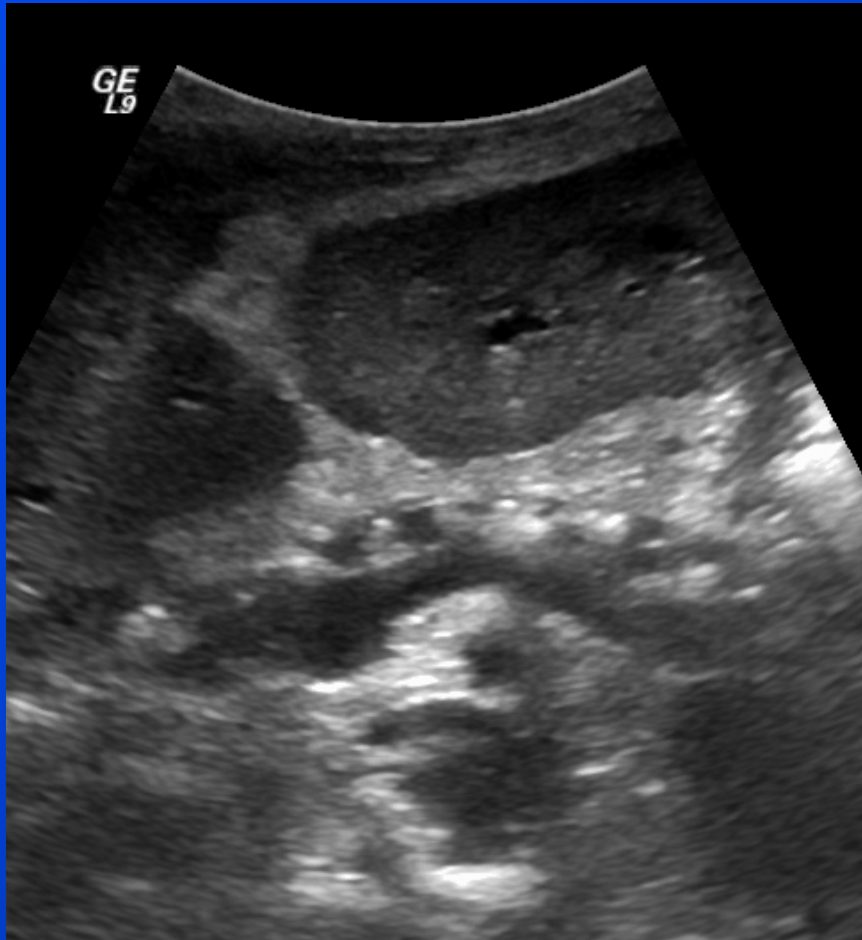
Chronic pancreatitis

- Observe
 - Dilated pancreatic duct with calculi (white arrowhead)
 - Massive calcifications (black arrowheads)





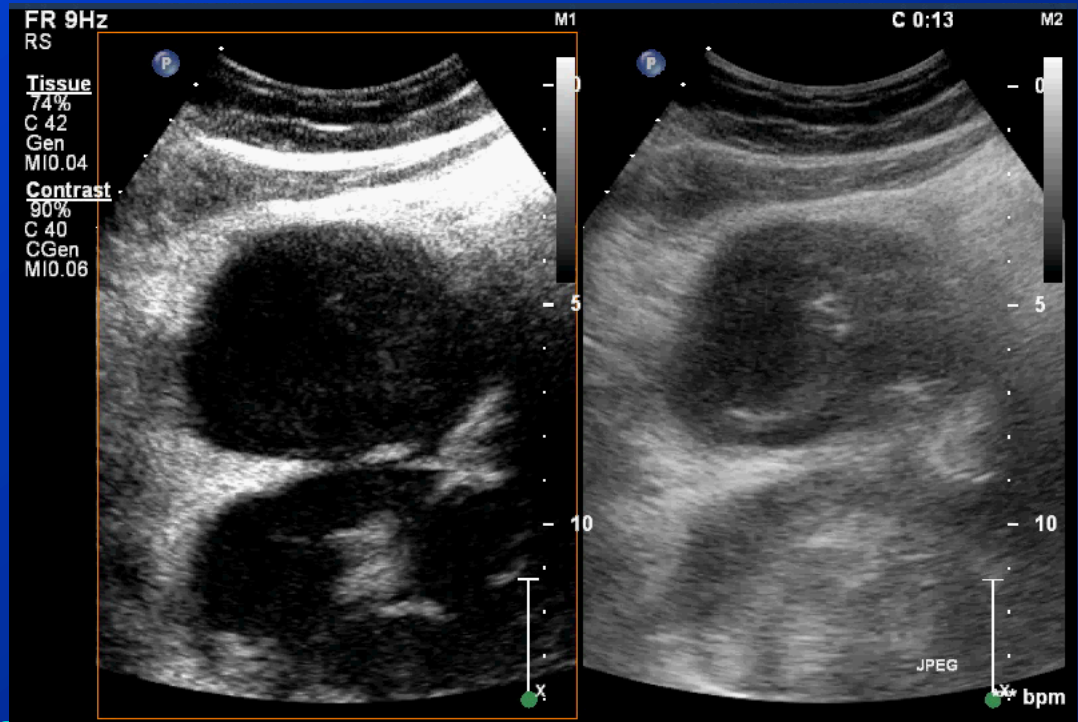
Chronic Pancreatitis – Twinkling artifact





Pancreatic pseudocyst

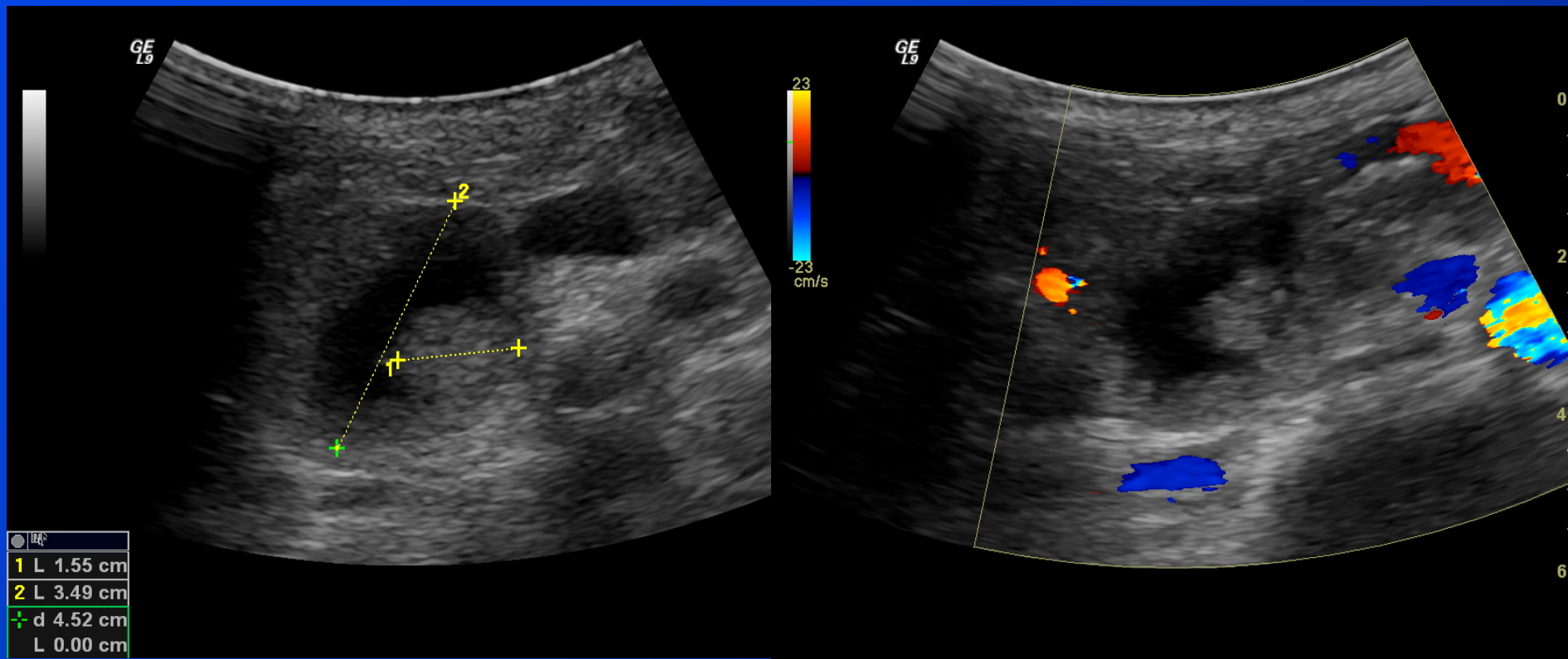
- A pancreatic pseudocyst is a circumscribed collection of fluid with no capsule rich in pancreatic enzymes, blood, and necrotic tissue, typically located in the lesser sac of the abdomen





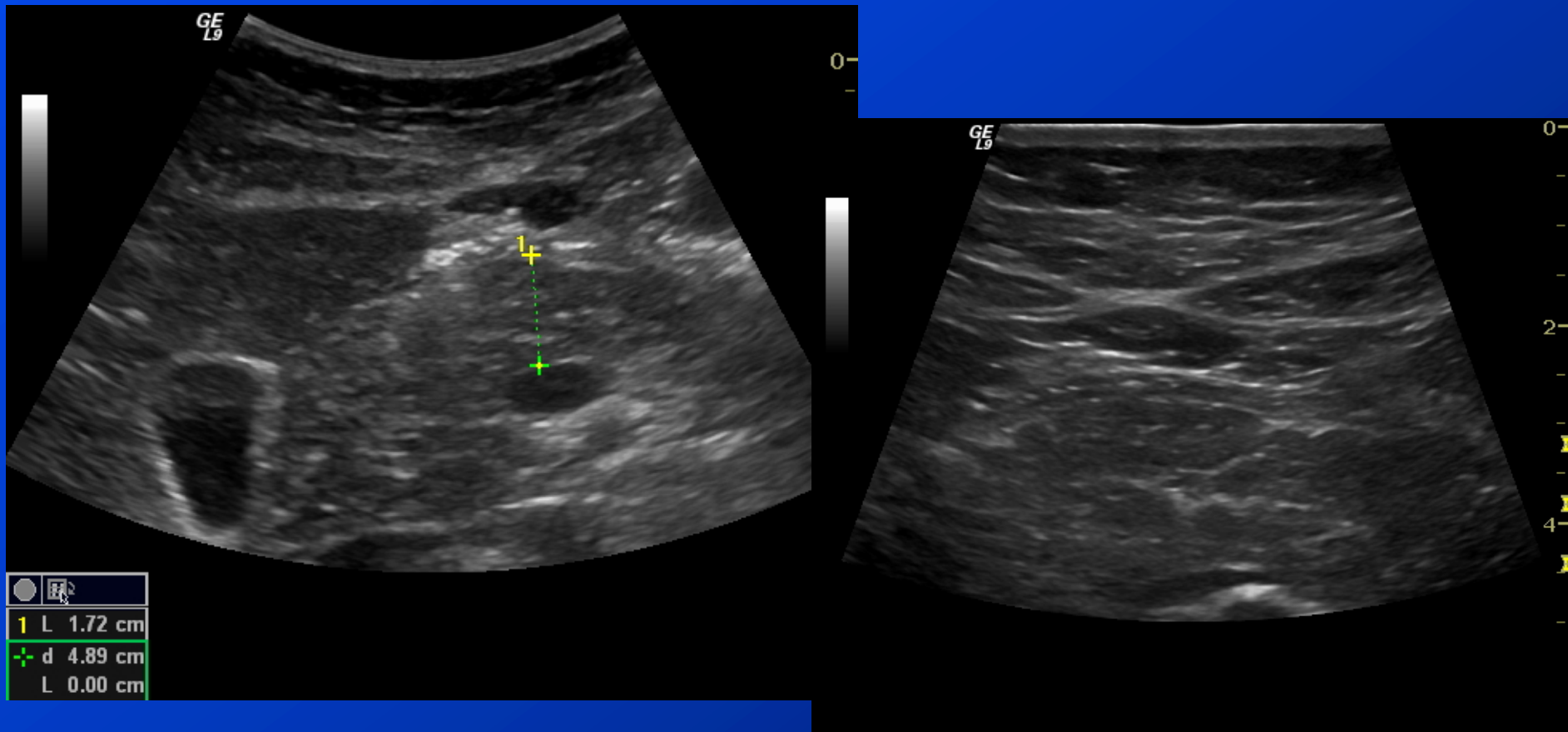
Extreme duct dilatation in chronic pancreatitis with IPMN

Male, 71 years



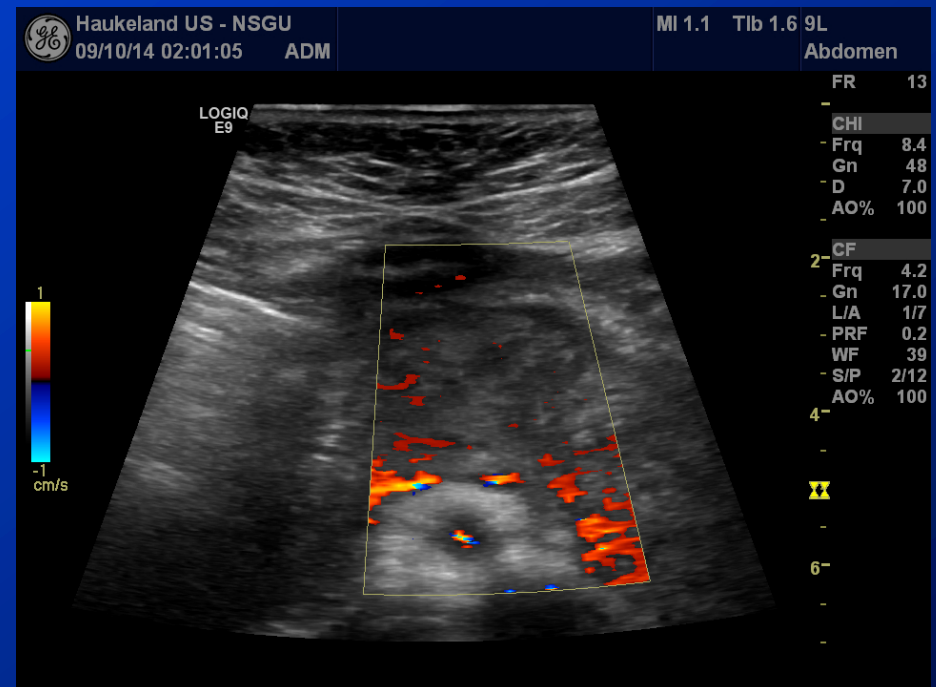


Autoimmune Pancreatitis





AIP





Pancreatic tumors

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

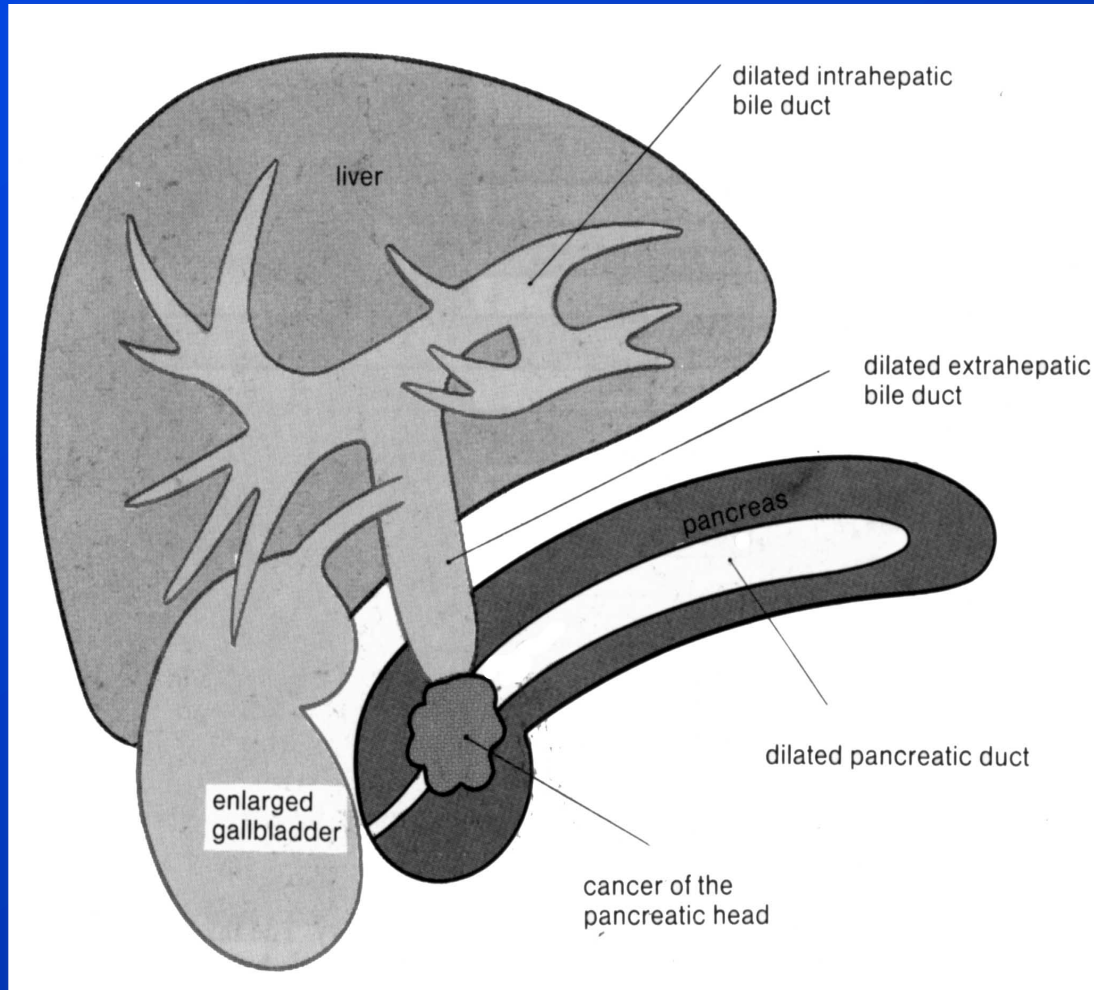


Pancreas Cystadenom





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



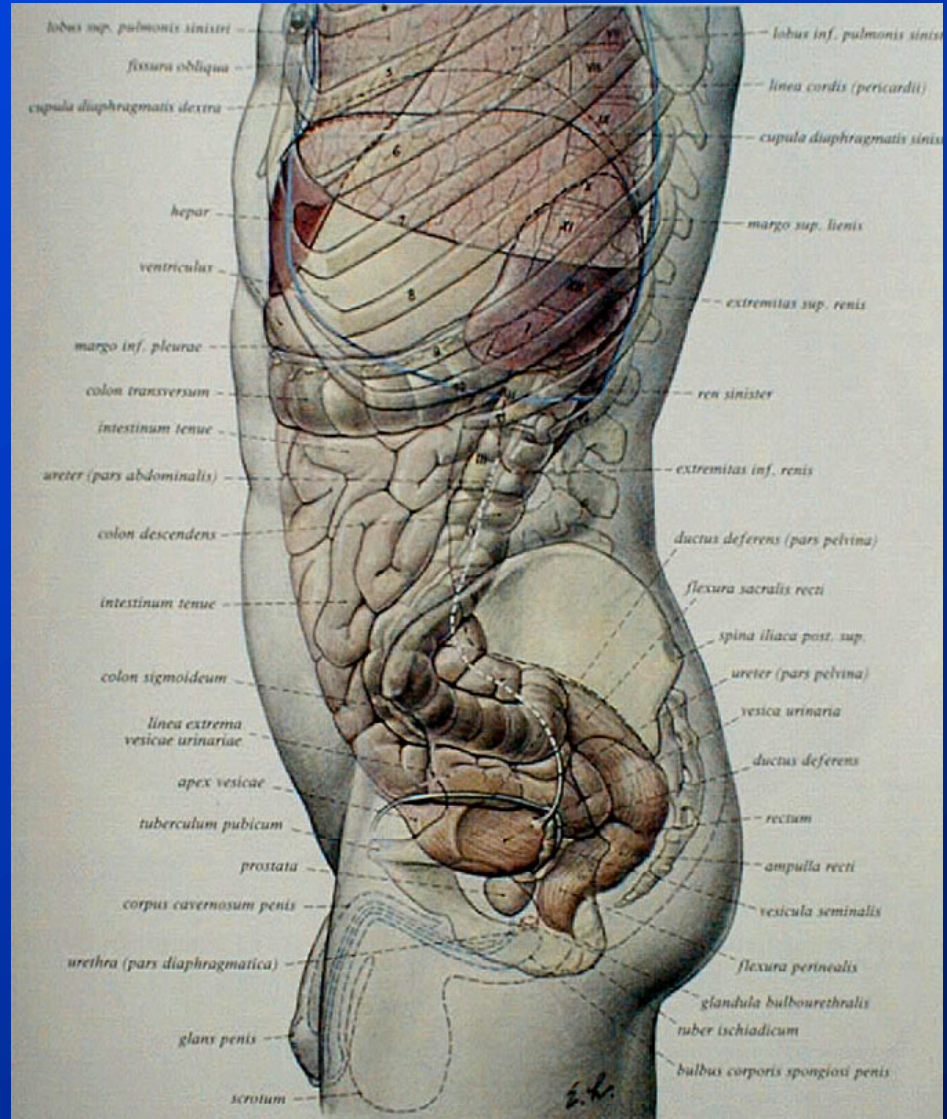
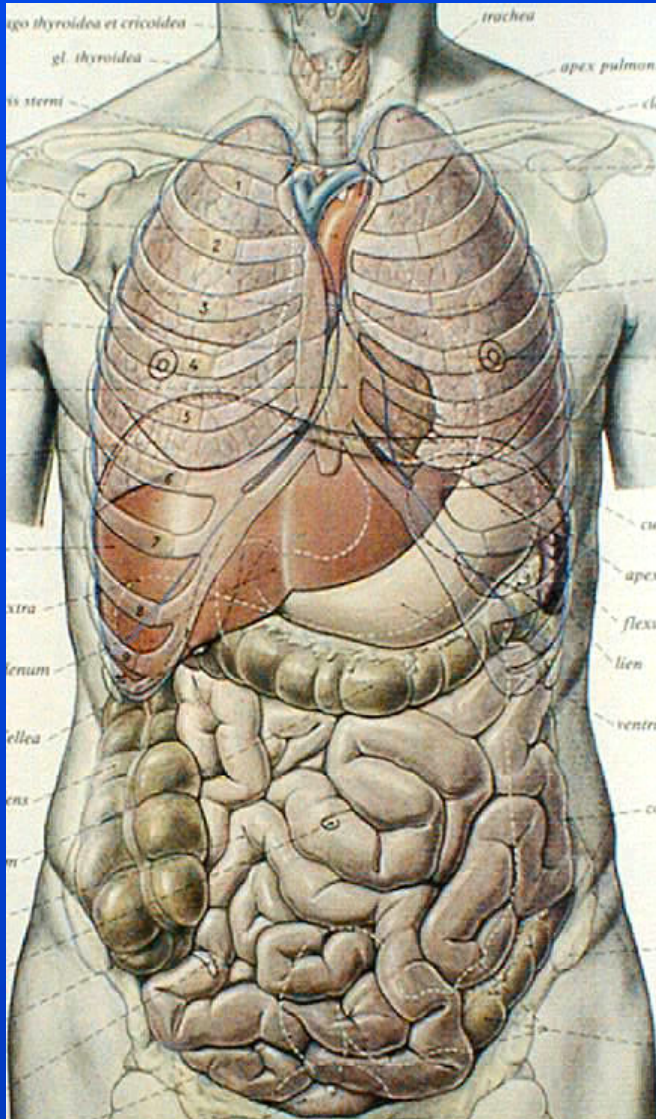


Conclusion

- 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

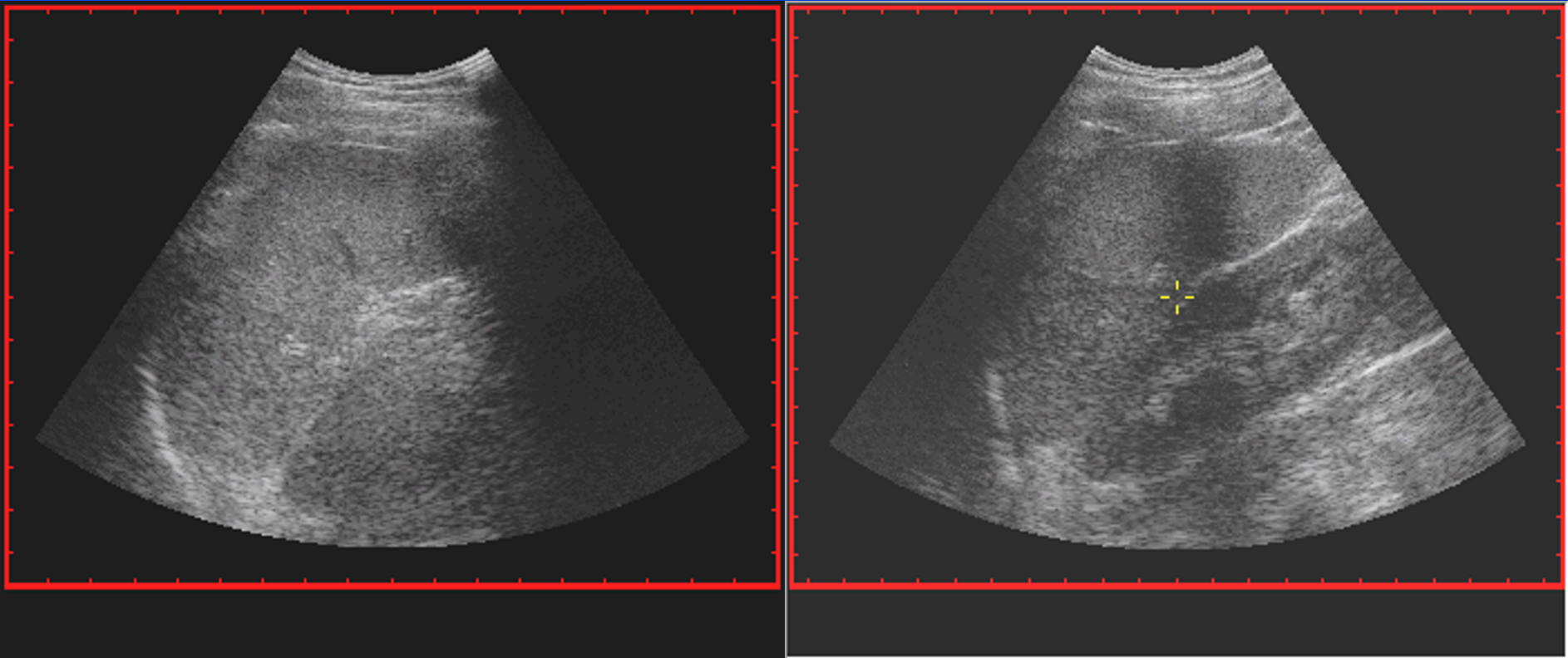


Organ Projection of Spleen





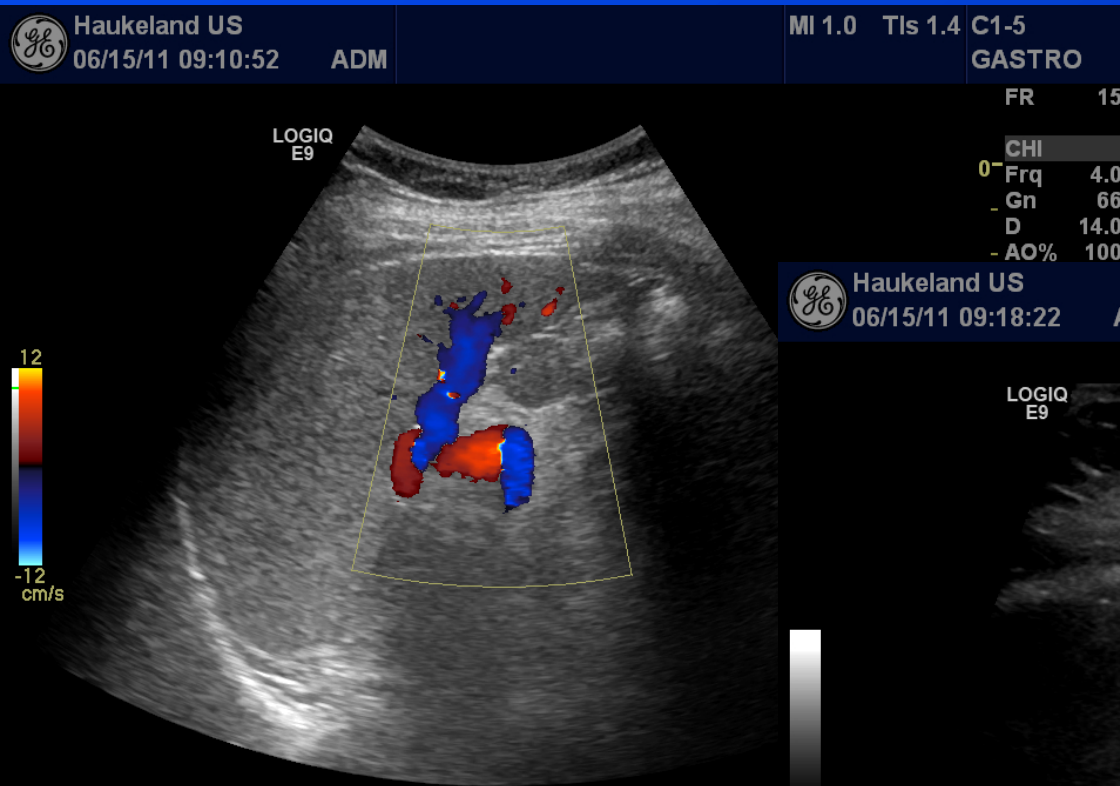
Normal spleen



- Maximal ultrasonographic size: 12 x 8 x 4 cm
- The size tends 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

FR 21

LOGIQ
E9

CHI
0- Frq 4.0
- Gn 70
- S/A 1/1
- Map F/1
- D 16.0
- DR 66
- AO% 100

5-

10-



15-

1 L 1.91 cm
+ d 2.16 cm
L 0.00 cm

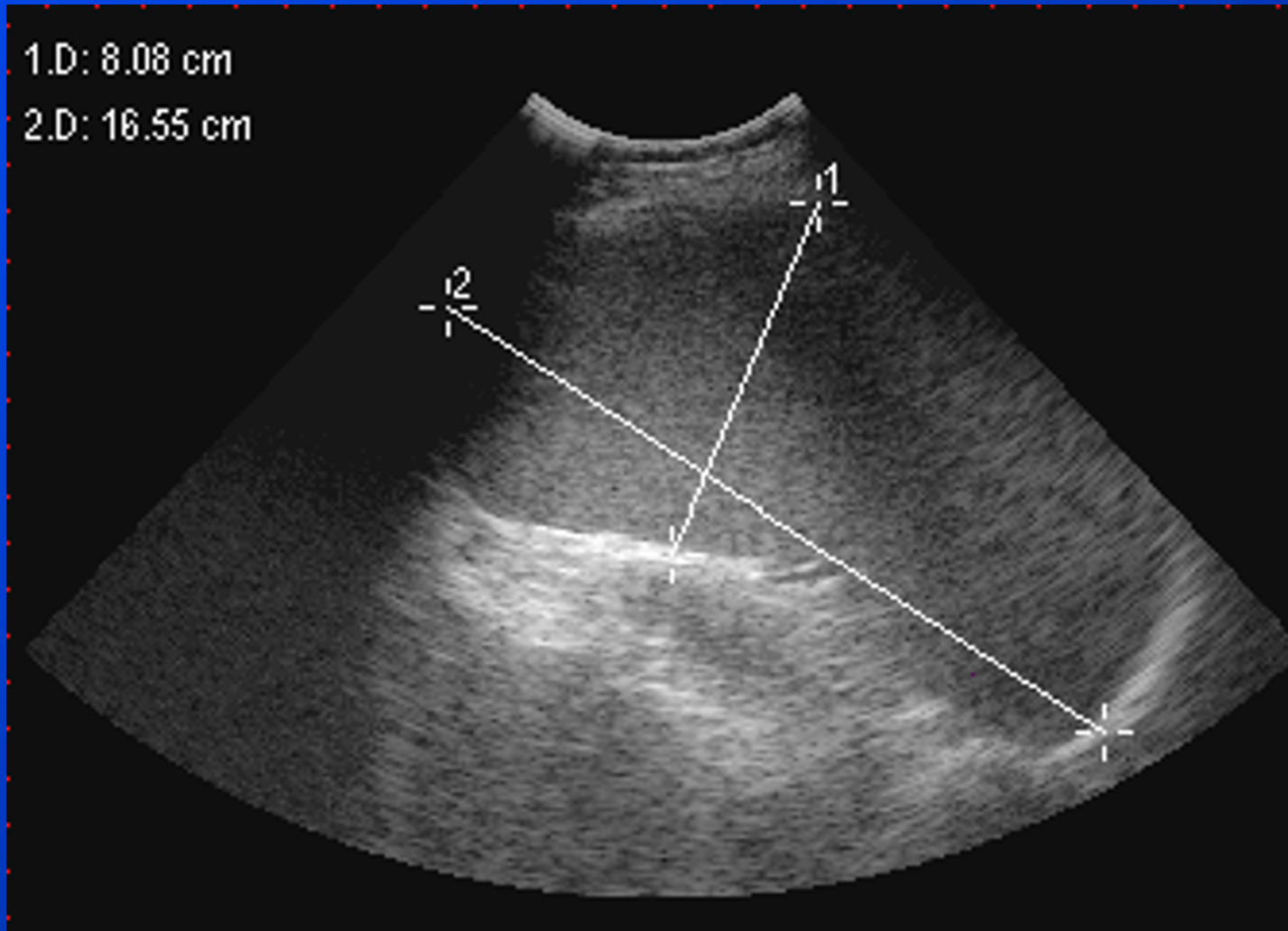


Diffuse splenomegaly

- 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 splenomegaly
 - Cirrhosis, portal or splenic vein thrombosis
- Metabolic diseases
 - Gaucher, Niemann-Pick, Amyloidosis



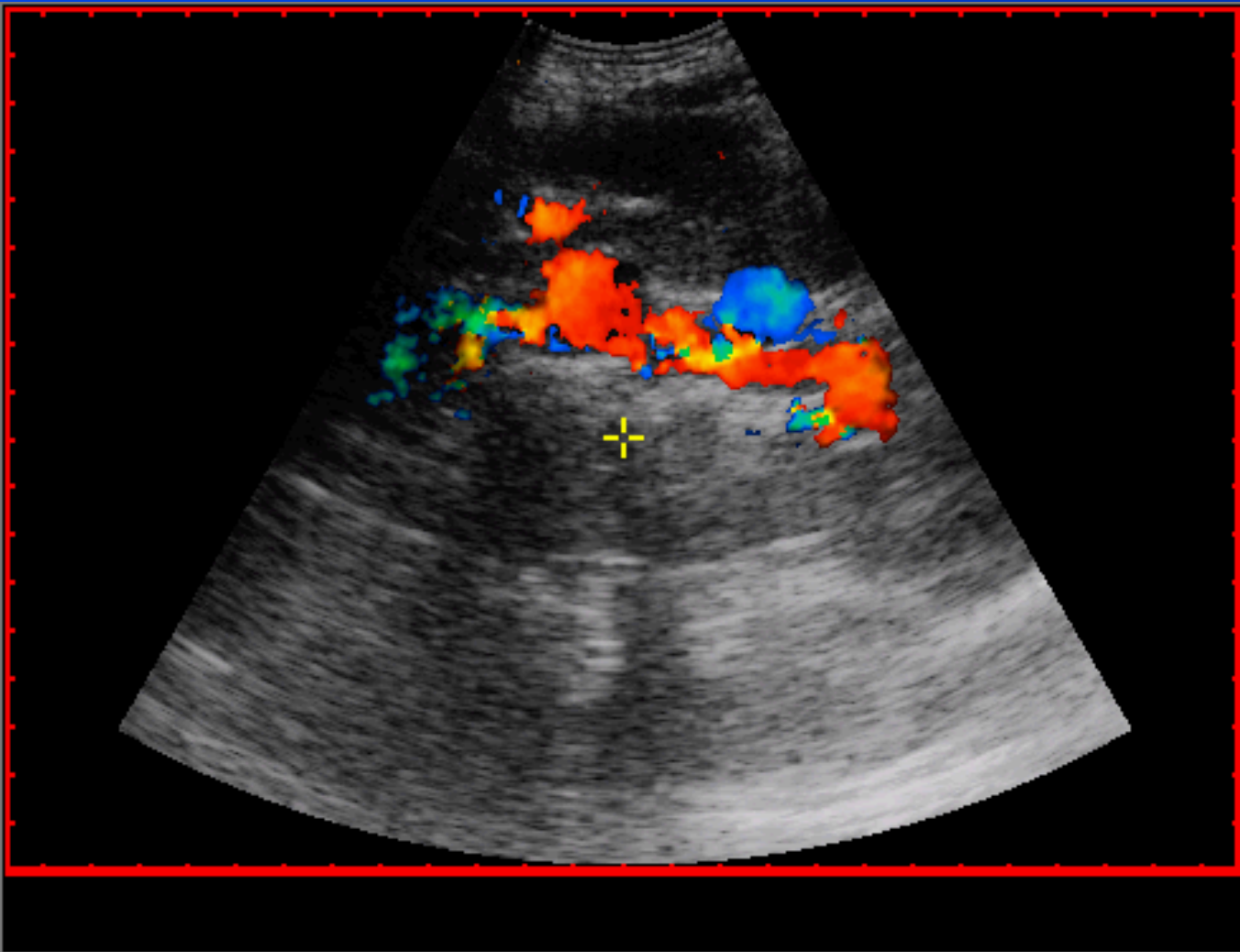
Splenomegaly



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)
- Lymphoma
- 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.

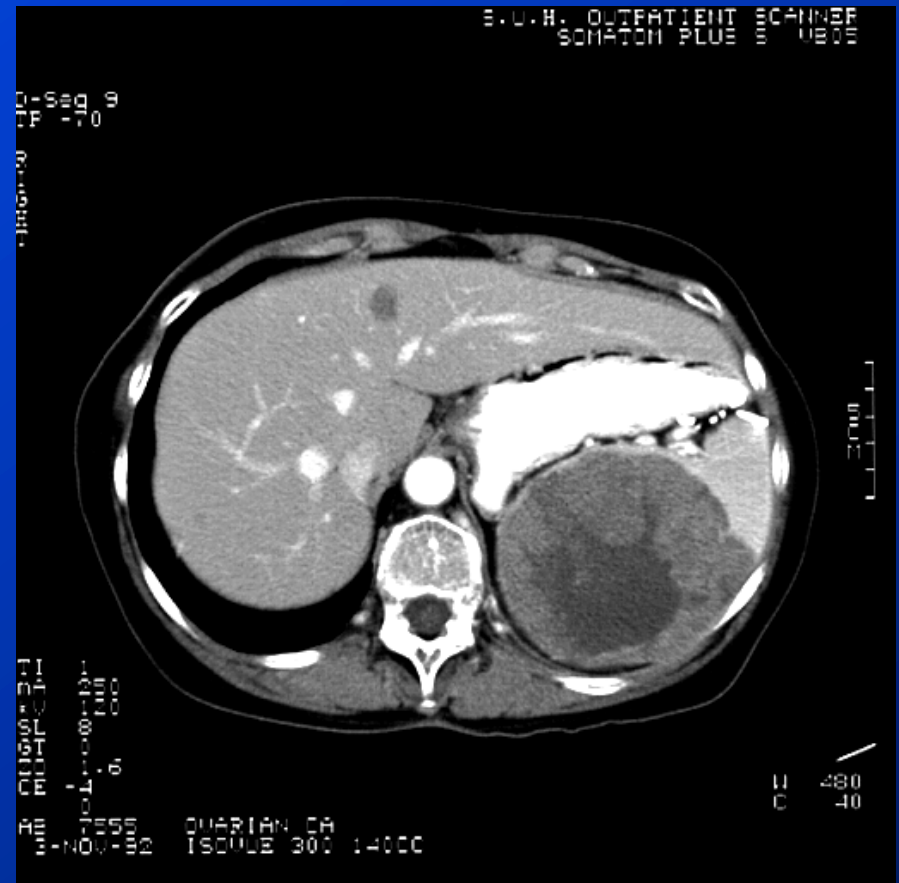
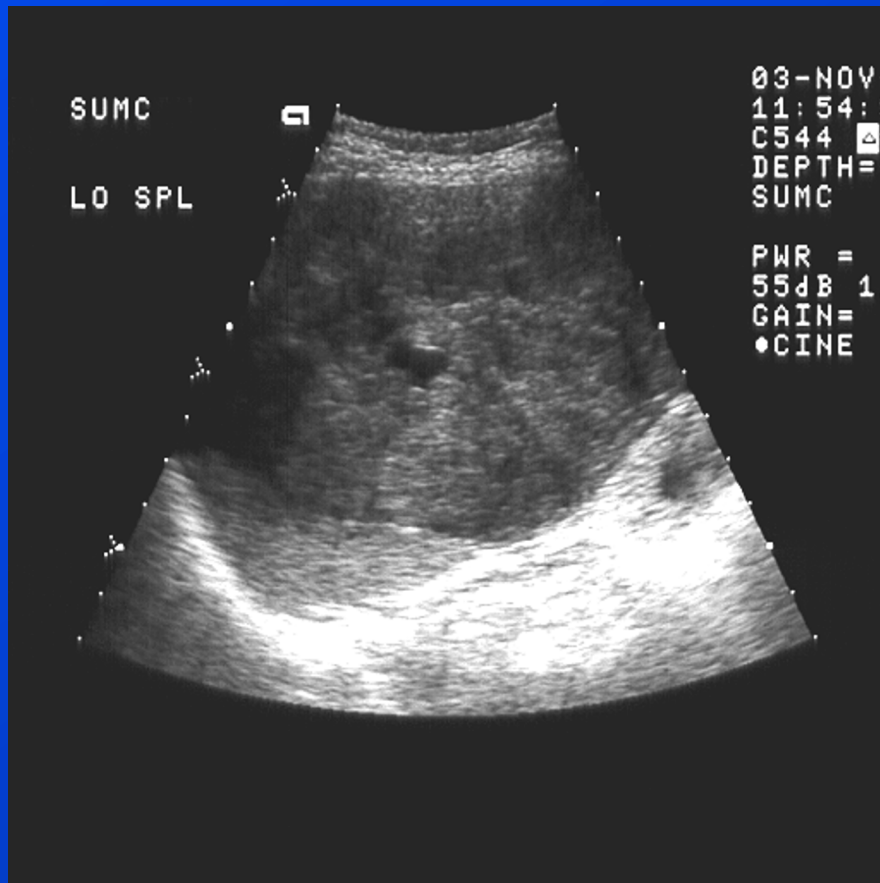


Image 1: A large lesion of mixed echogenicity occupying most of the spleen.

Image 2: Contrast-enhanced CT scan demonstrating a large low attenuating splenic lesion with areas of decreased attenuation centrally, probably related to necrosis.

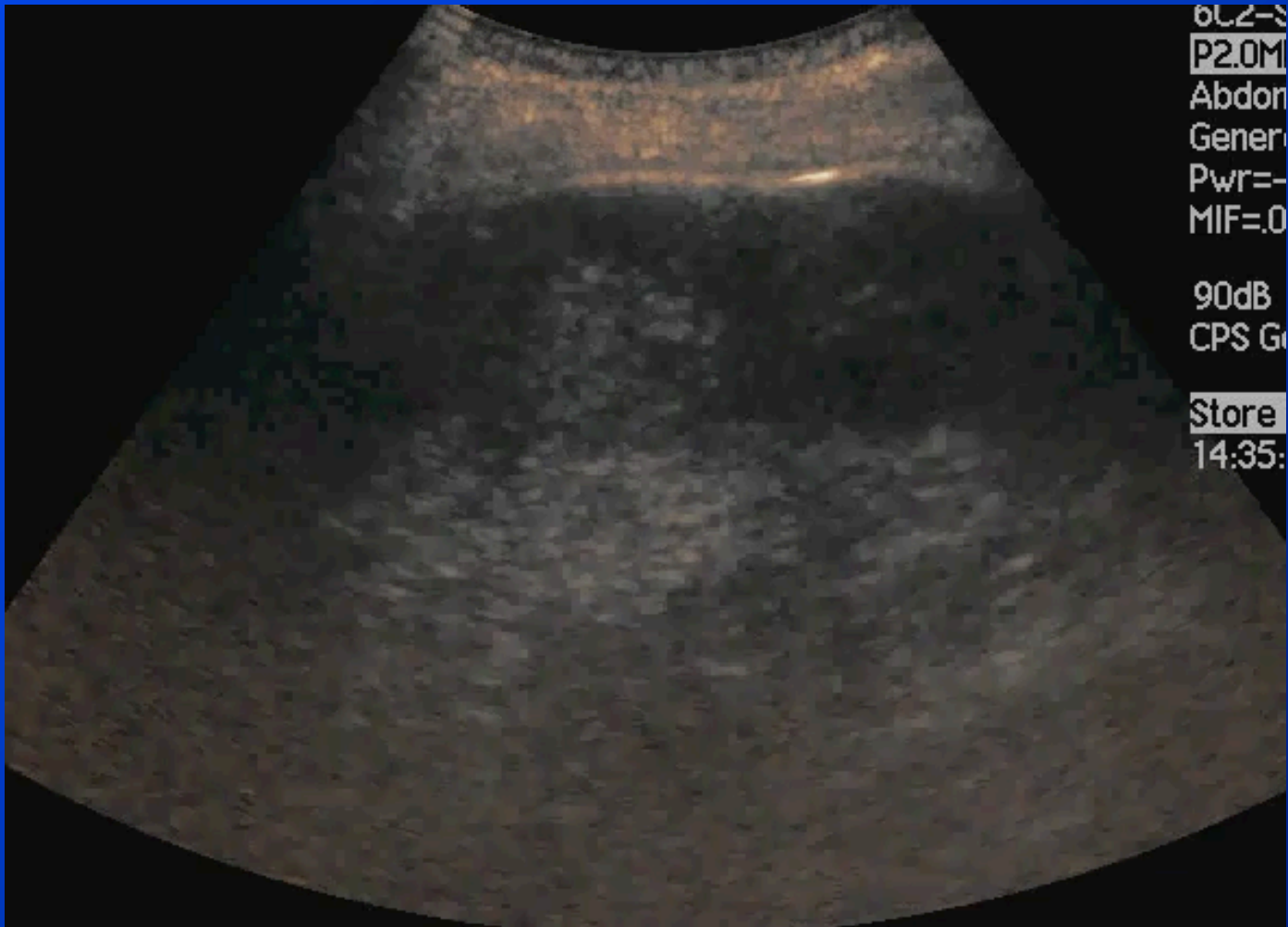


Vascular Lesions of the Spleen

- 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

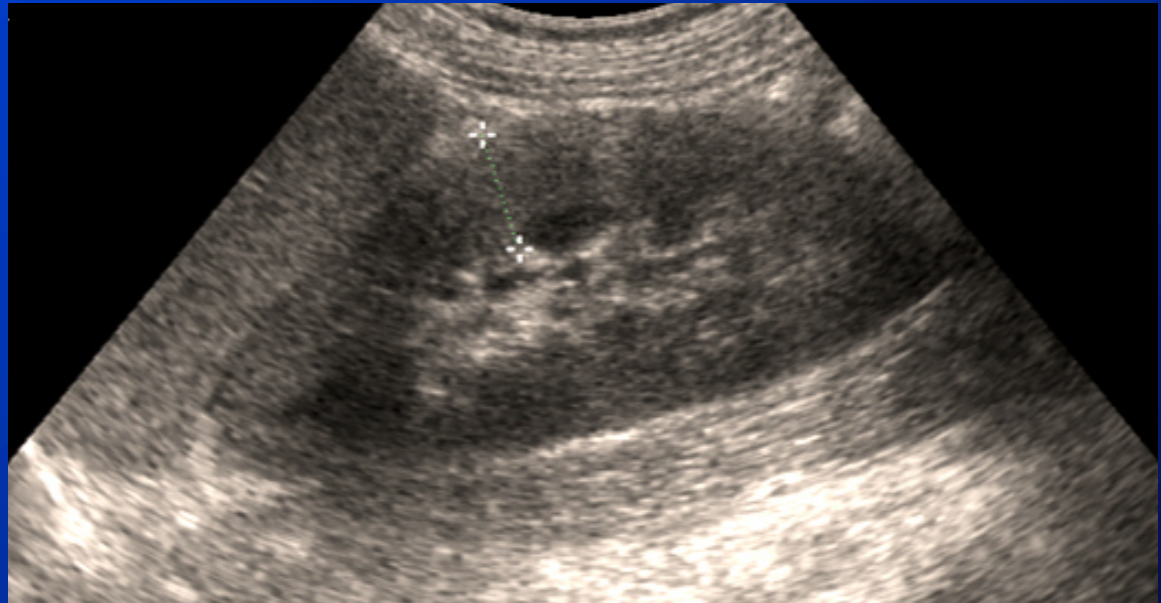
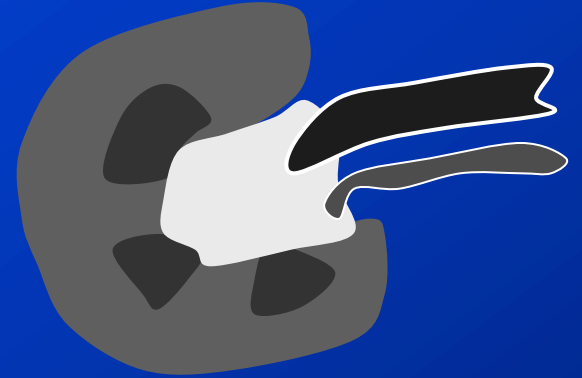




Renal Ultrasound

• Indications:

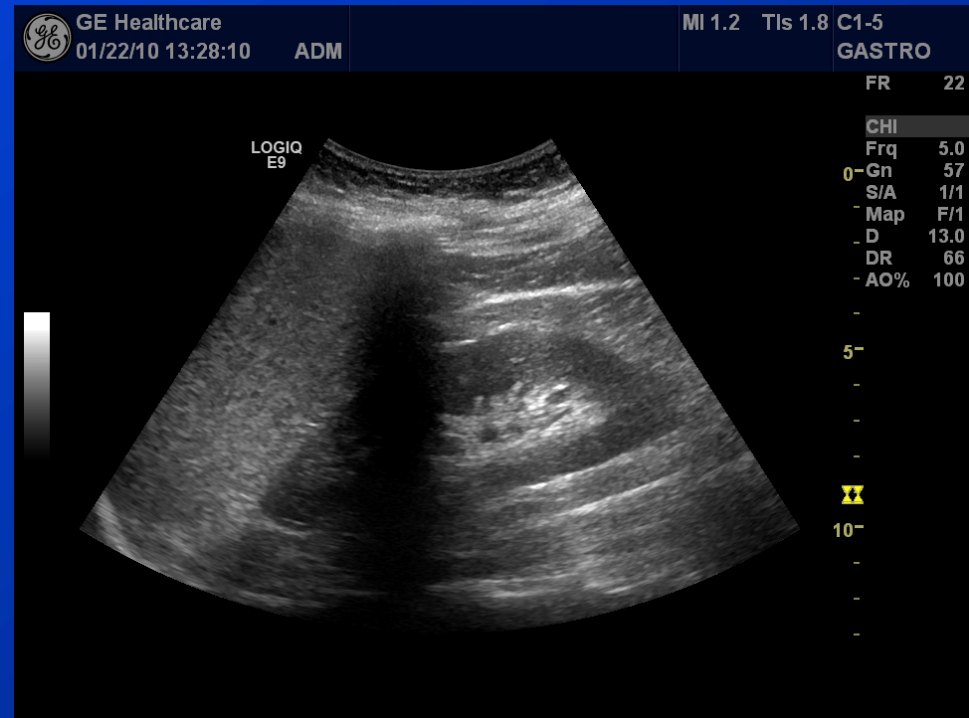
- Flank pain
- Haematuria
- Suspected renal mass
- Kidney failure
- Recurrent infection
- Fever unknown origin
- Anomalies
- Transplanted kidney
- Abdominal ultrasound





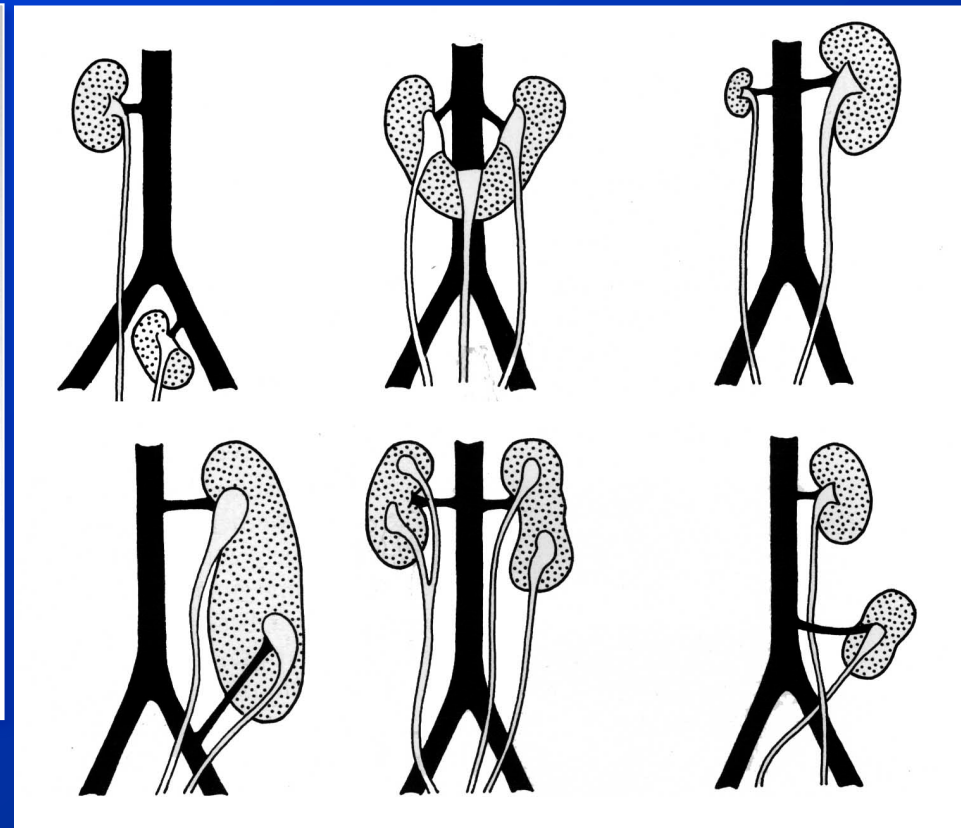
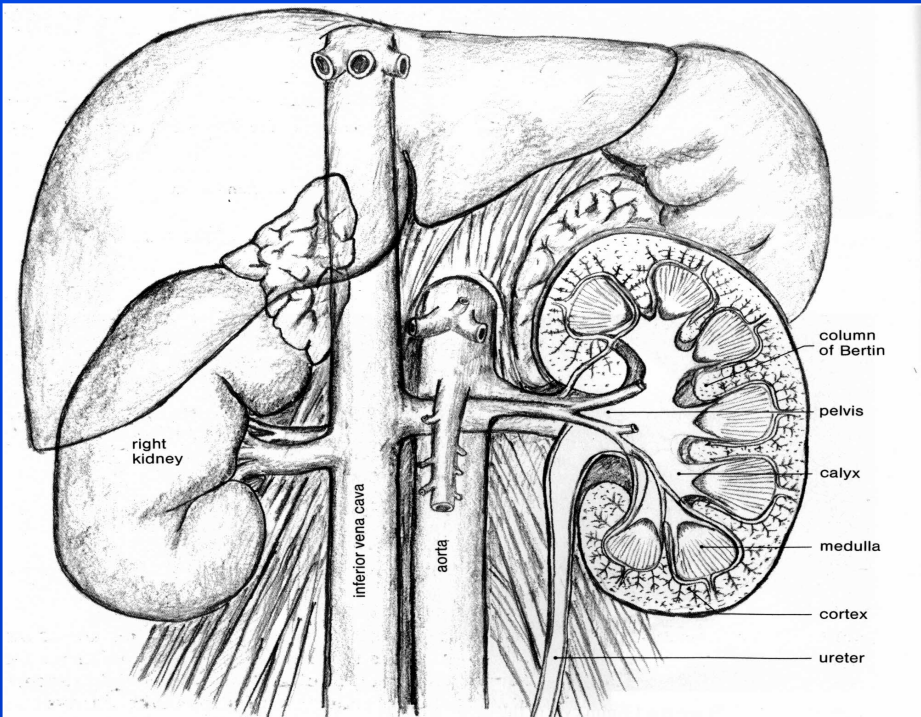
Station 4

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





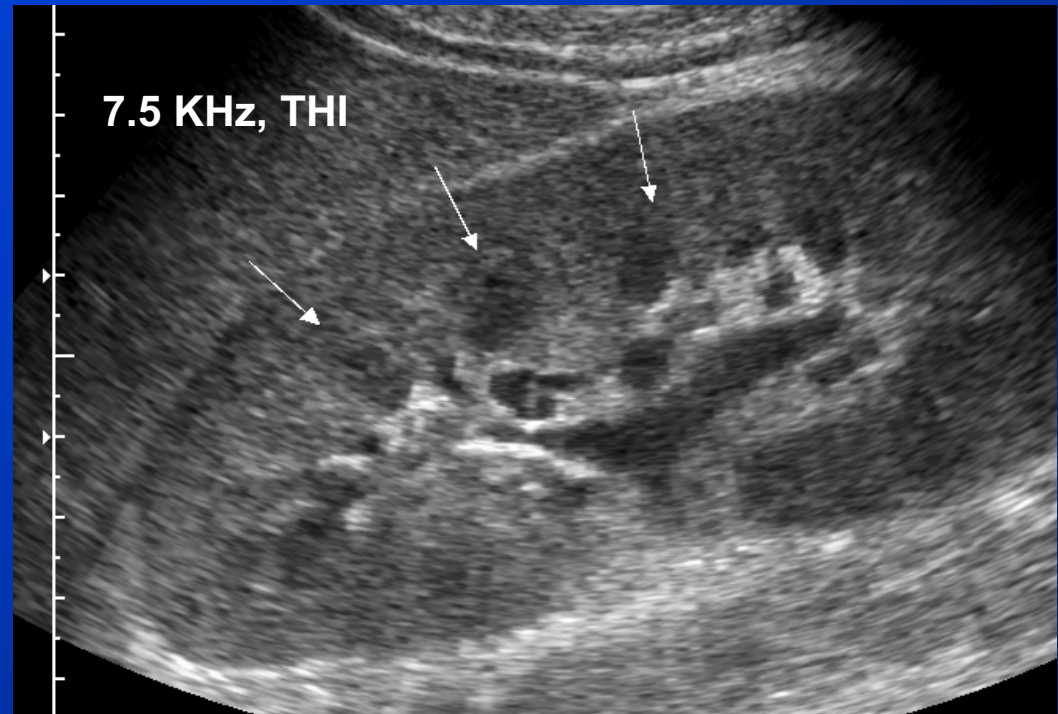
RENAL ANATOMY





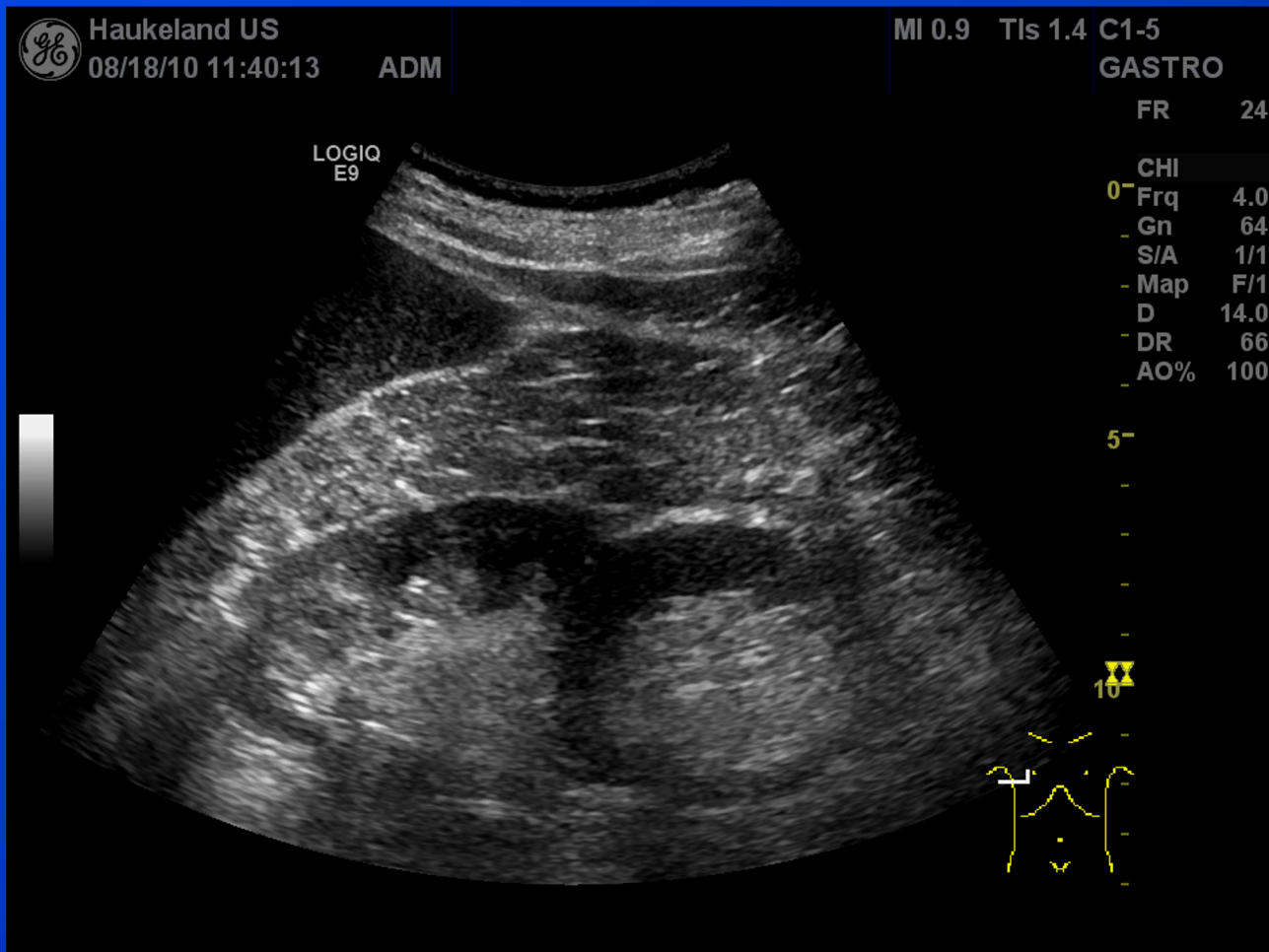
Sonoanatomy

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



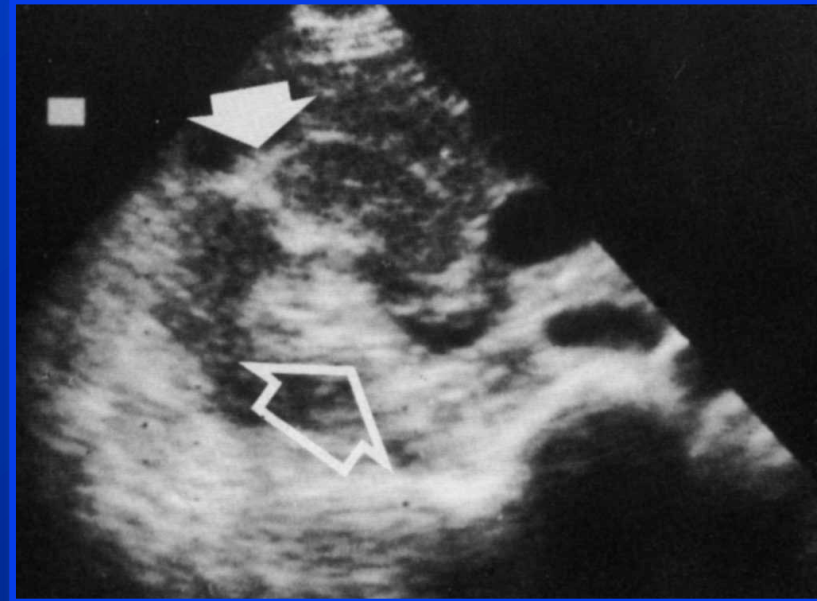
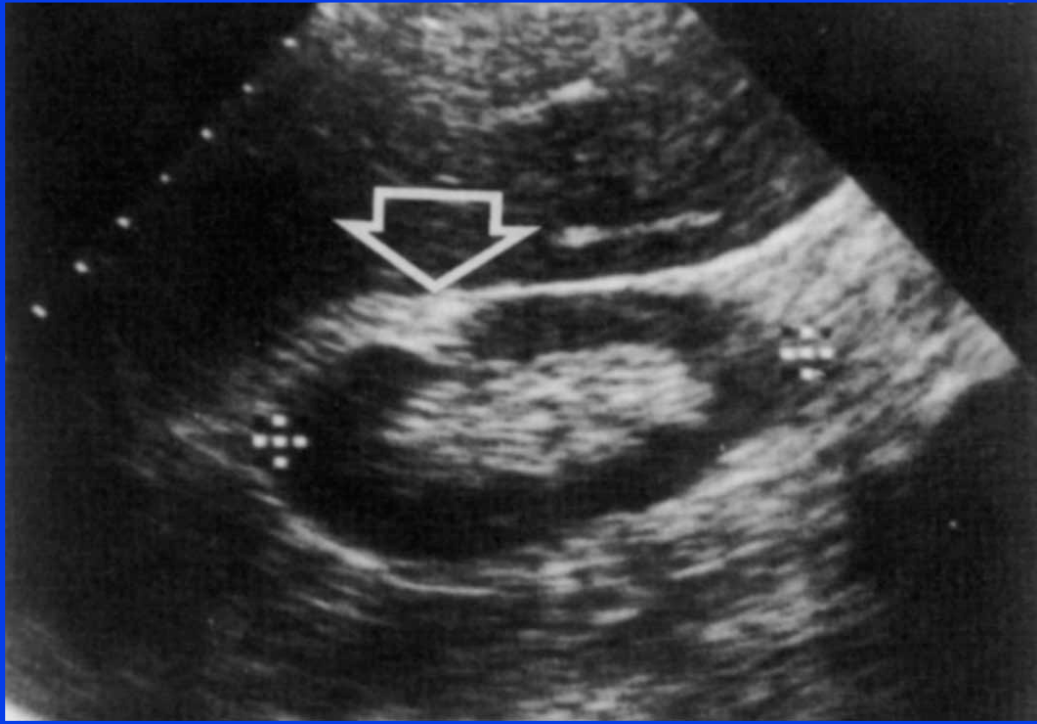


Parenchymal bridge



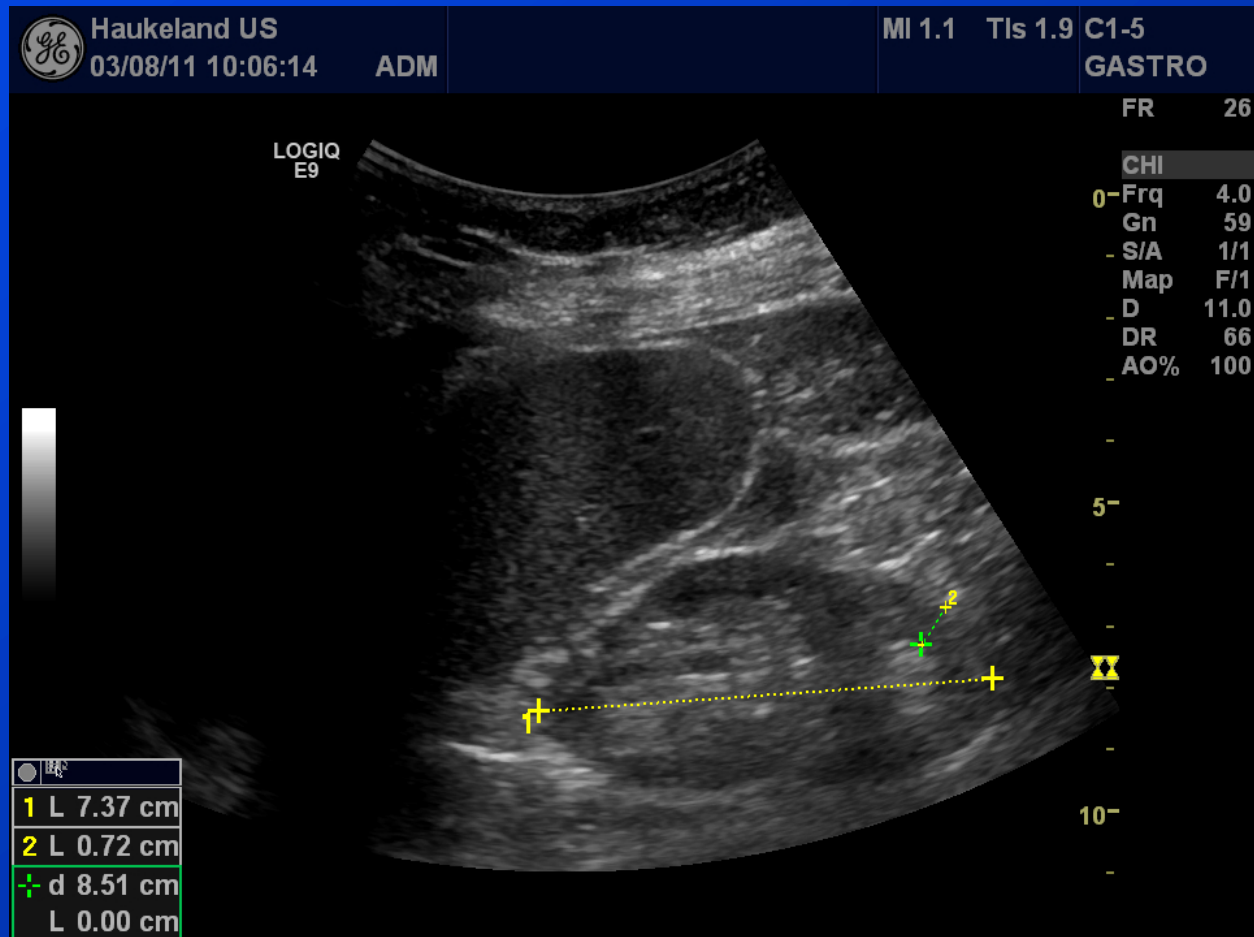


Scar of the kidney



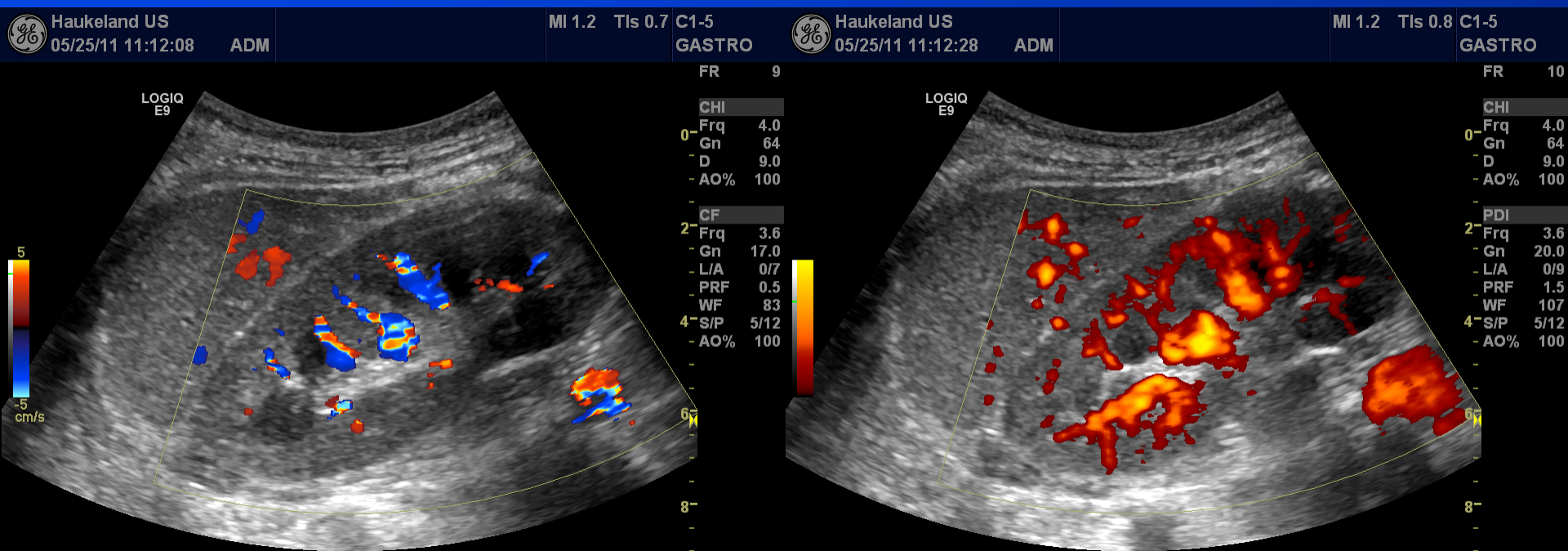


Atrophy of the Kidney



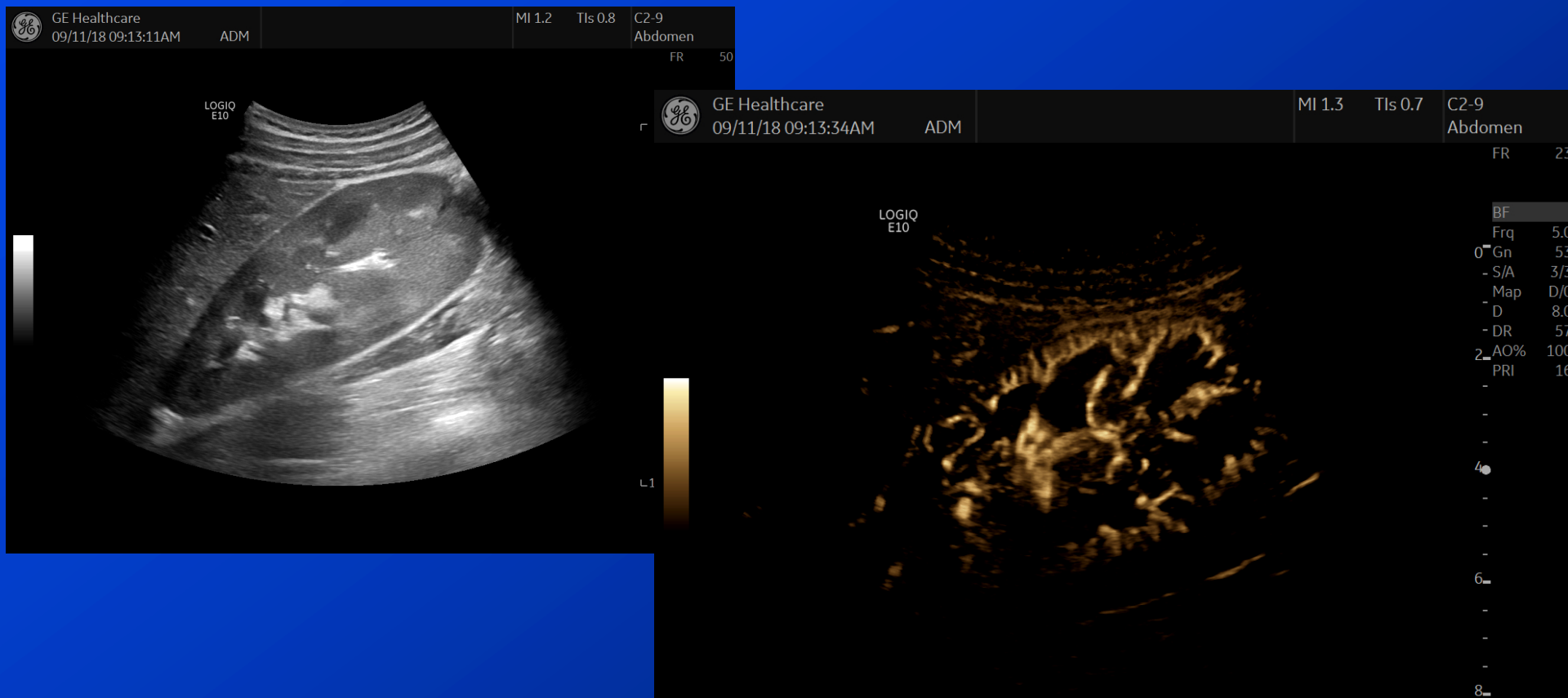


Doppler of the Kidneys





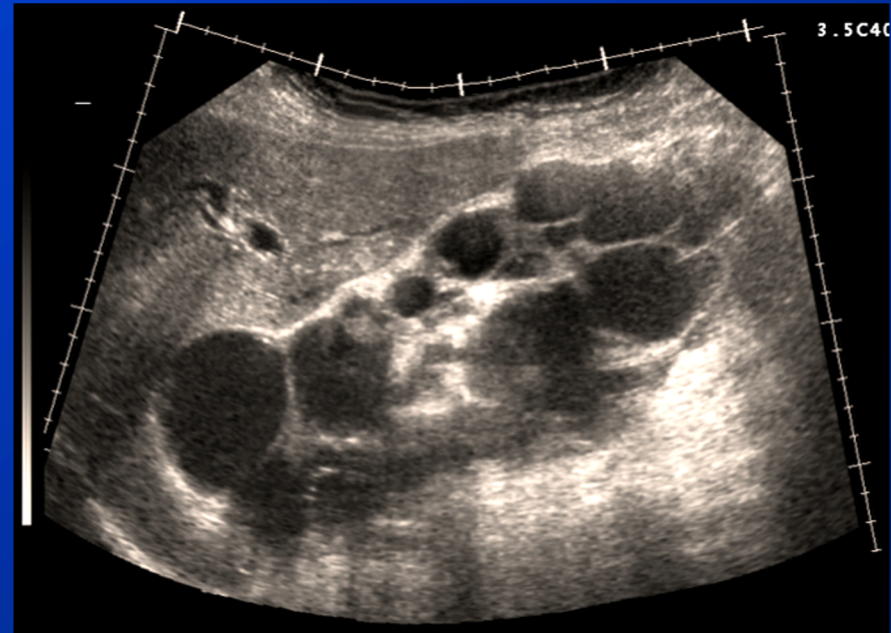
B Flow





PATHOLOGY

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



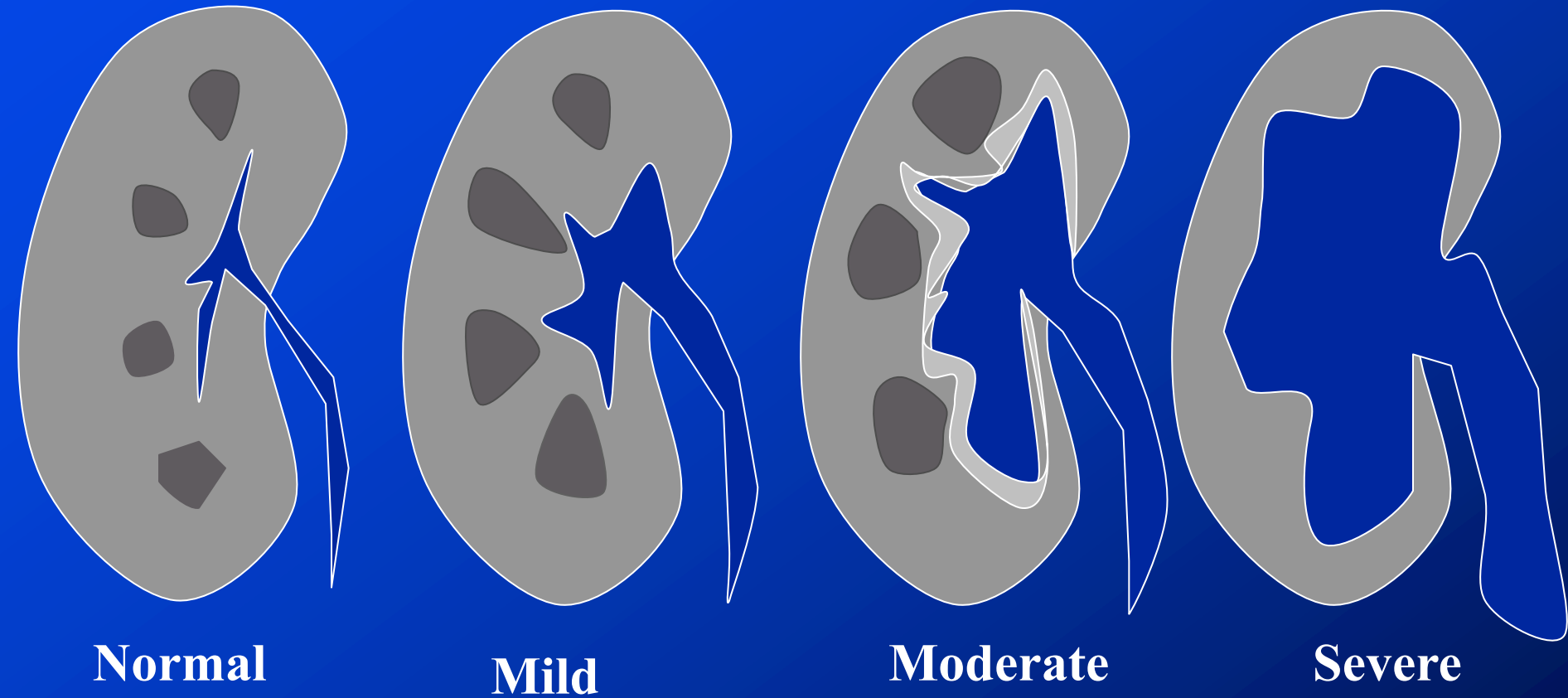


HYDRONEPHROSIS

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



Range of Hydronephrosis



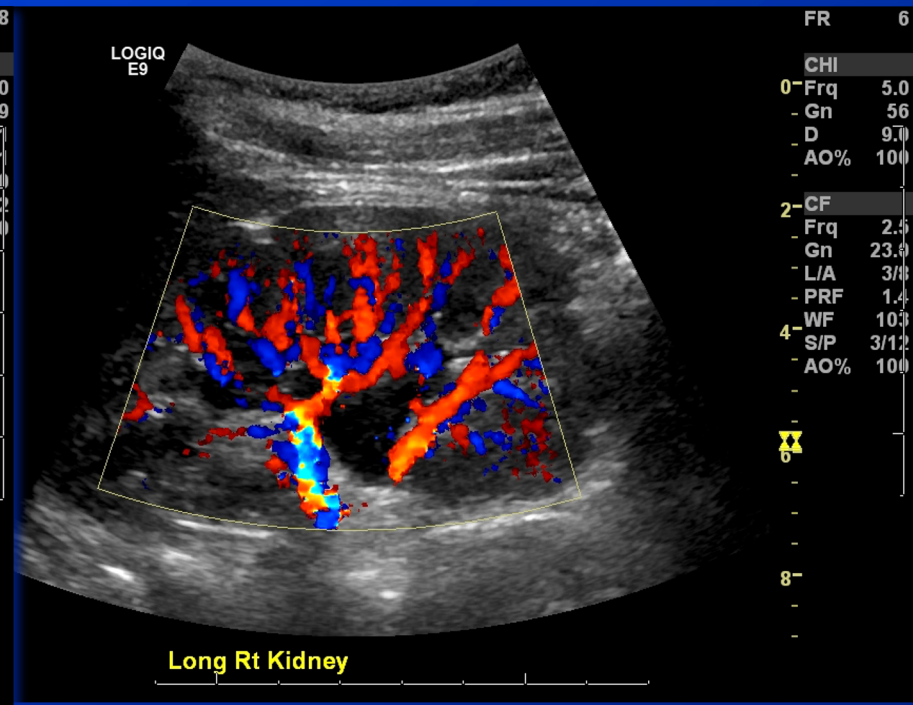
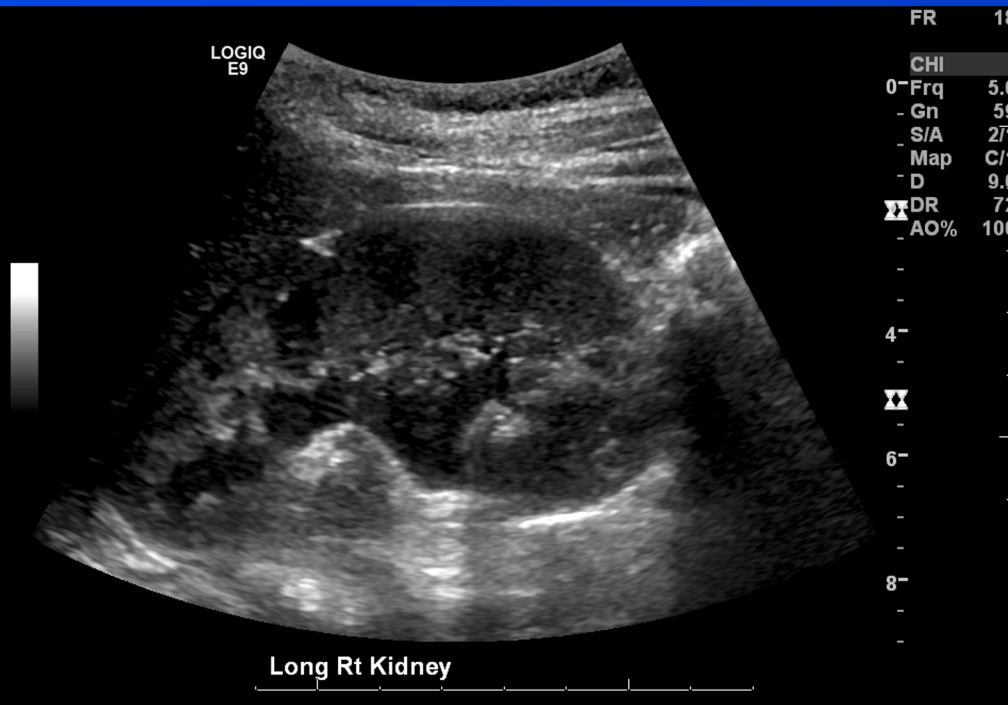


Hydronephrosis



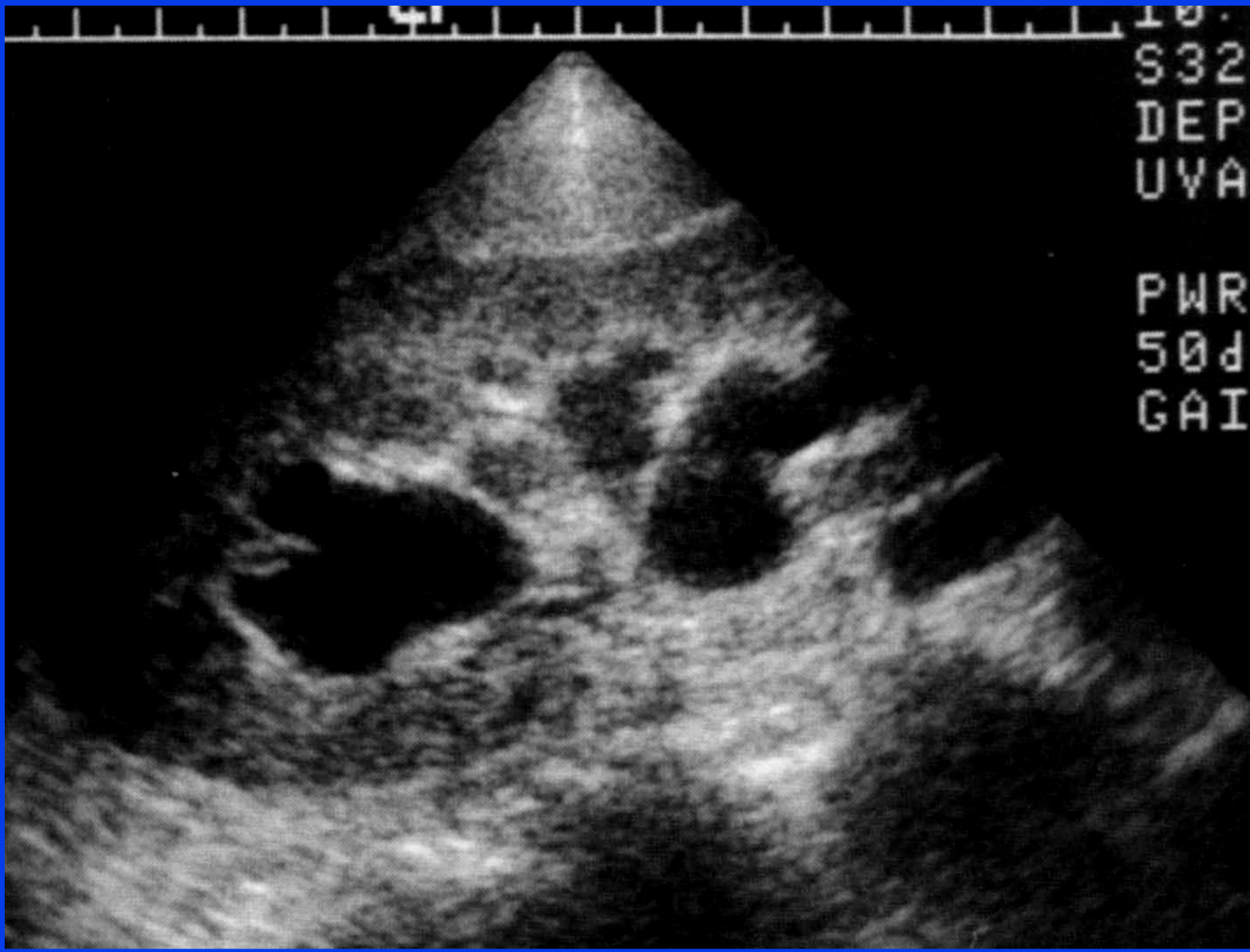


Use the Doppler !



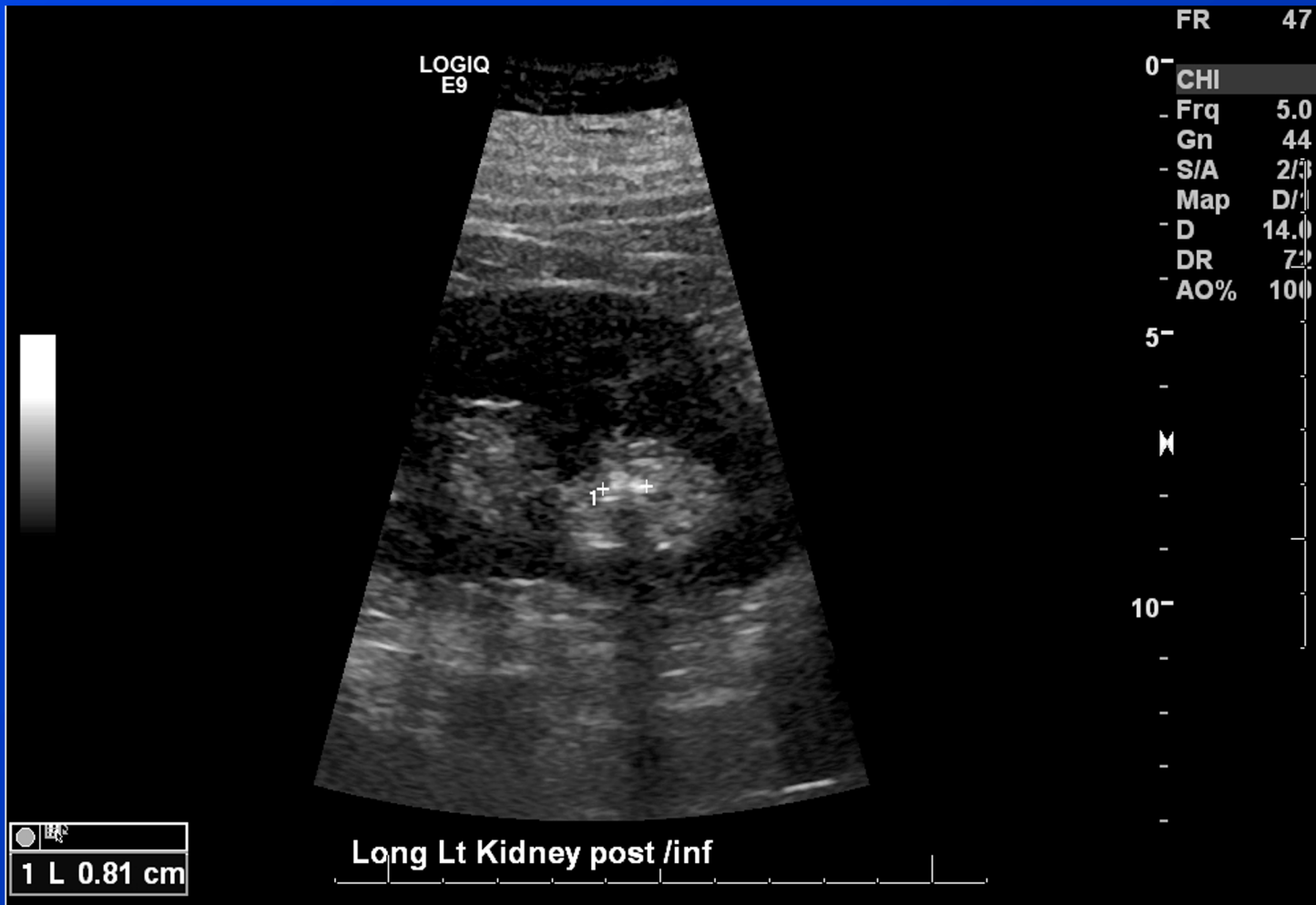


Hydronephrosis





Kidney stone





Acute Pyelonephritis

ultrasound findings:

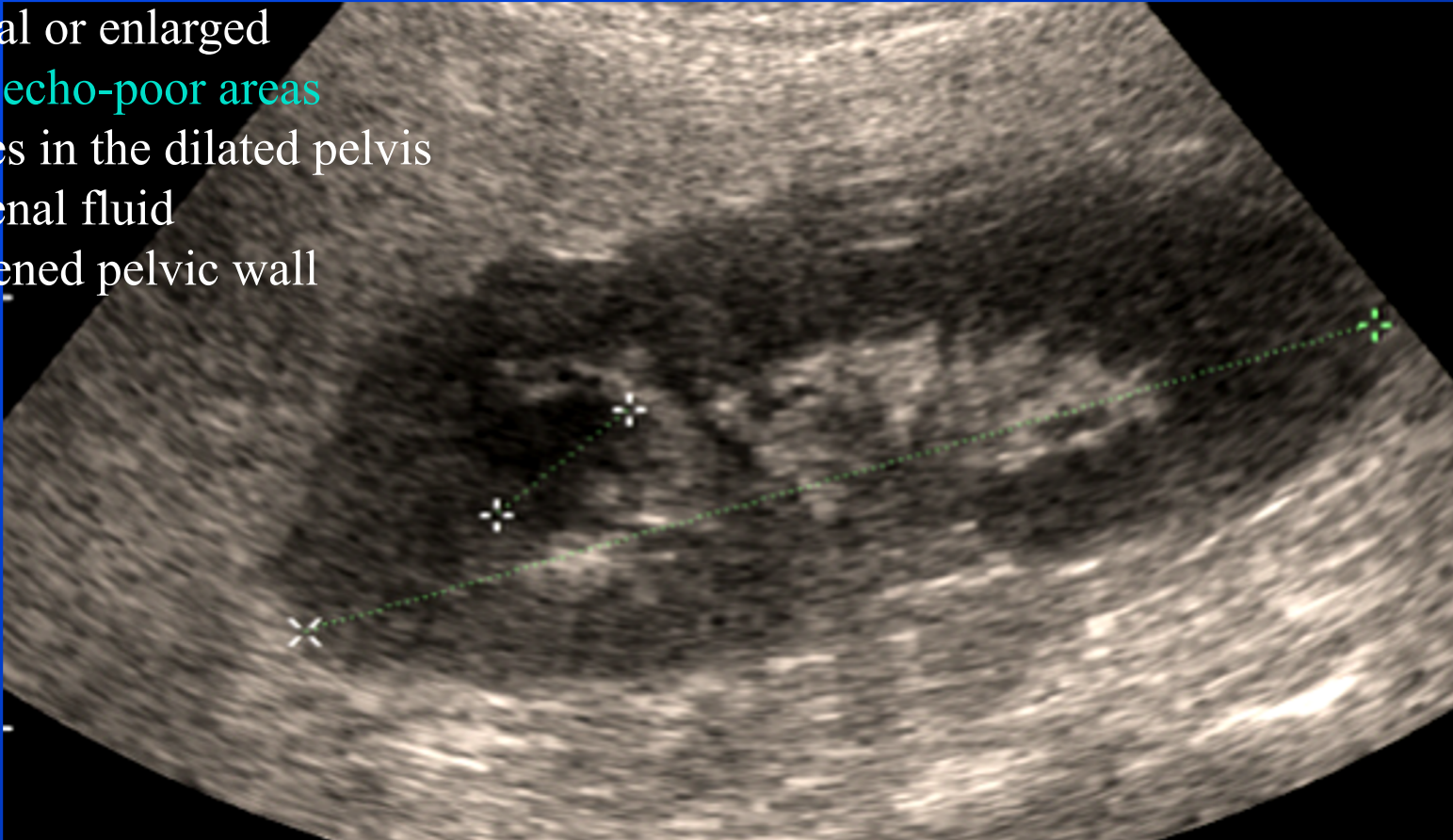
normal or enlarged

focal echo-poor areas

echoes in the dilated pelvis

perirenal fluid

thickened pelvic wall





Acute Pyelonephritis

ultrasound findings:

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

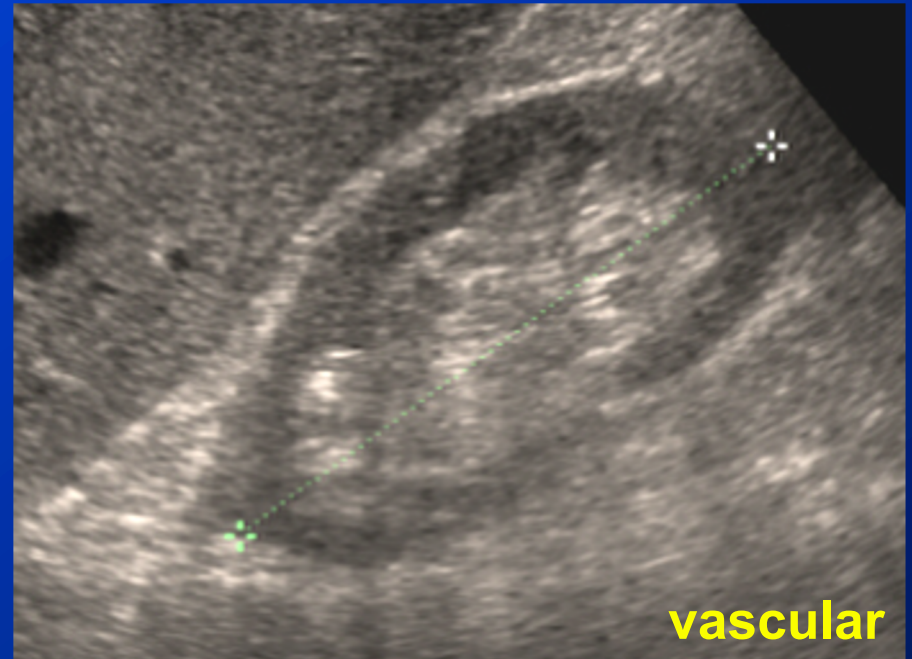




Chronic pyelonephritis

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

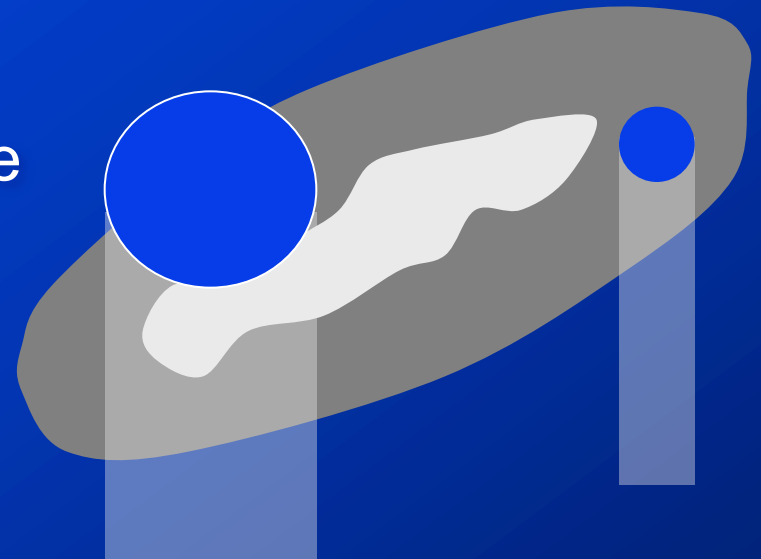
- Carcinoma (RCC)-80%
- Adenoma (10%)
- Urothel-carcinoma
- Lymphoma
- Metastasis



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

FR 26

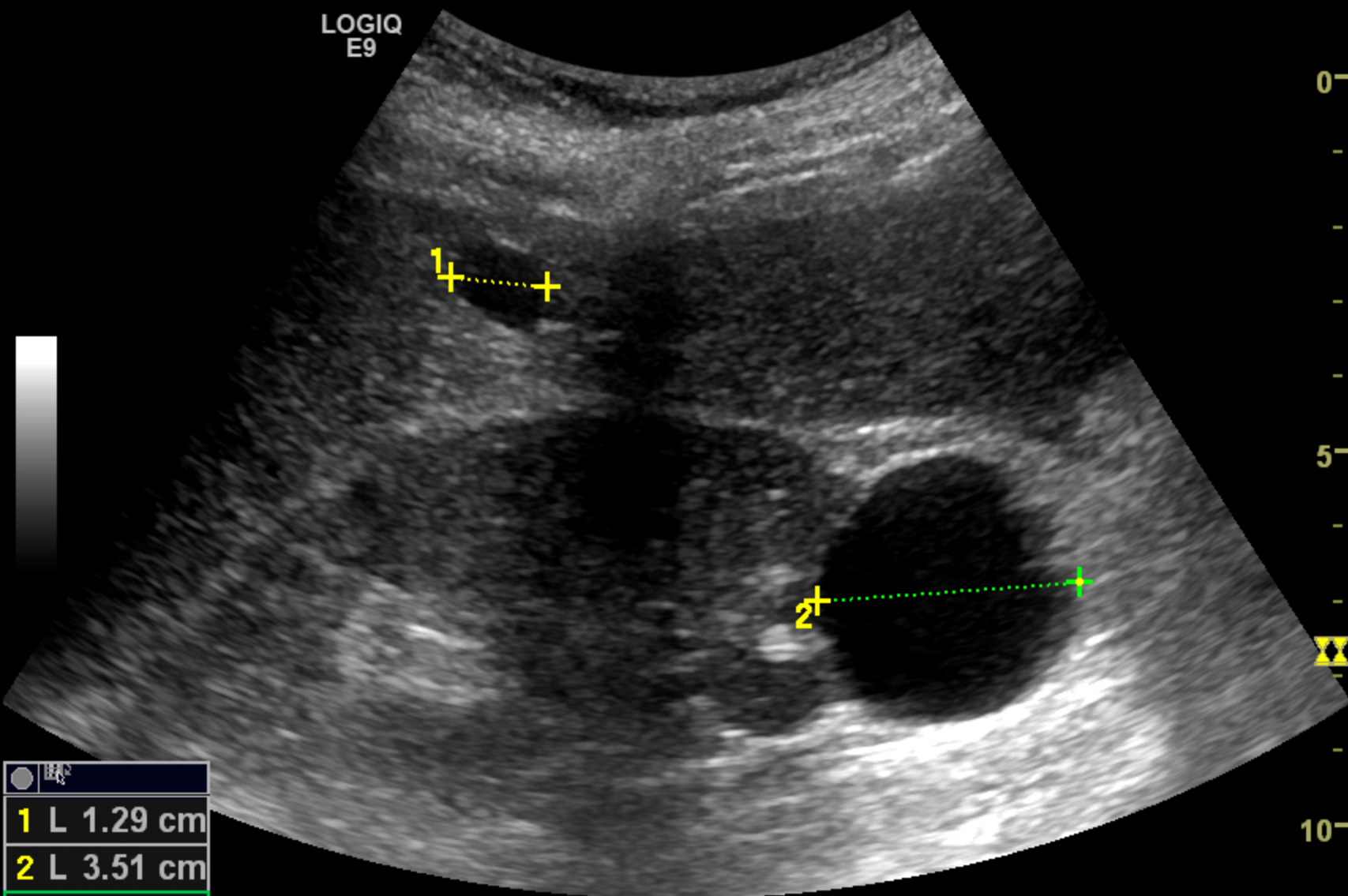
LOGIQ
E9

CHI

0-Frq	4.0
Gn	64
- S/A	1/1
Map	F/1
- D	11.0
DR	66
- AO%	100



●	MC
1	L 1.29 cm
2	L 3.51 cm
+	d 7.85 cm
	L 0.00 cm



5-

10-



BOSNIAK'S CLASSIFICATION

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

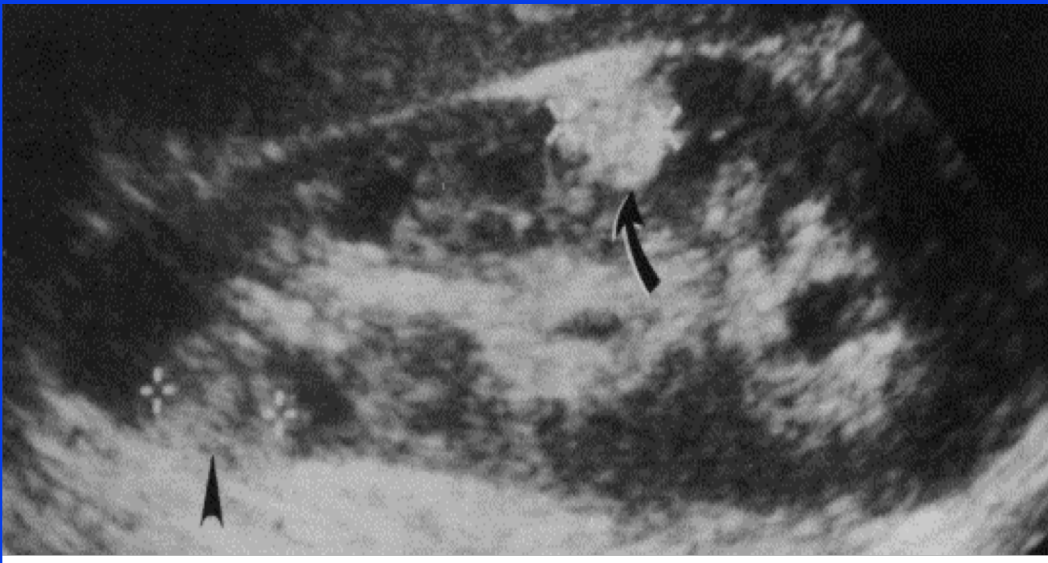


ANGIOMYOLIPOMA

- 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

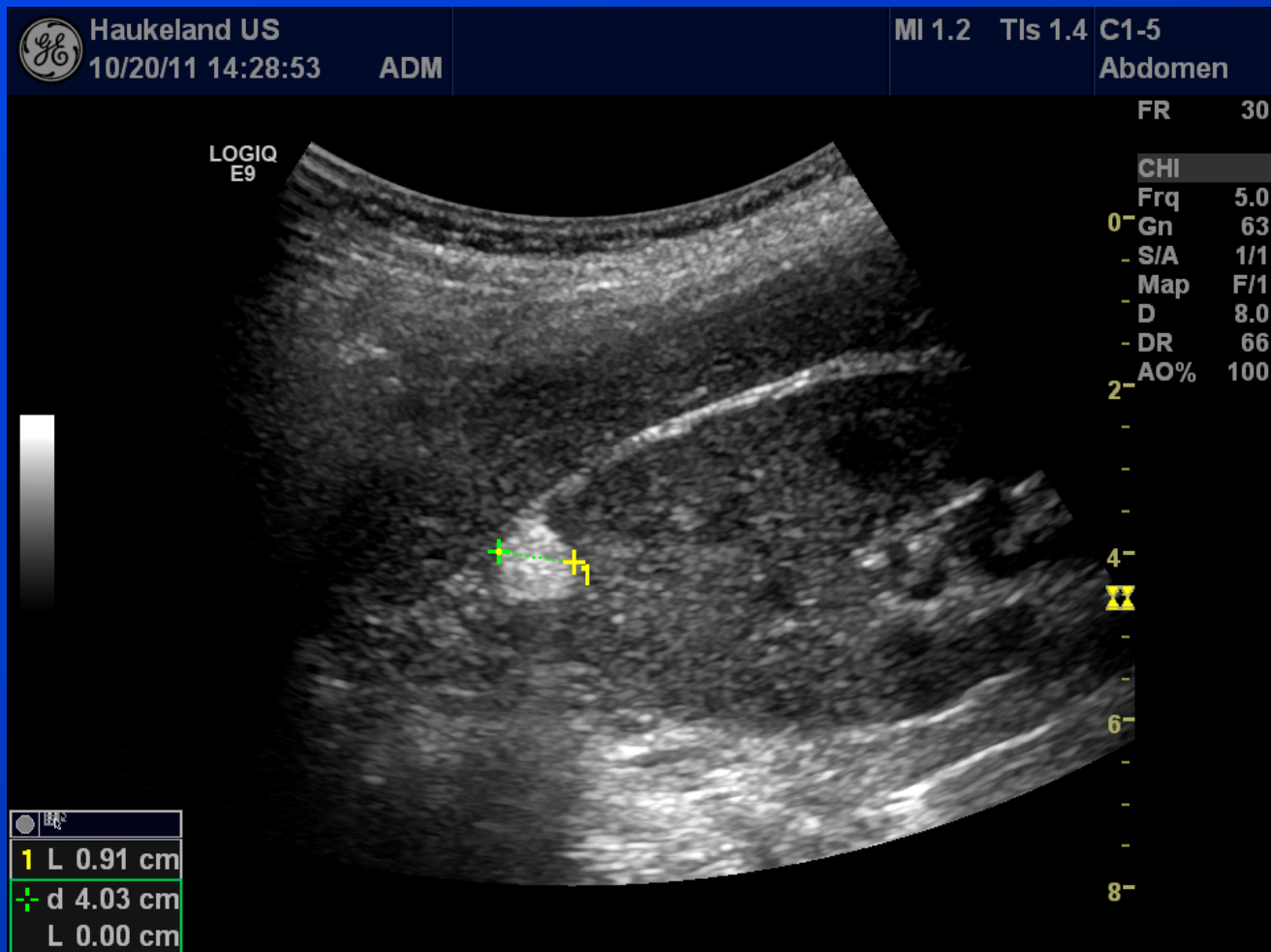


ANGIOMYOLIPOMA





Angiomyolipoma



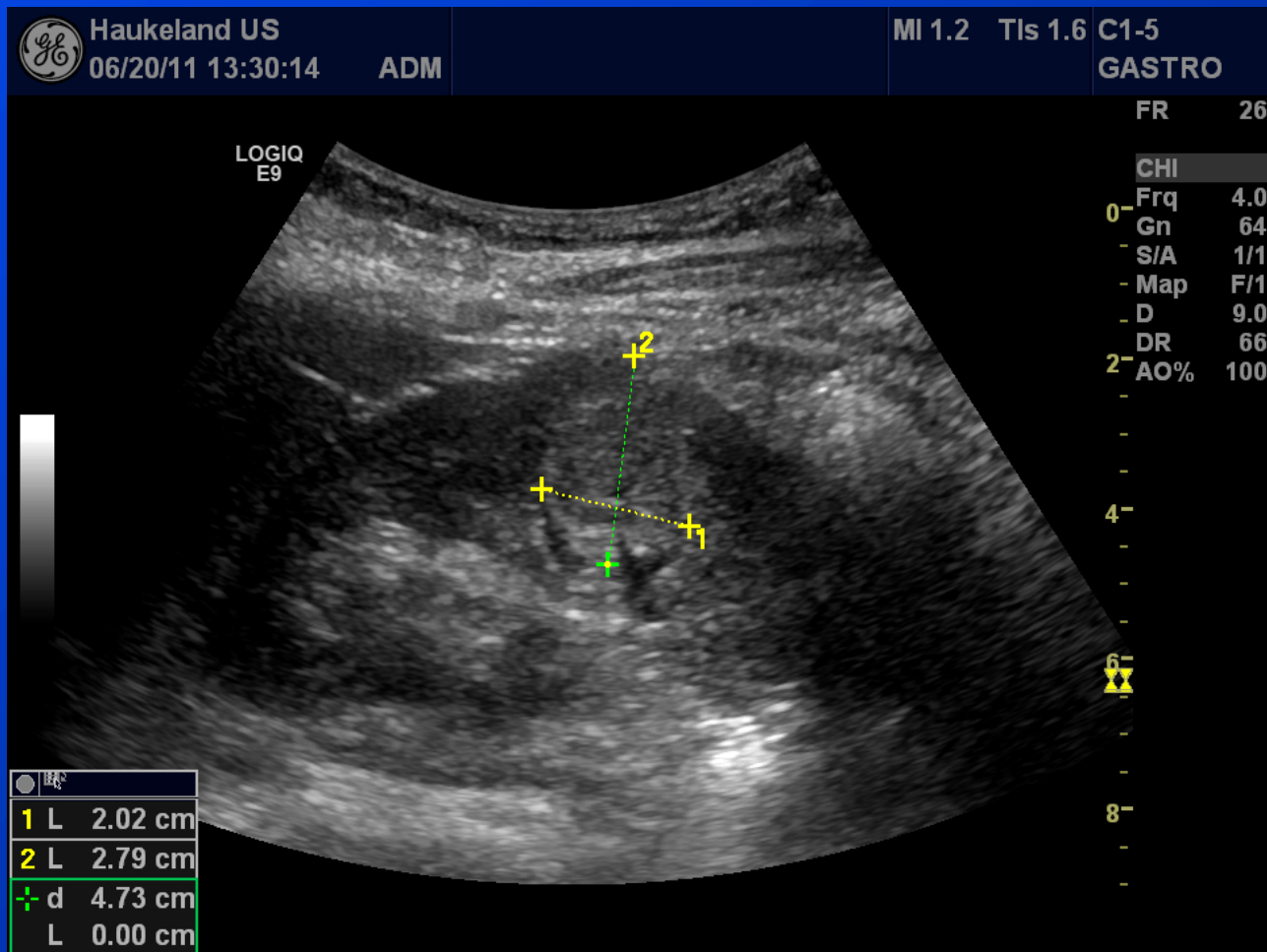


Renal Cell Carcinoma

- 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

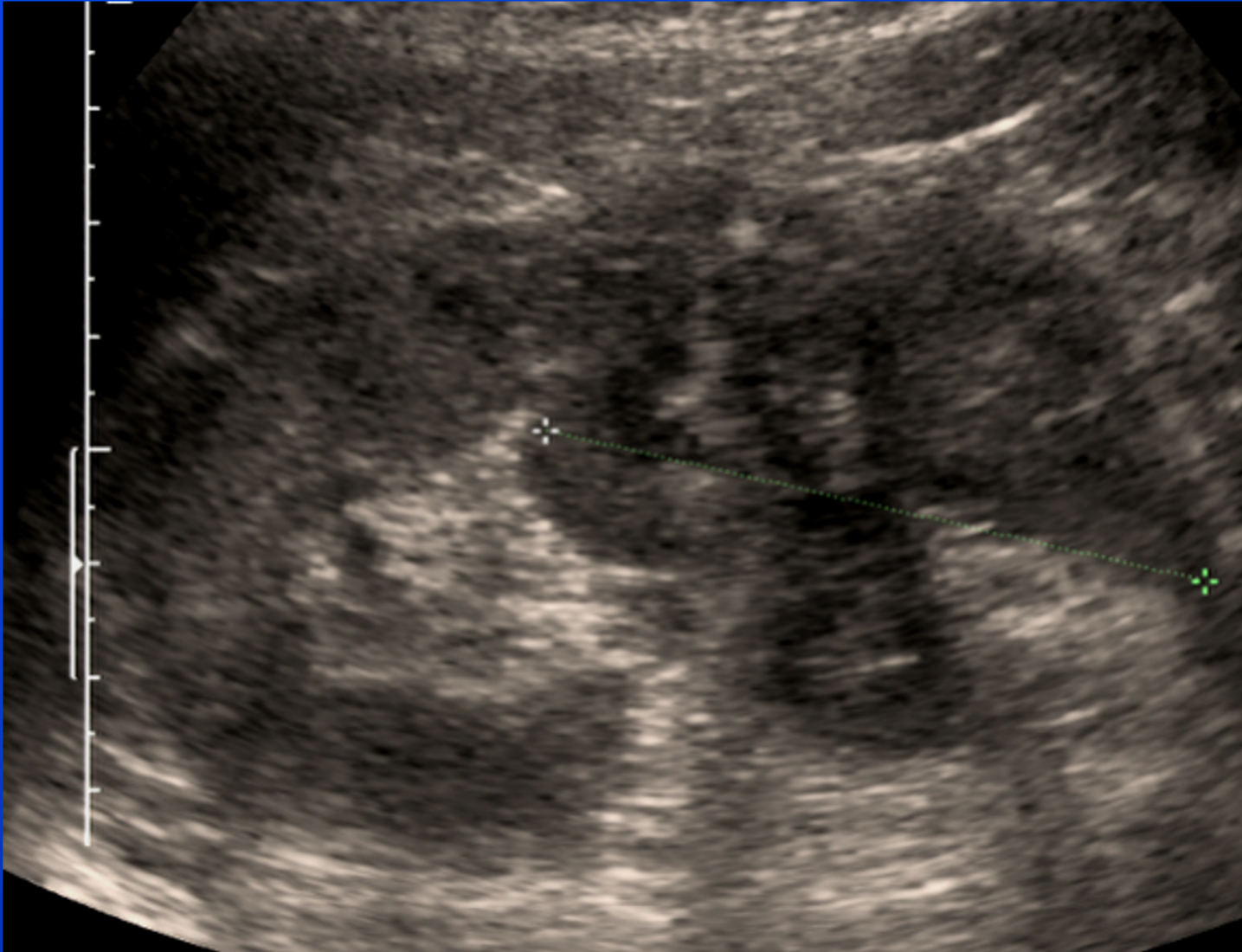


RCC



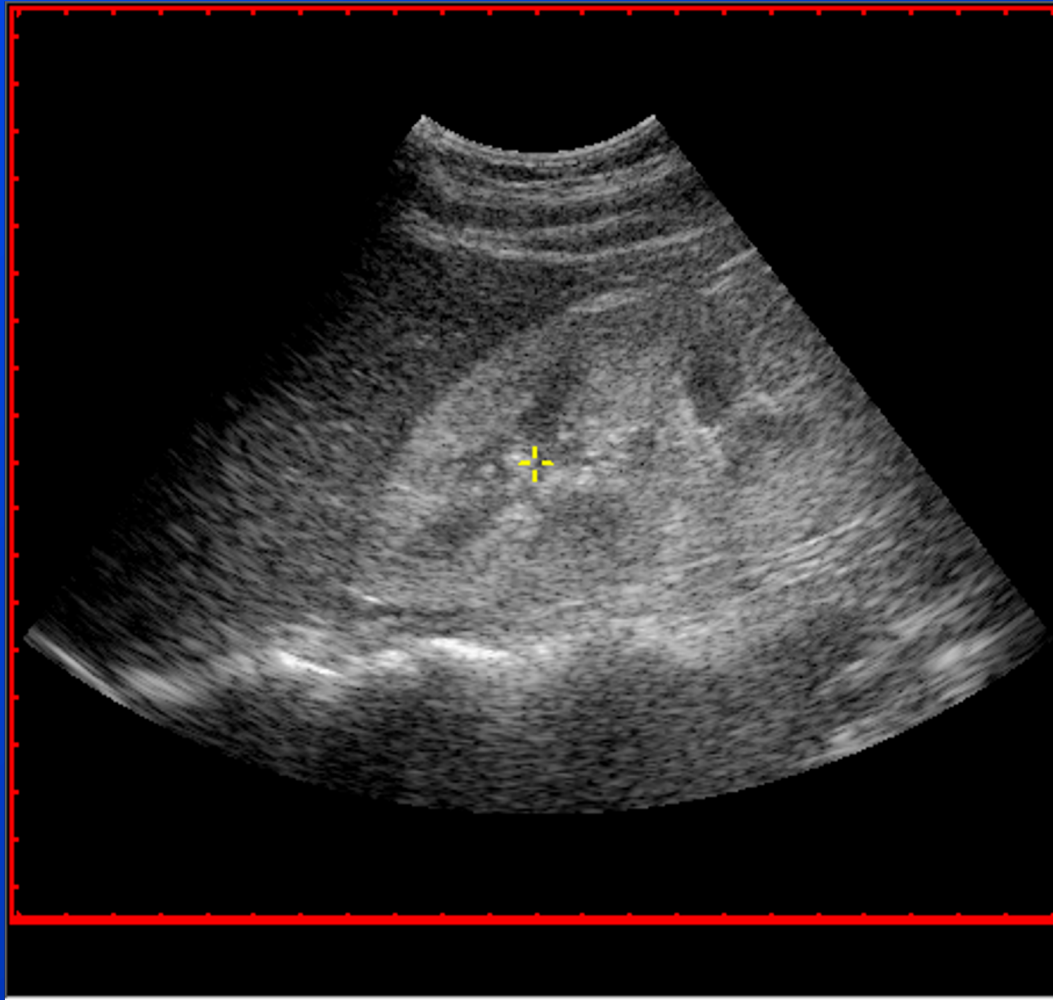


Renal cell carcinoma





Hyperechogenic kidney



Defroster liquid (Ethylen Glycol) intoxication
with oxalat sedimentation



Dangerous or not ?

