



Nasjonalt Senter for Gastroenterologisk Ultrasonografi

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

Ultrasound of the Pancreas

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US of the pancreas – before and now



1995

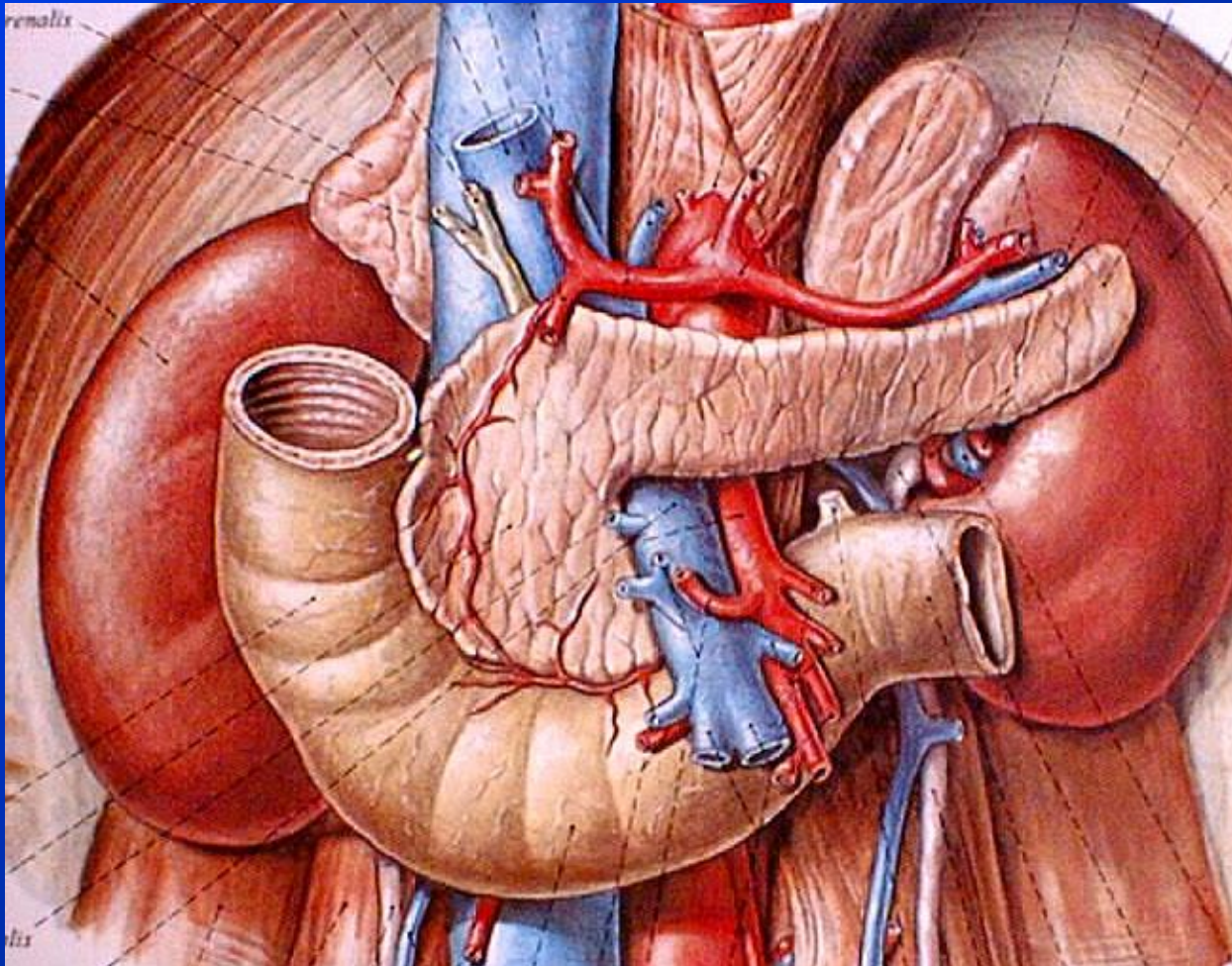


2015

A «pause» in publications 1995-2015

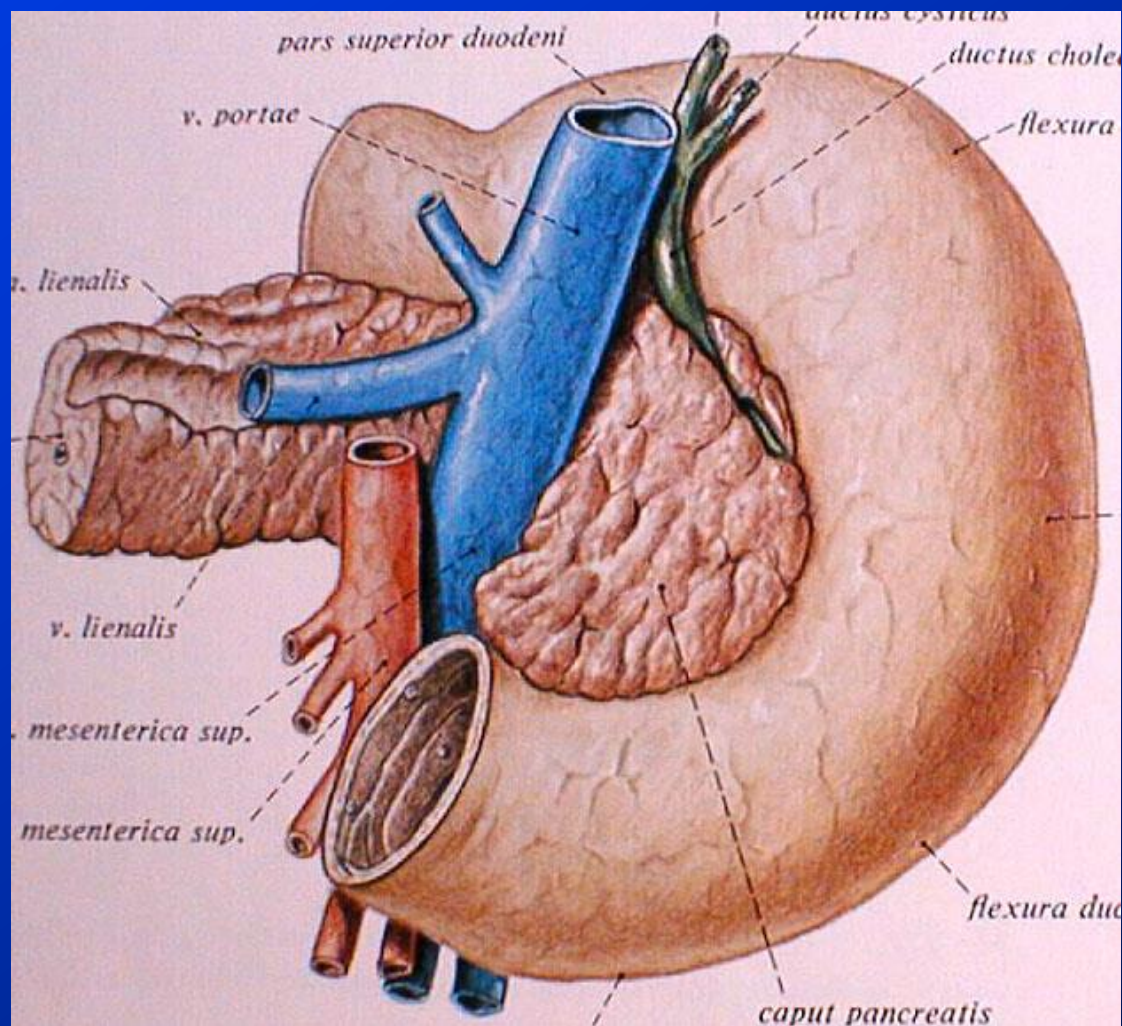


Pancreatic anatomy





Pancreas viewed from behind



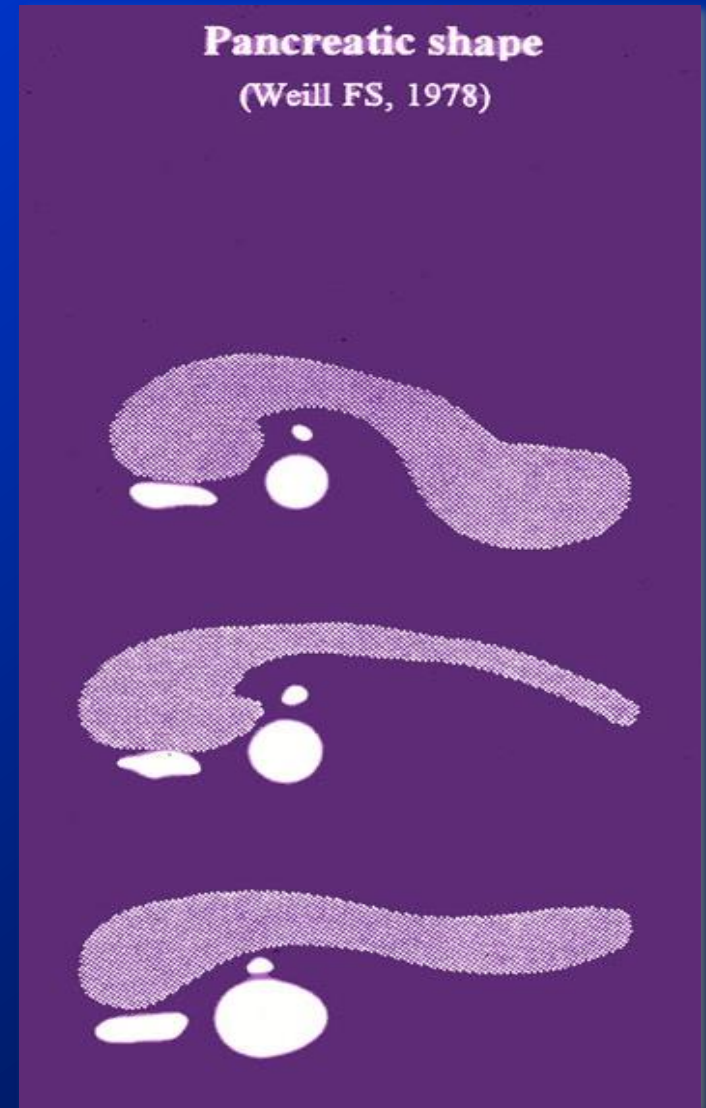


Pancreatic size and shape

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

DeGraff C et al. Radiology
1978

Niderau C et al. Radiology
1983





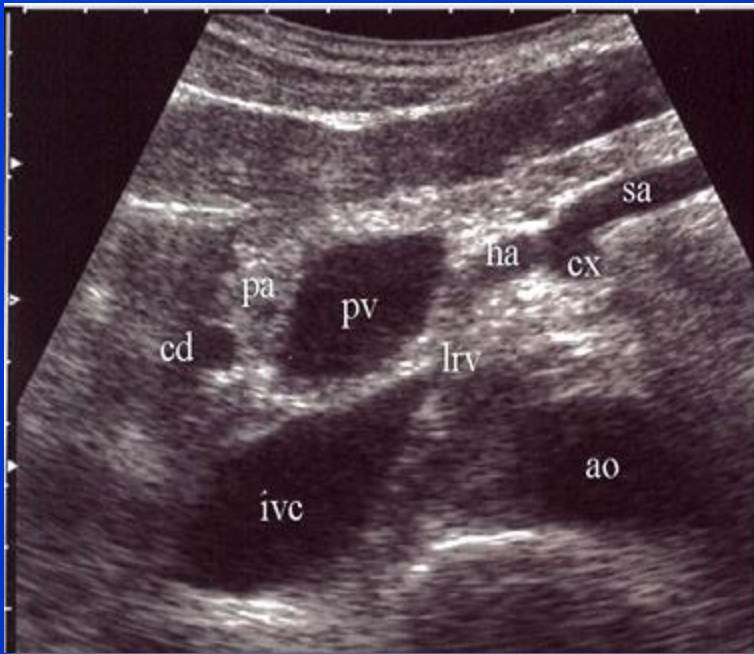
Scanning Technique

- 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"

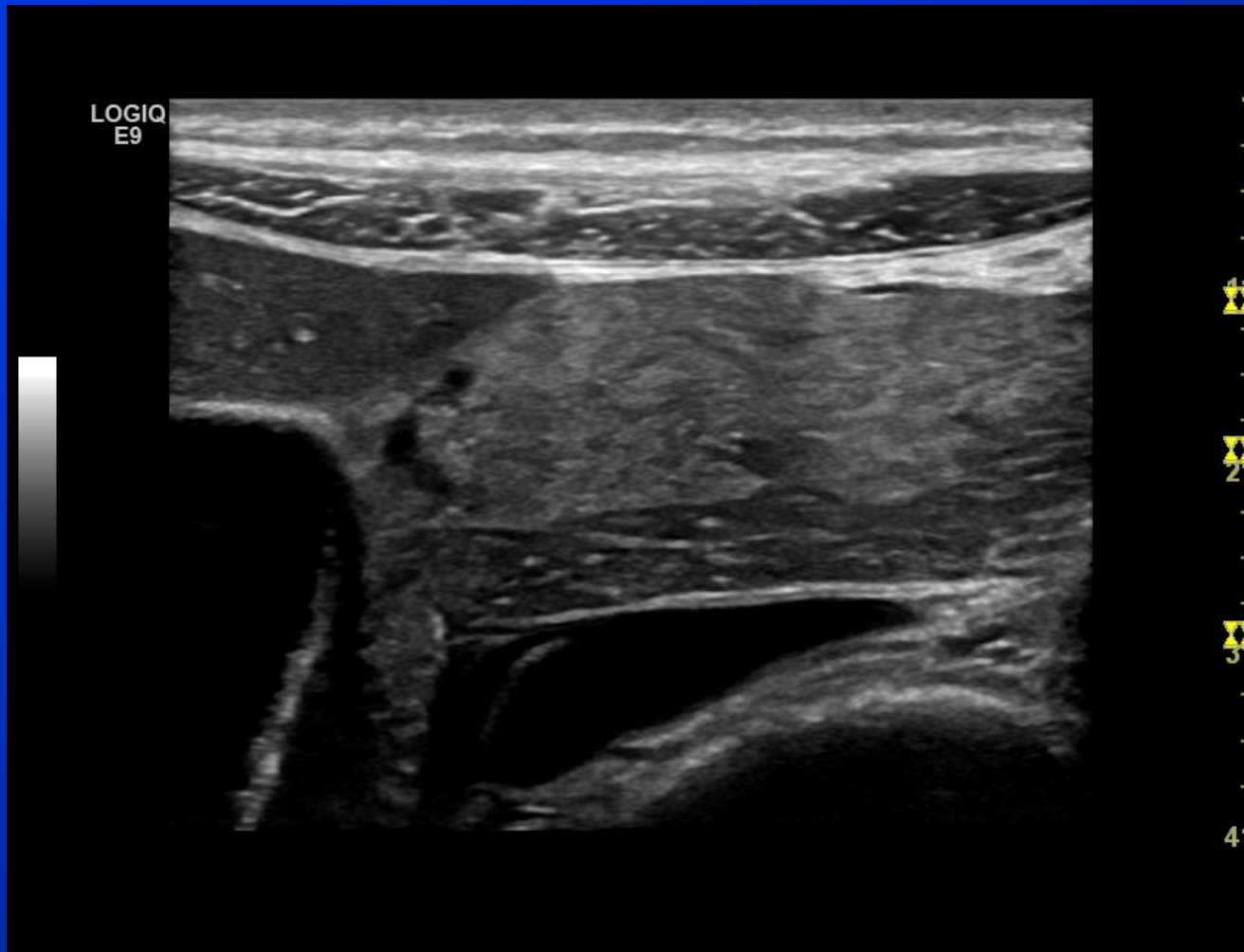


Normal Pancreatic Tail





Ventrale Anlage – Result of embryonic development





Elderly persons have more echogenic pancreas



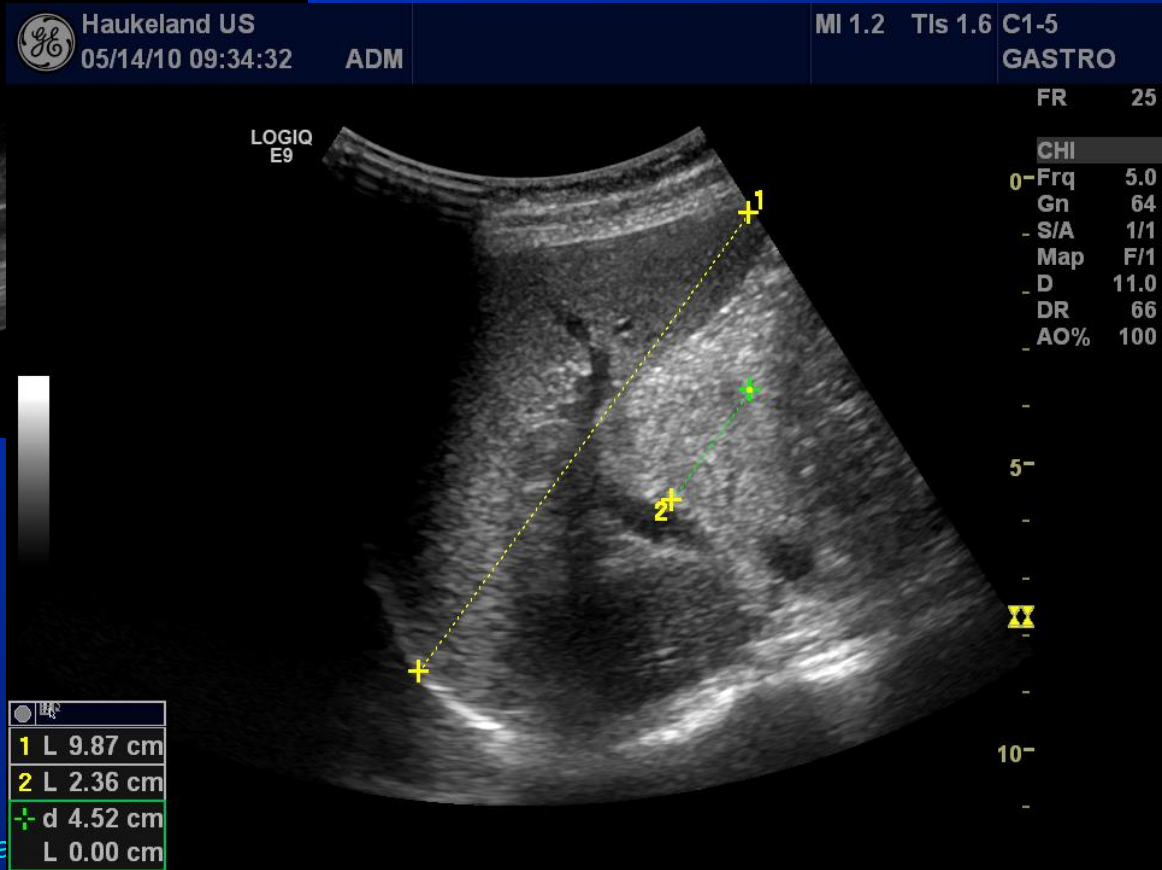


Fluid-filled Stomach as Acoustic Window





Pancreas viewed through the spleen





Pancreatic Duct size

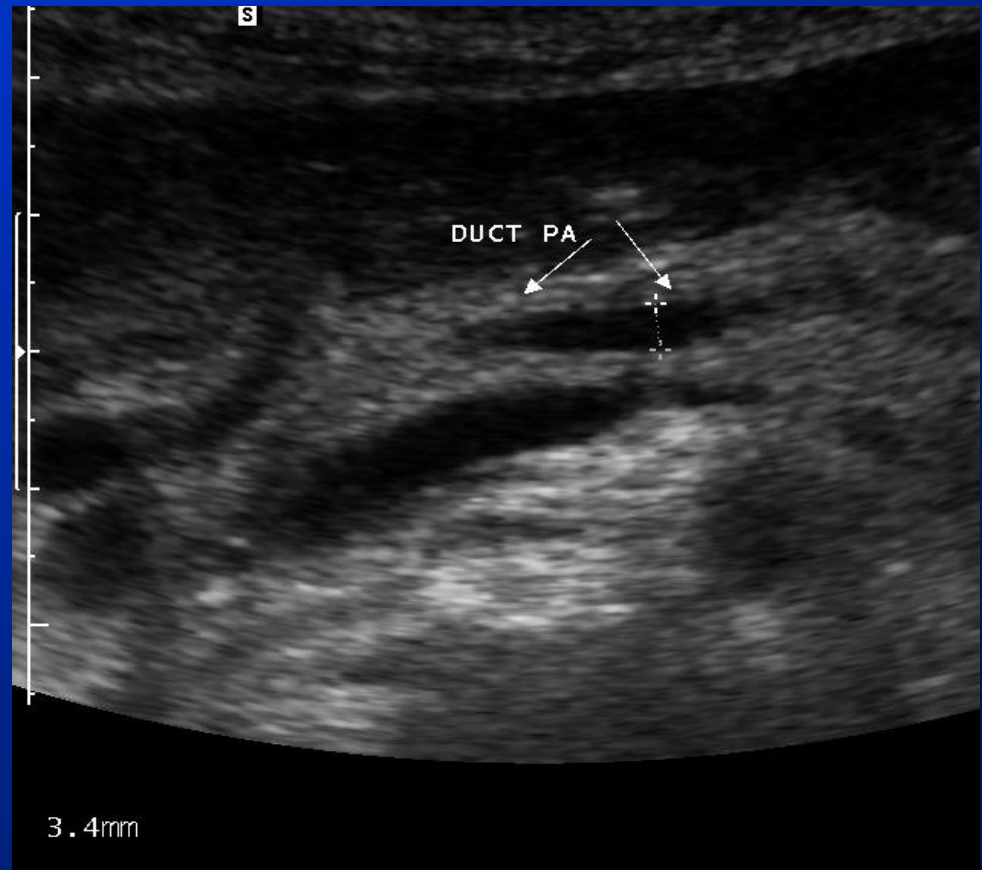
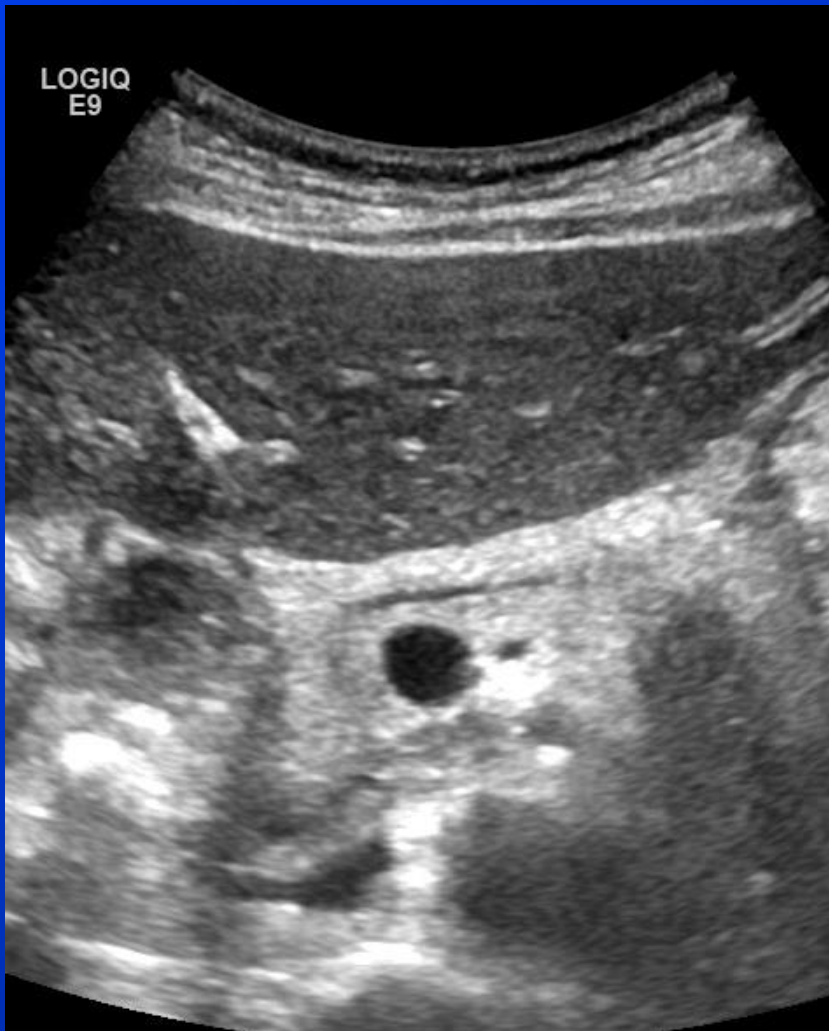
- PD diameter < 2.5 mm
- An important criteria of Chronic Pancreatitis
- Pancreatic duct dilatation is one of the very few early signs of pancreatic cancer

— Sachiko T. Jpn J Clin Oncol 2002;32:407-411





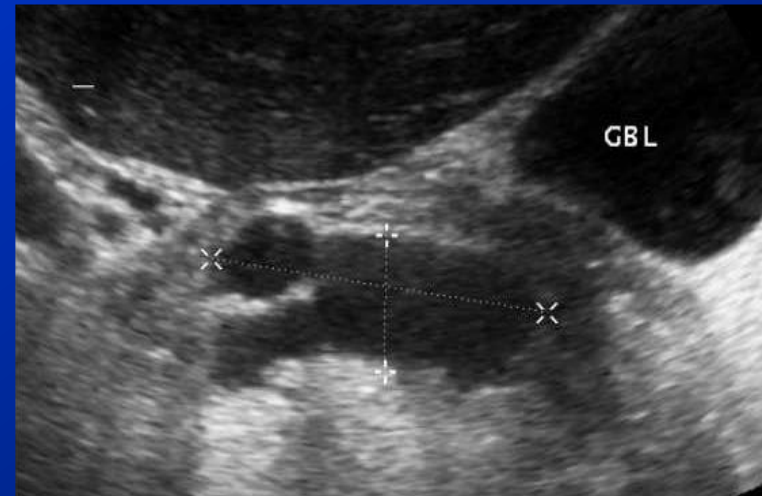
Ductus Pancreaticus





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 - Severity

Mild pancreatitis

Enlarged organ (leading sign)
Blurred hypoechoic texture
Regular size and texture in “concurrent”
pancreatitis
Heterogeneous texture possible

Severe pancreatitis

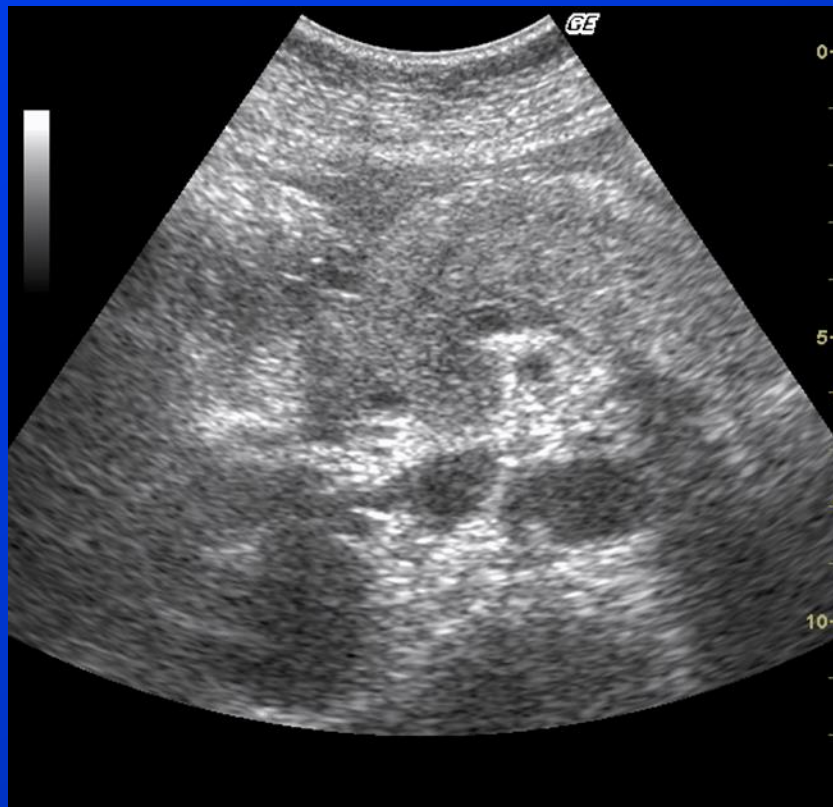
In addition to the mild form:
Focal hypo-/hyperechoic intra- and extra-
pancreatic mass (hemorrhage/necrosis/ fatty
necrosis)
Ascites, pleural effusion



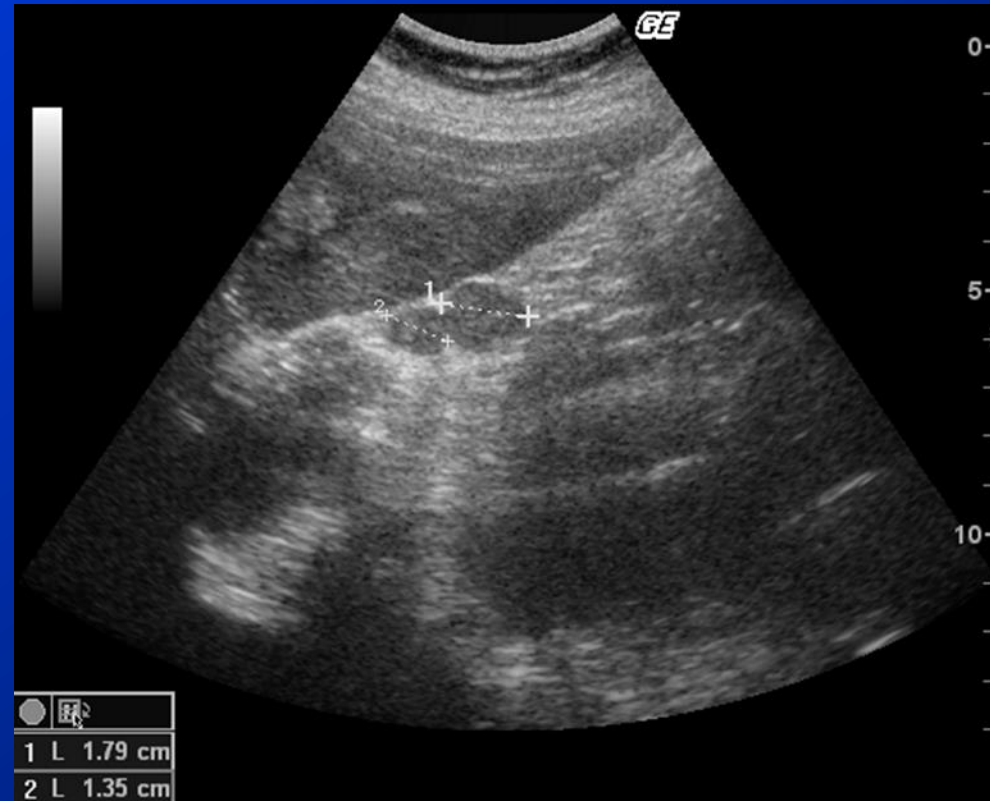
Schmidt G, Greiner L, Nuernberg D: Differential Diagnosis in Ultrasound Imaging, Thieme 2010



Mild Acute Pancreatitis



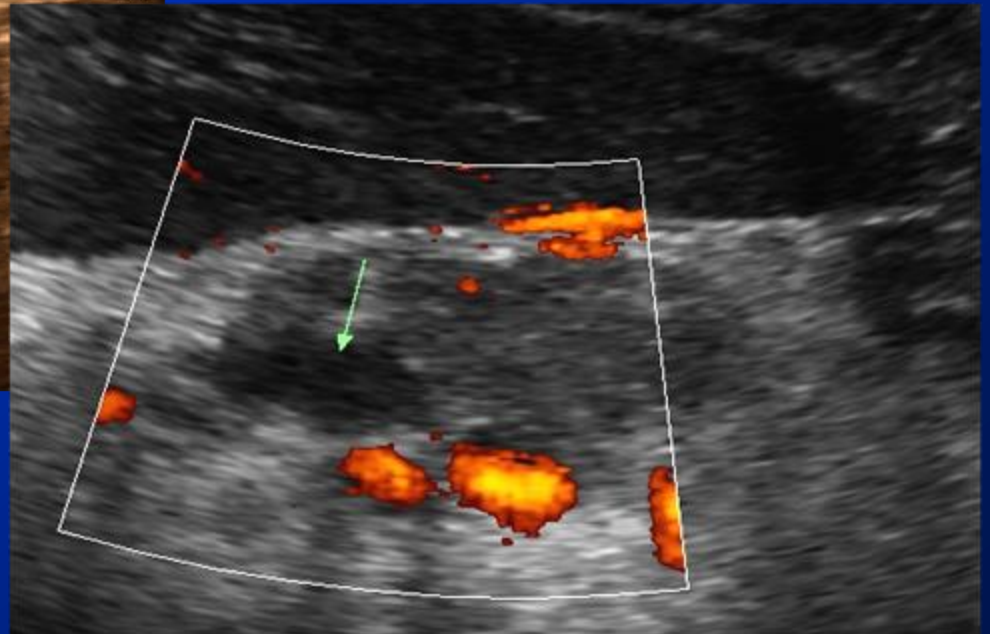
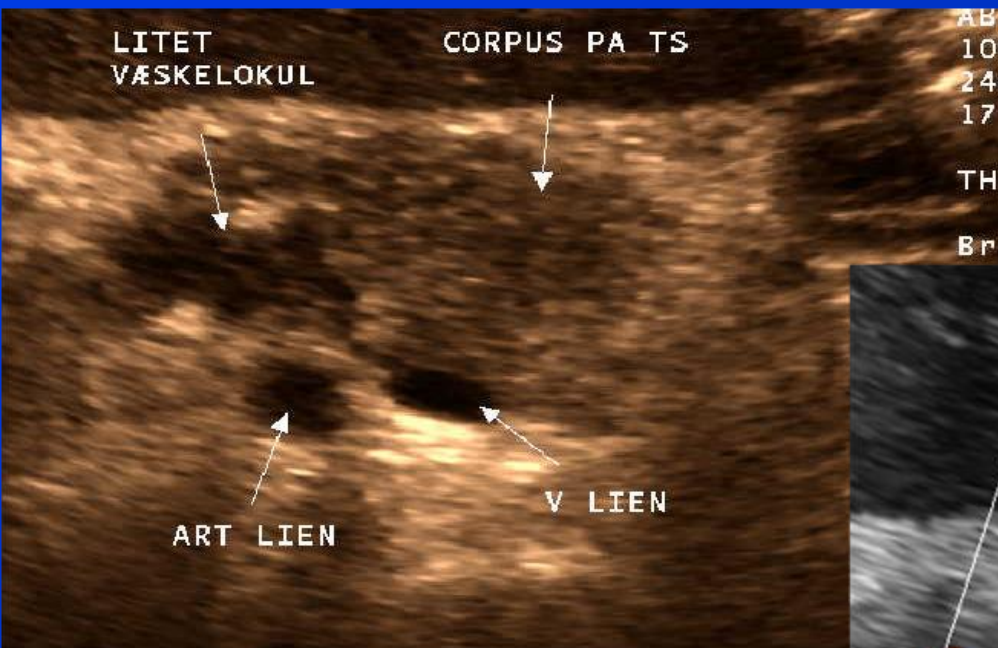
Enlarged pancreas



Enlarged Lymphnodes



Transabdominal ultrasound in acute pancreatitis

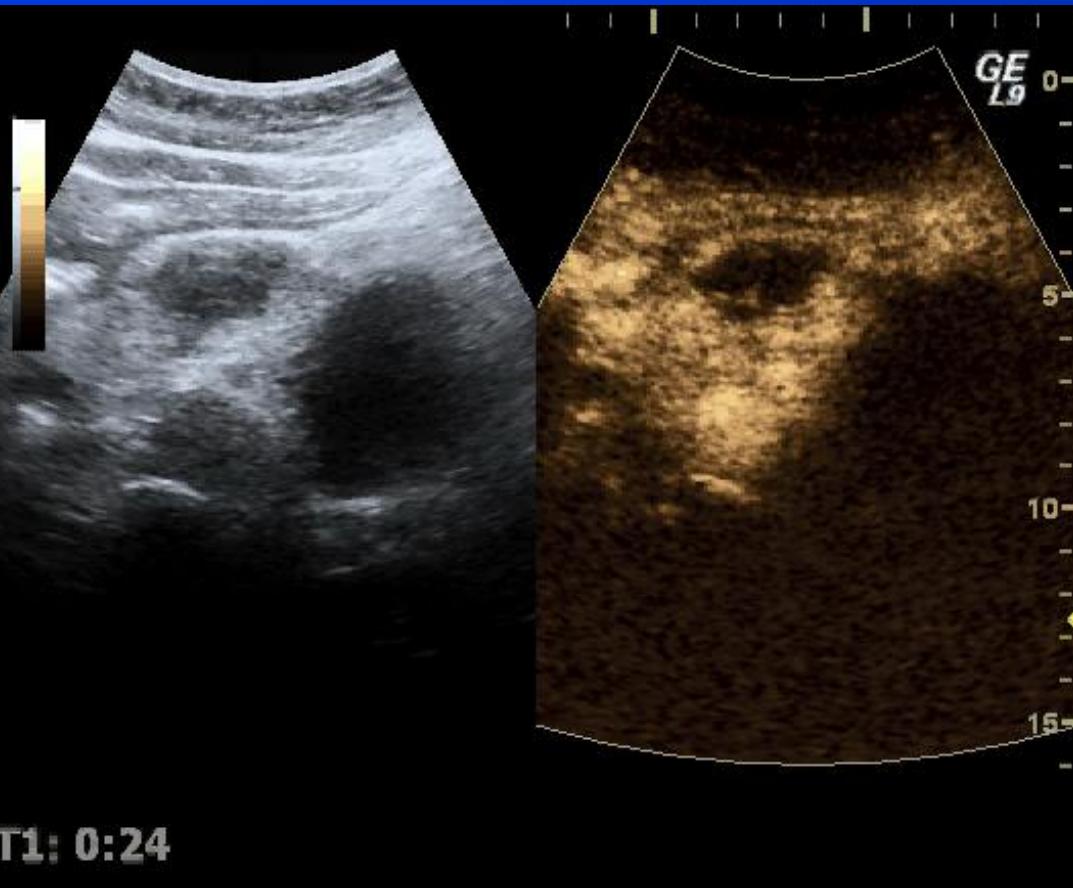


Fluid collections



Severe acute pancreatitis

- Evaluations of necrosis
 - CECT (Gold standard)
 - CEUS (follow-up)



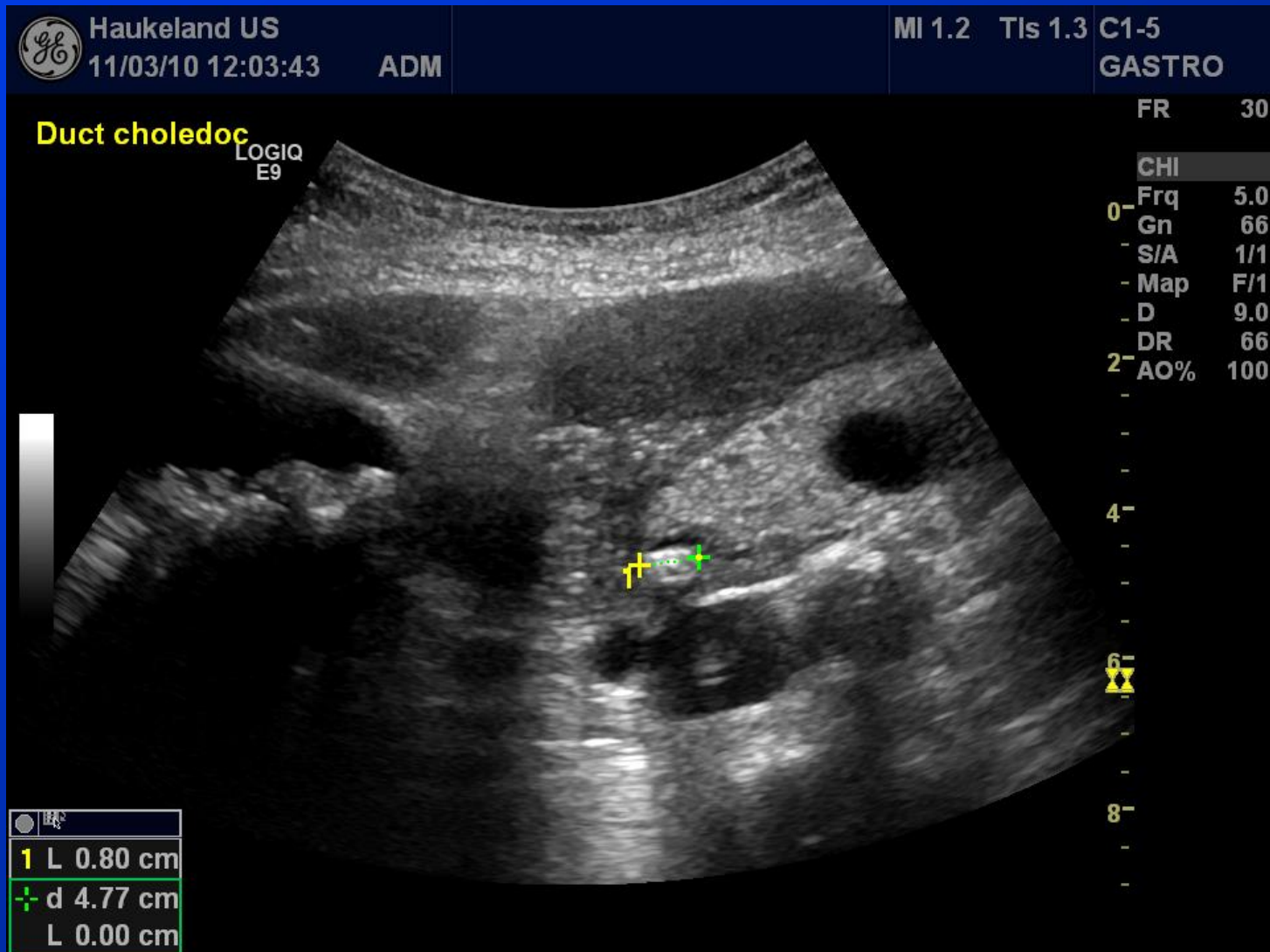


Detection of necrosis





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



Endoscopic ultrasound criteria for the diagnosis of chronic pancreatitis

TABLE 1

Endoscopic ultrasound criteria for the diagnosis of chronic pancreatitis

Conventional criteria	Rosemont criteria
Parenchymal criteria	Major criteria A
Hyperechoic foci	Hyperechoic foci (>2 mm in length/width with shadowing)
Hyperechoic strands	
Hypoechoic lobules, foci or areas	Major duct calculi (echogenic structure[s] within the MPD with acoustic shadowing)
Cyst	
	Major criteria B
	Lobularity (≥ 3 contiguous lobules = 'honeycombing')
Duct criteria	Minor criteria
Irregular duct	



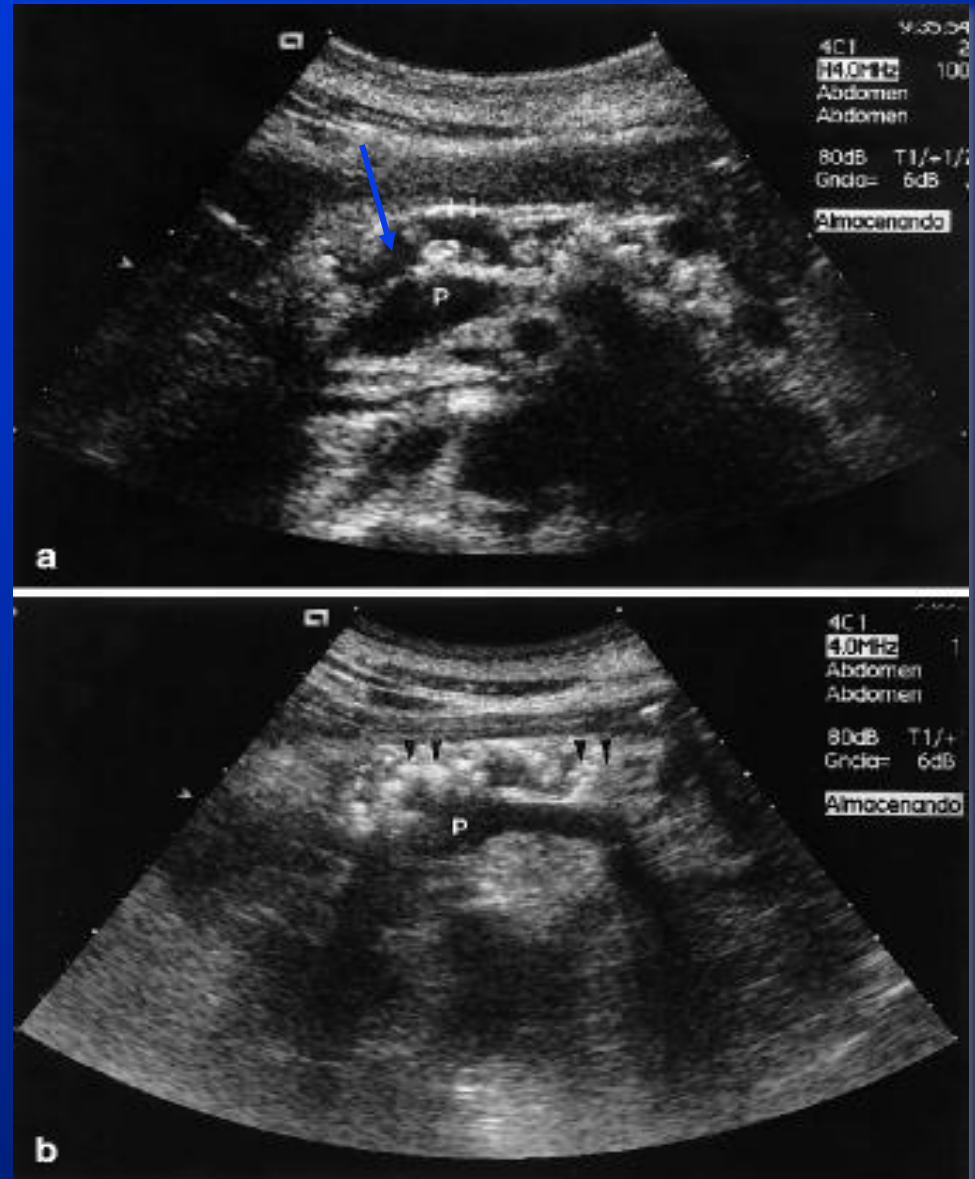
Rosemont - Minor criteria

- Cyst (anechoic, round/elliptical - septations)
- Irregular duct contour (irregular outline and ectatic)
- Dilated side branch (>3 tubular anechoic structures each measuring ≥ 1 mm in width)
- Hyperechoic duct wall (echogenic, distinct structure >50% of entire MPD in the body and tail)
- Hyperechoic strands (≥ 3 mm in at least 2 different directions with respect to the imaged plane)
- Hyperechoic foci (>2 mm in length/width that are nonshadowing)*
- Lobularity (>5 mm, noncontiguous lobules)



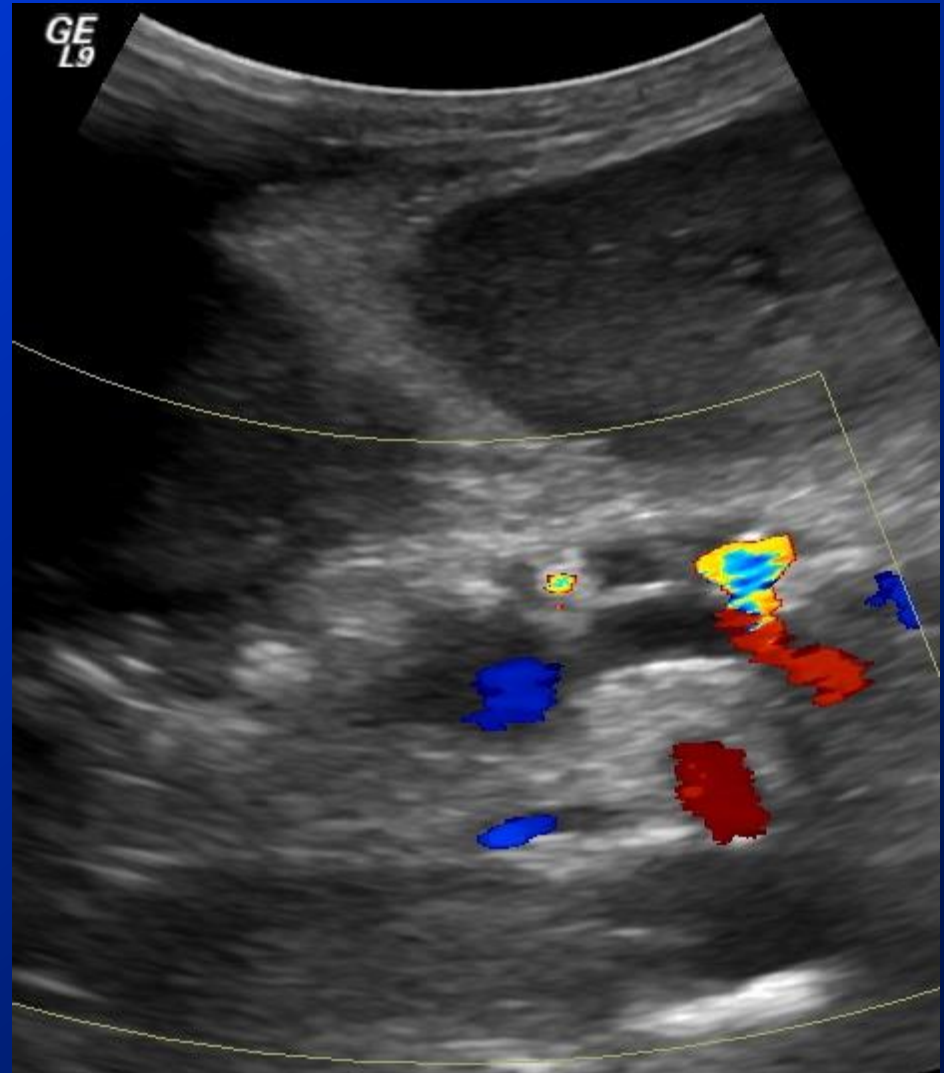
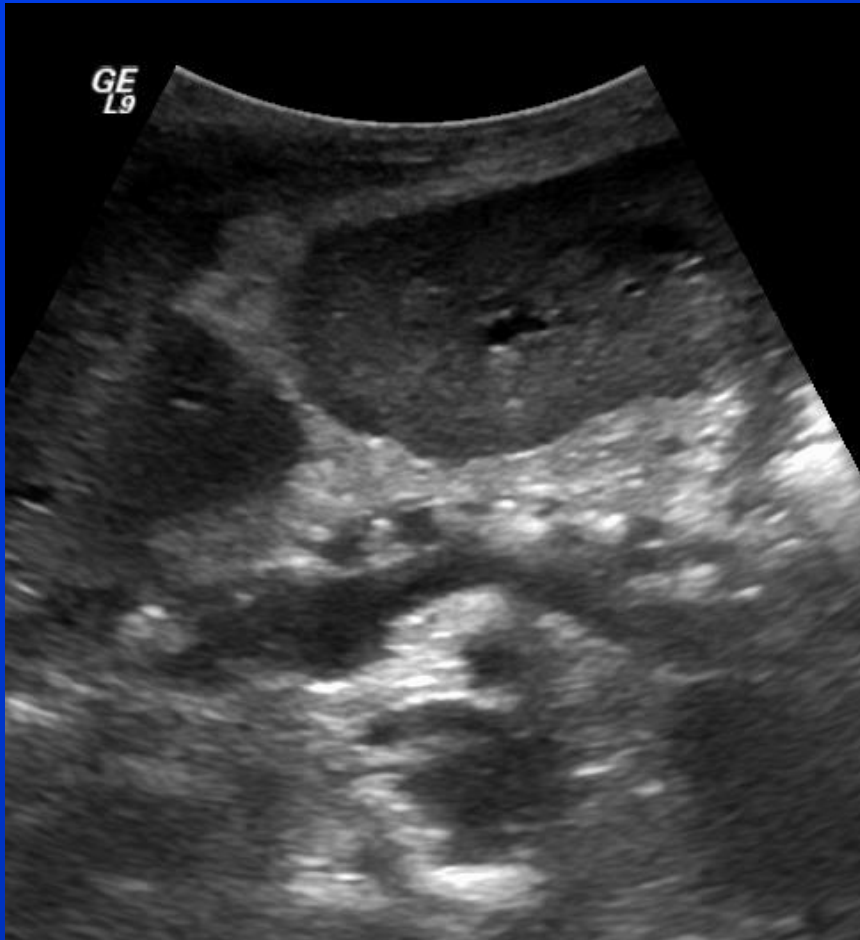
Chronic pancreatitis

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





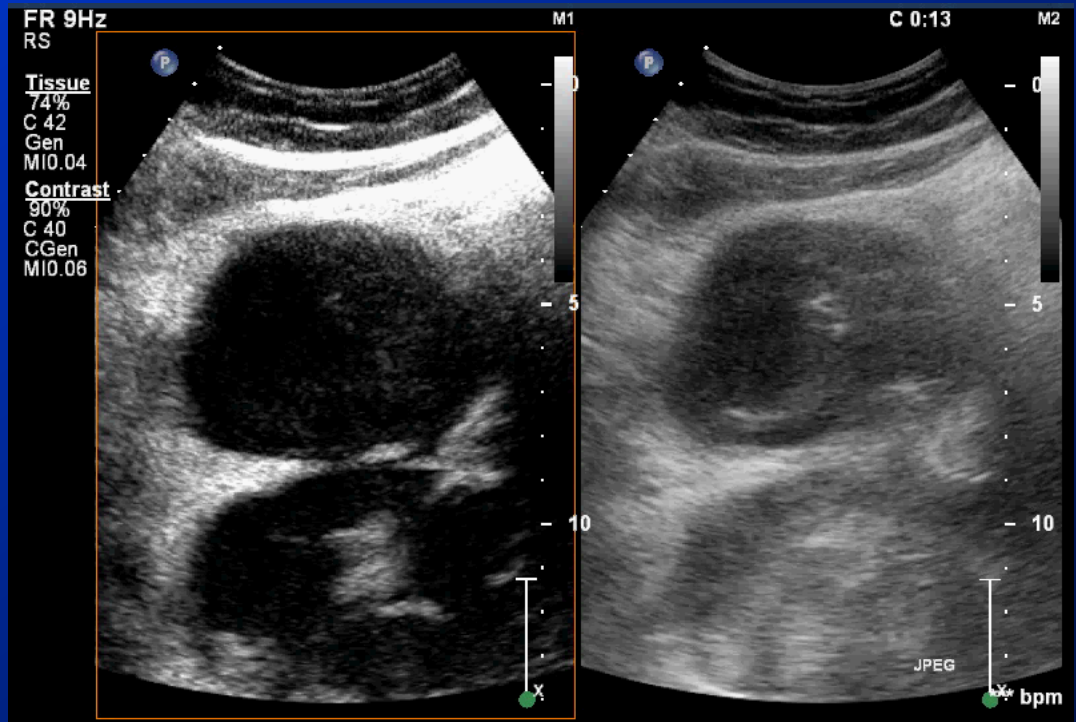
Chronic Pancreatitis – Twinkling artifact





Pancreatic pseudocyst

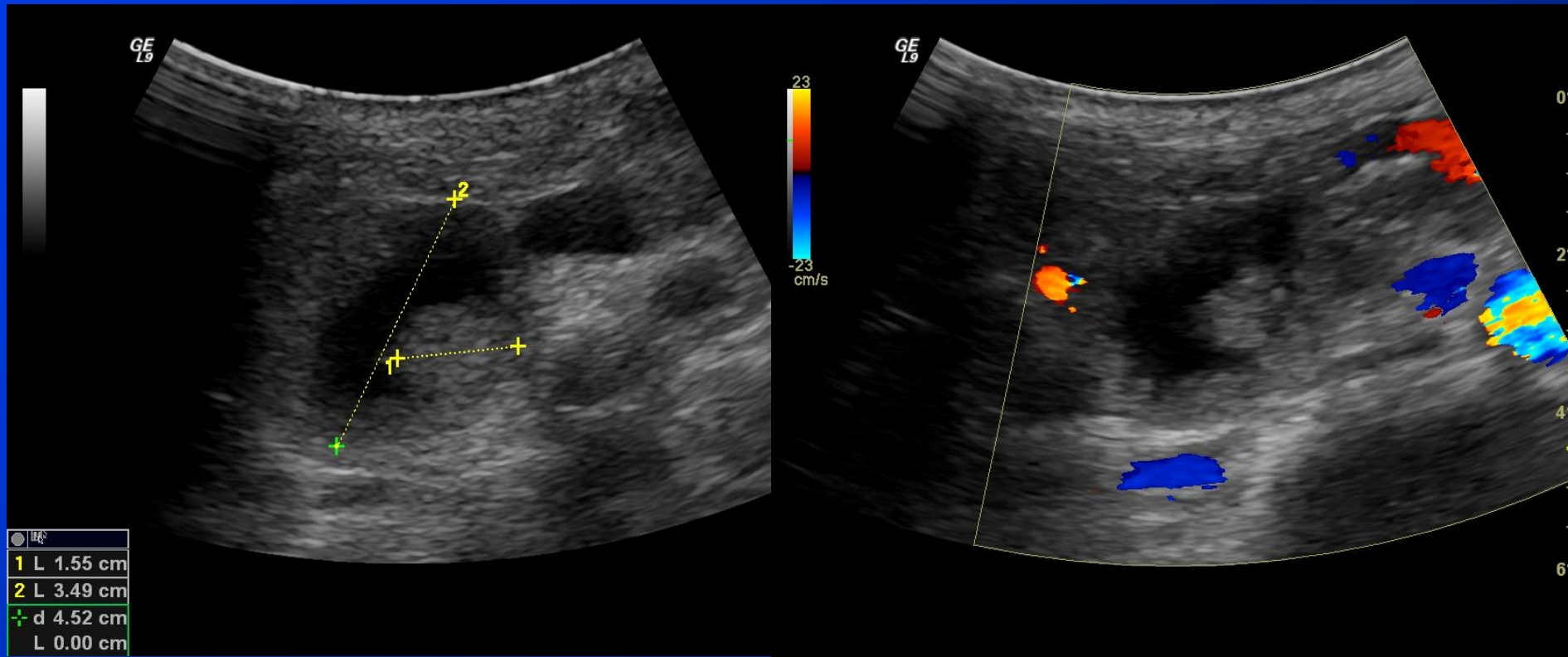
- A pancreatic pseudocyst is a circumscribed collection of fluid with no capsule rich in pancreatic enzymes, blood, and necrotic tissue, typically located in the lesser sac of the abdomen





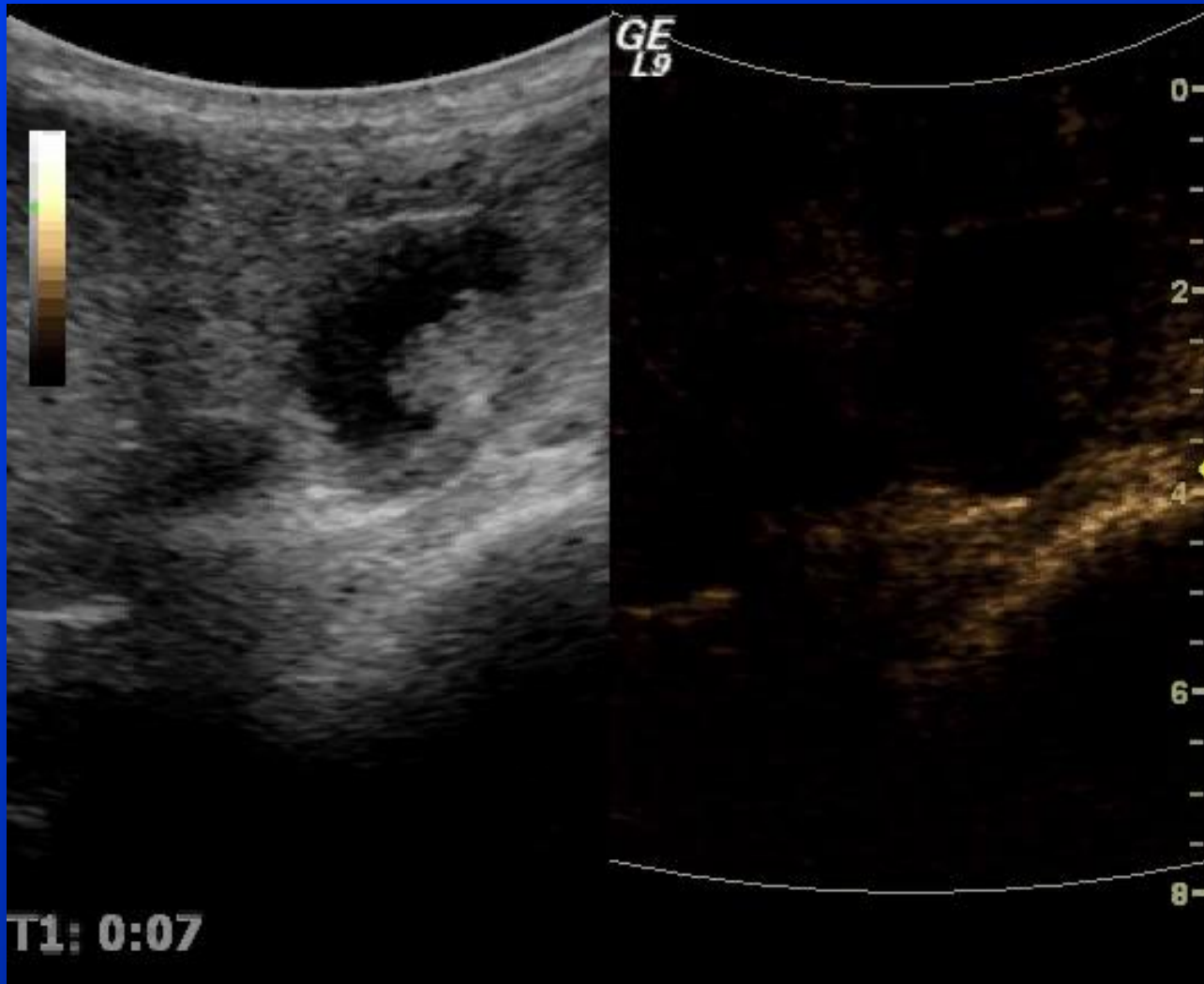
Extreme duct dilatation in chronic pancreatitis

Male, 71 years





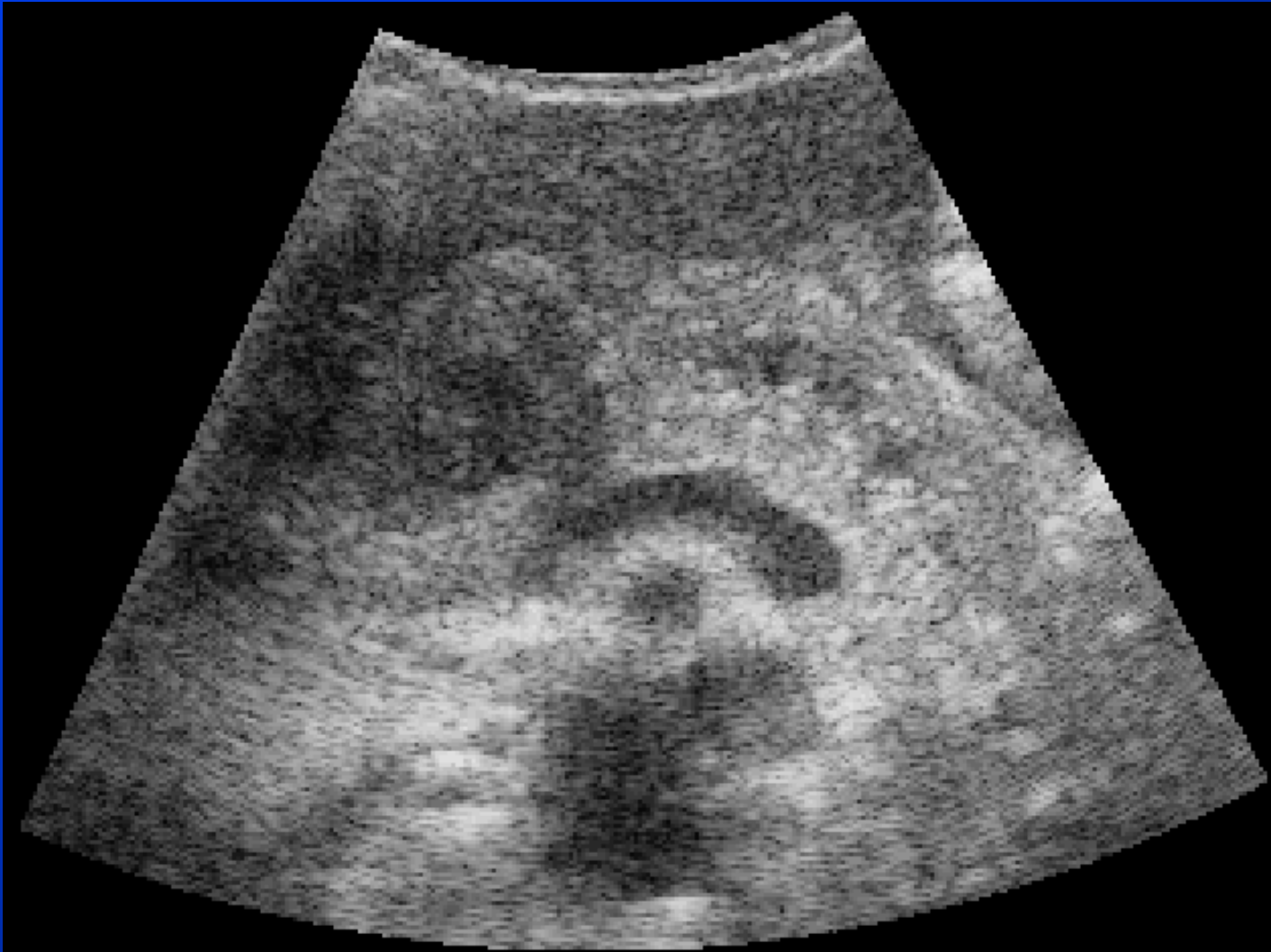
CEUS of the Pancreas



IPMN: Intraductal Papillary Mucinous Neoplasia

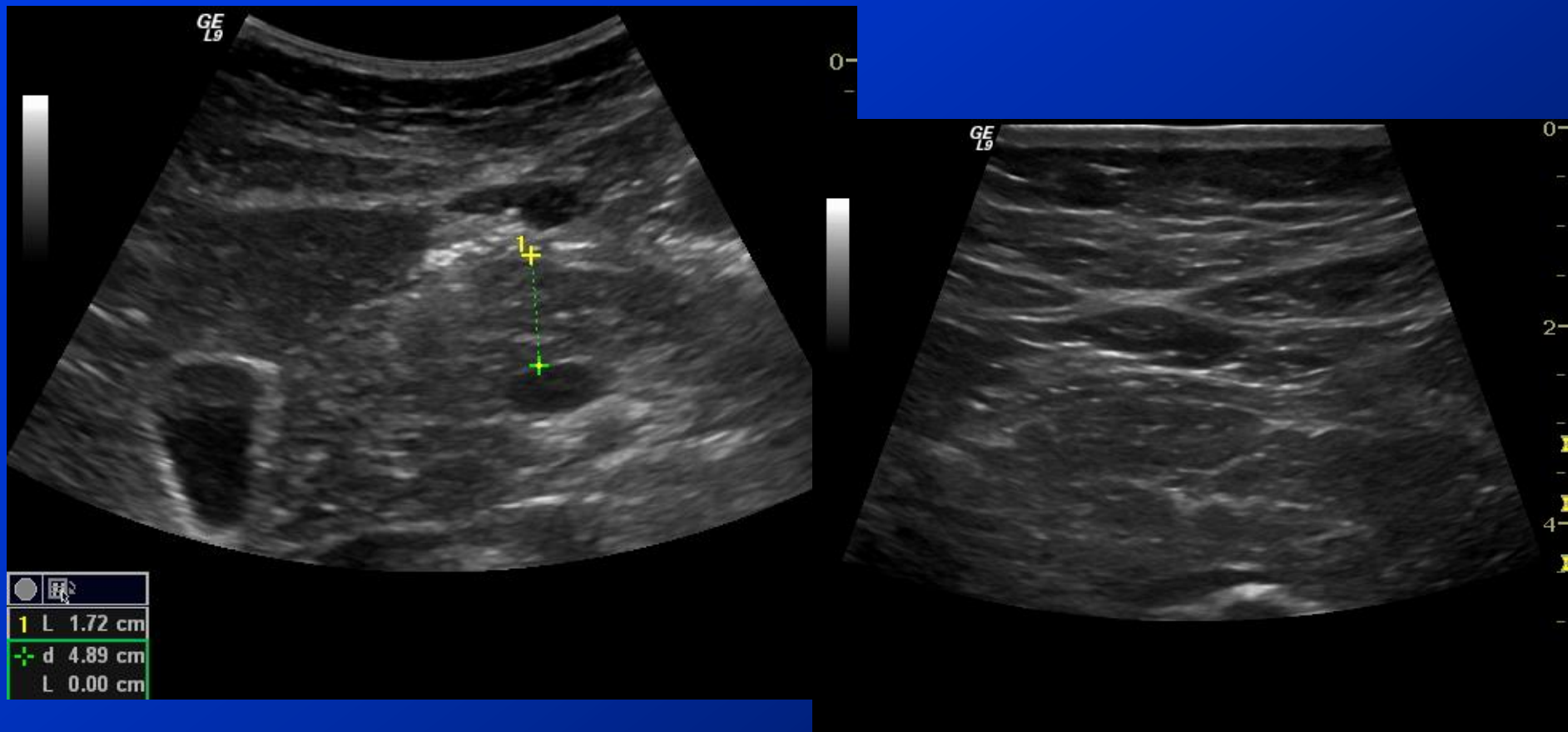


"Acute on chronic" Pancreatitis



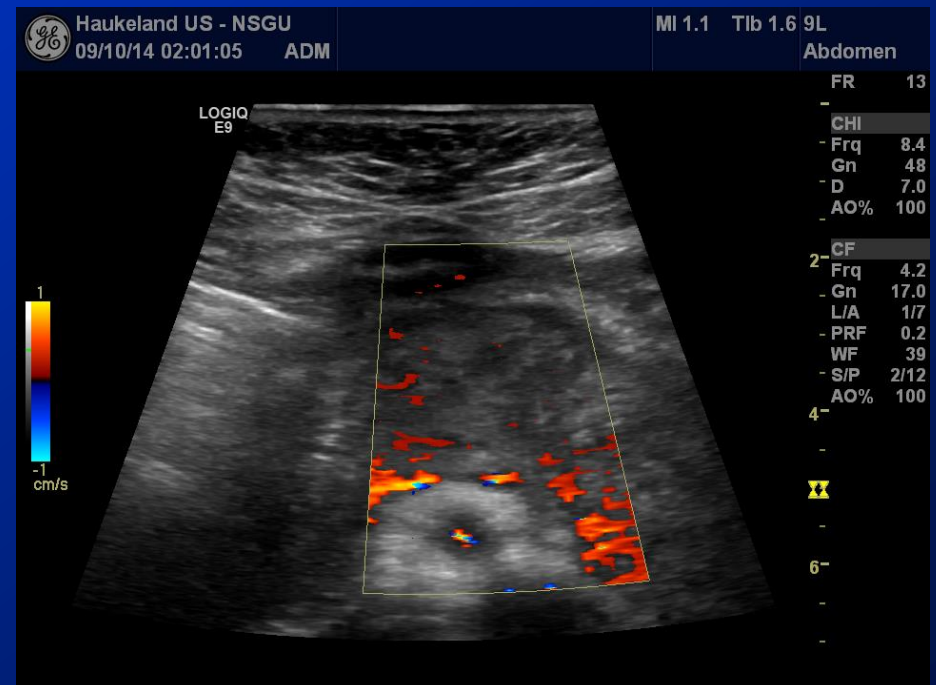


Autoimmune Pancreatitis



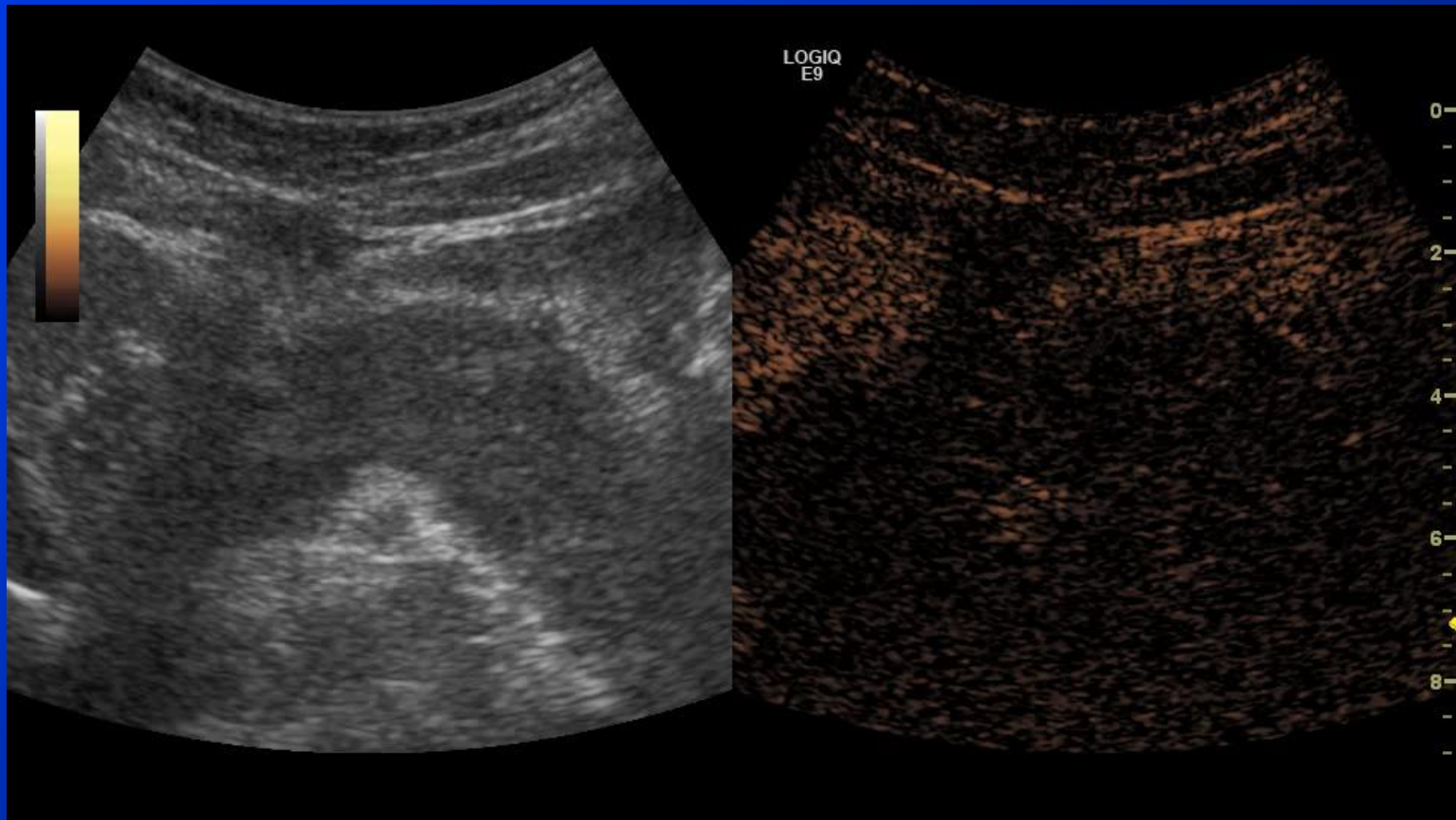


AIP



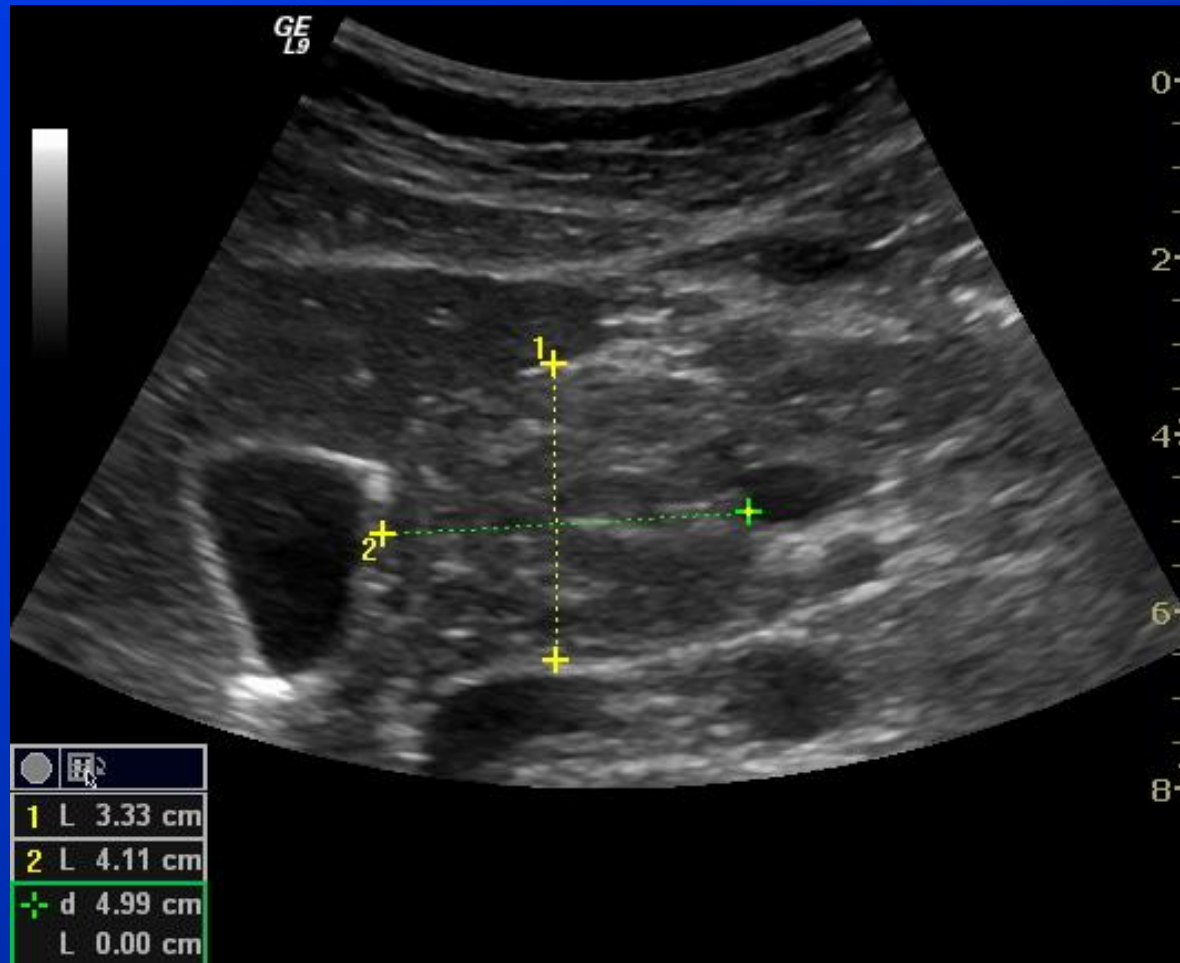


CEUS – SNZ – Arterial phase





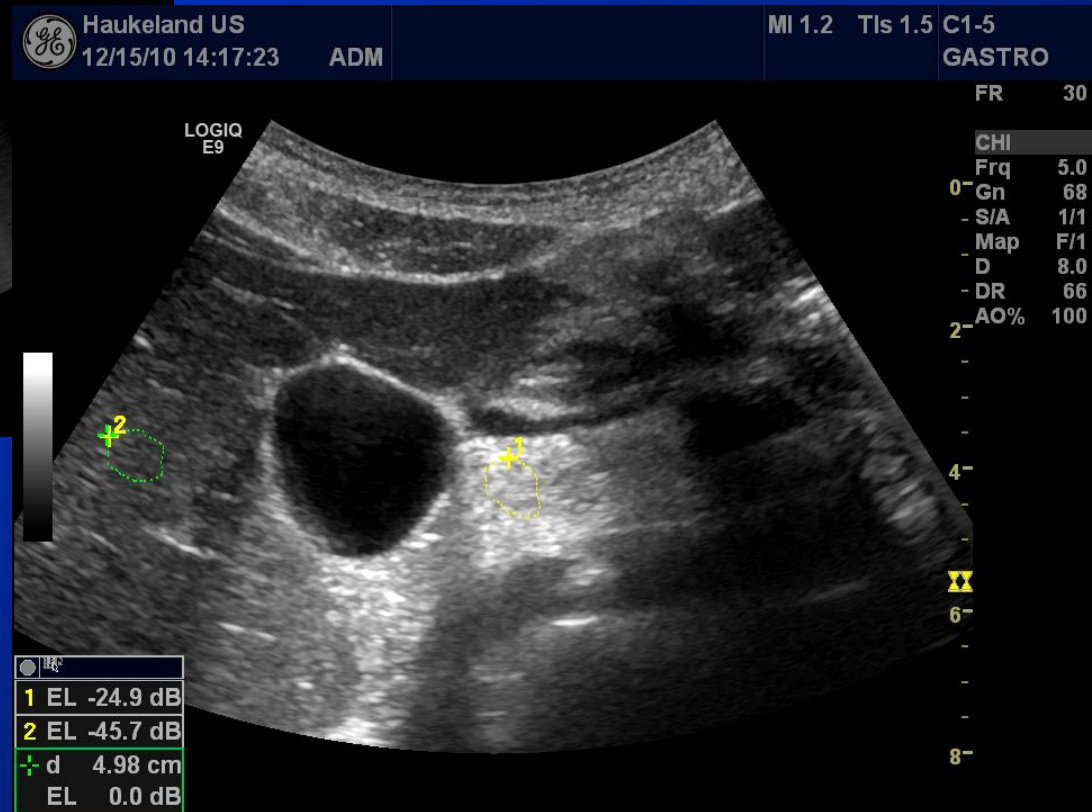
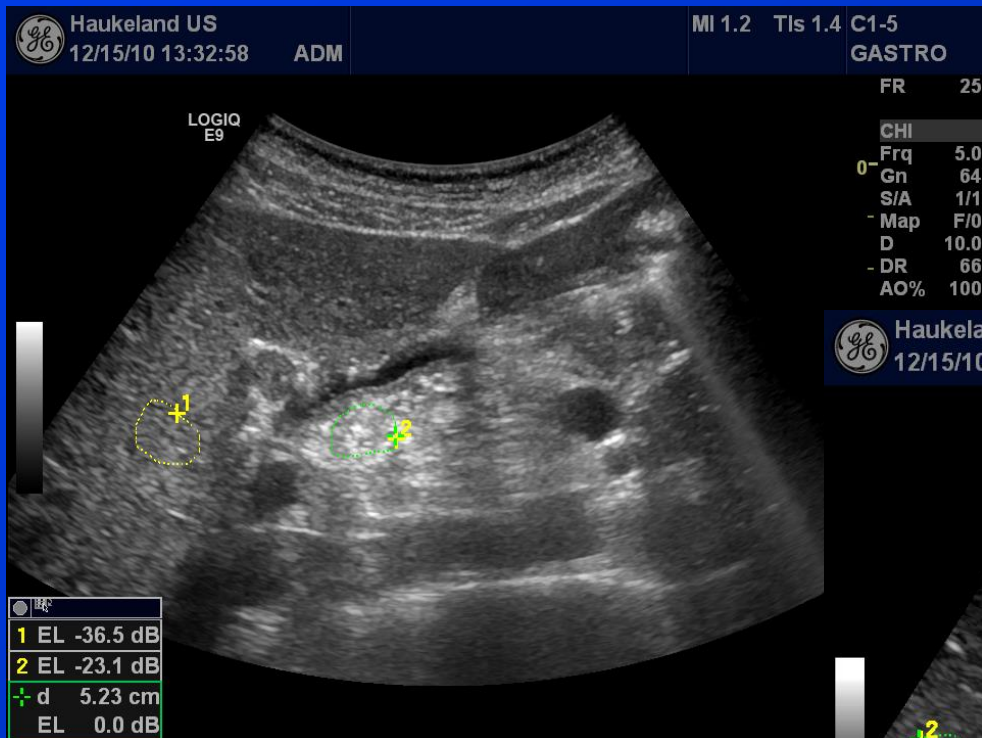
Focal lesion in the head



Focal pancreatitis? PDAC? SCN? AIP?



Lipomatosis in Cystic Fibrosis





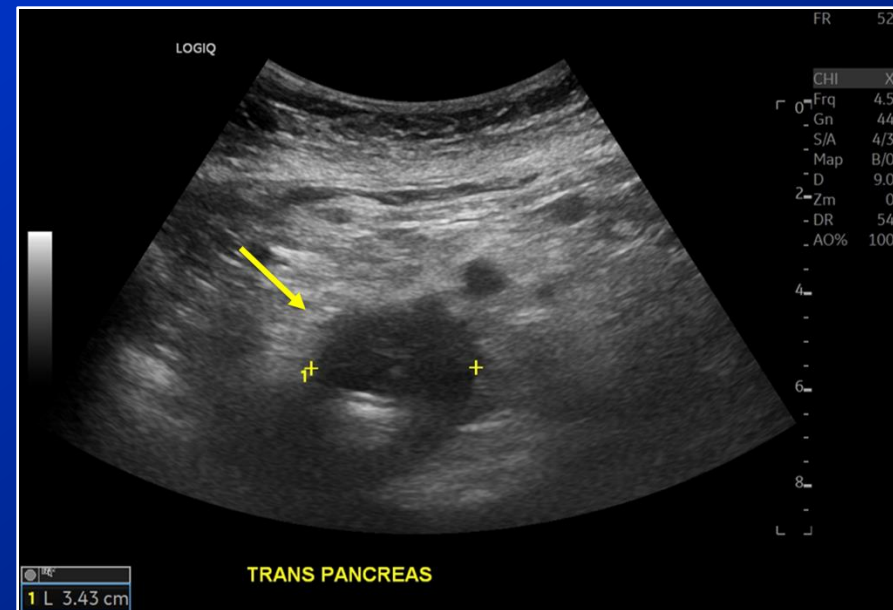
Cystic TB lesions of the Pancreas





Pancreatic tumors

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



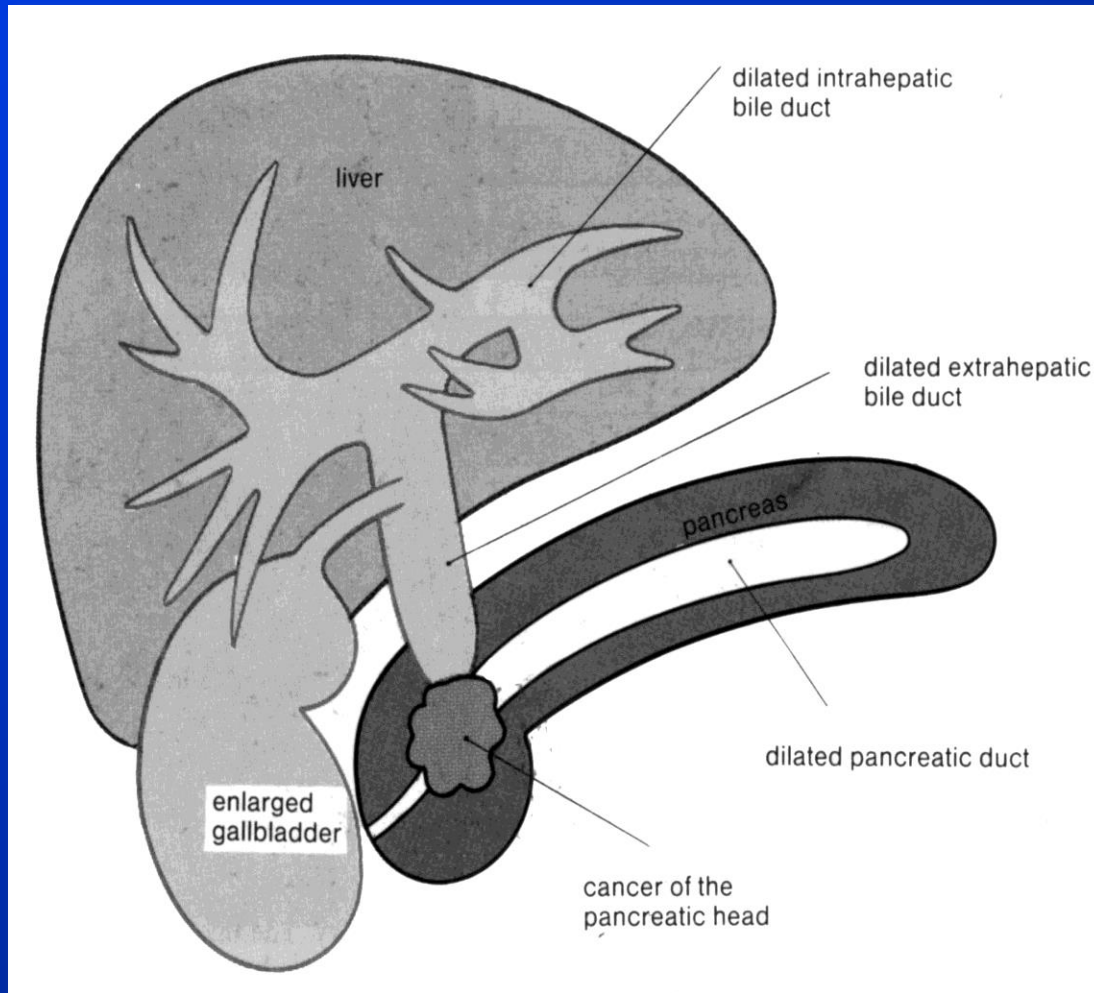


Pancreas Cystadenom





Tumor in the pancreatic head



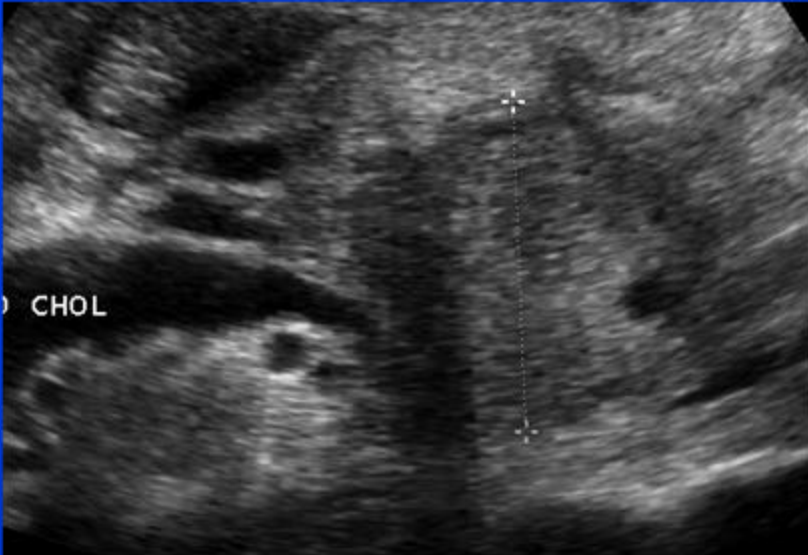


Pancreatic cancer

- 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



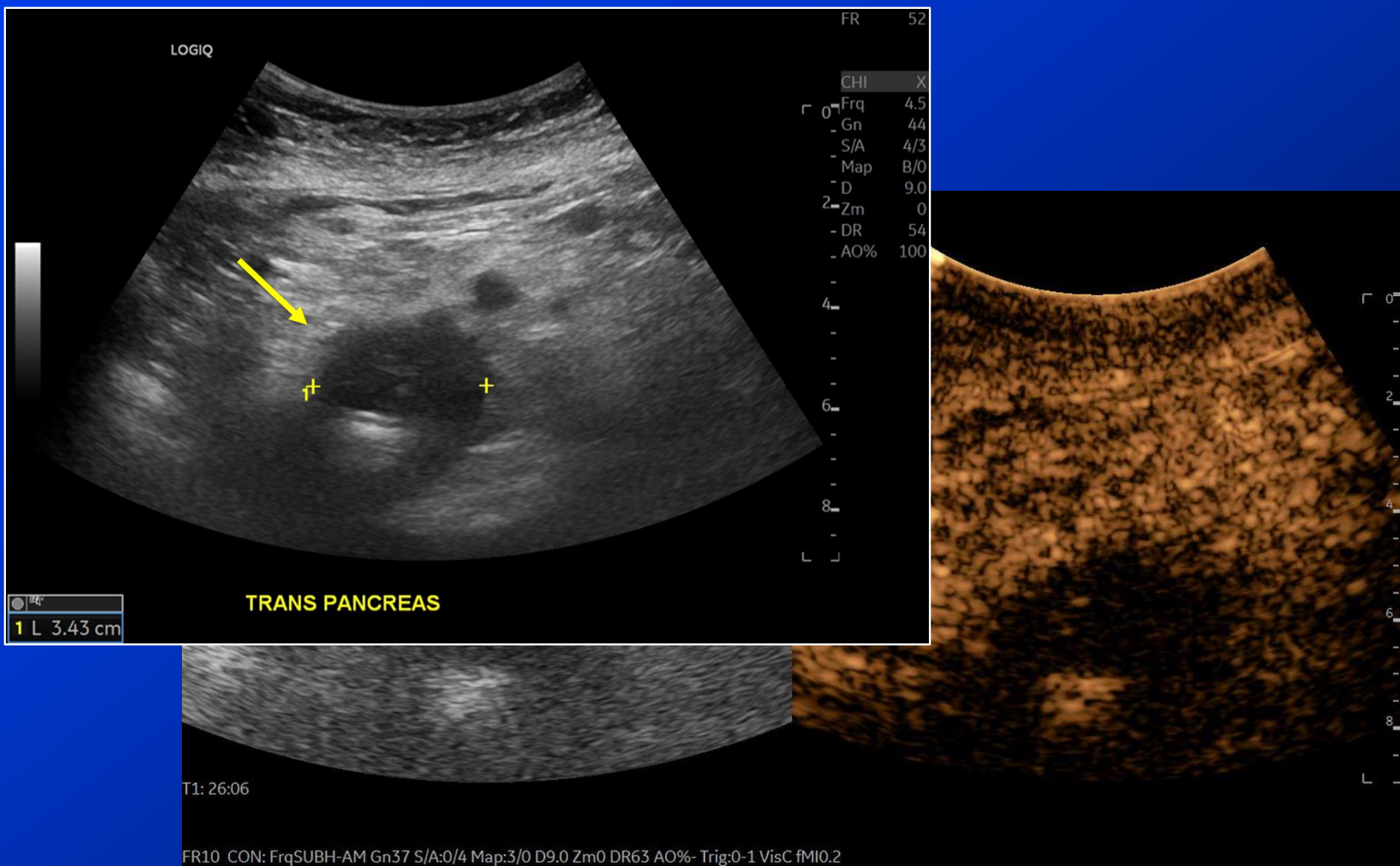


Pancreatic Cancer





PDAC



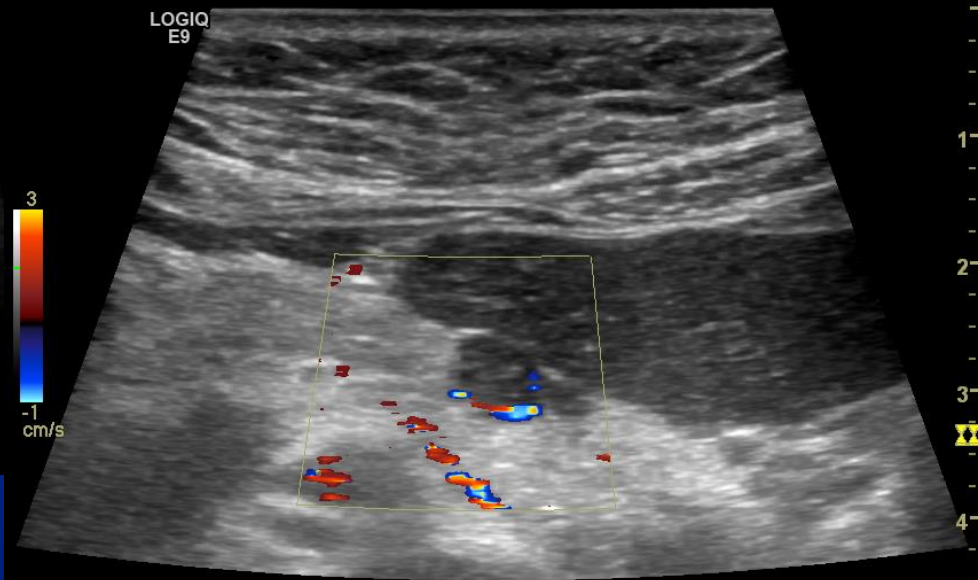
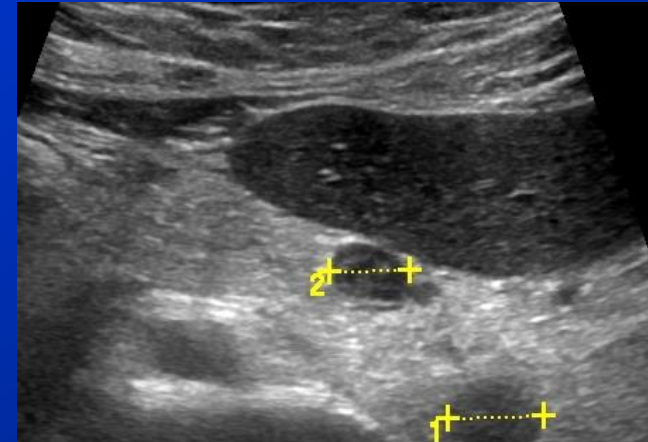
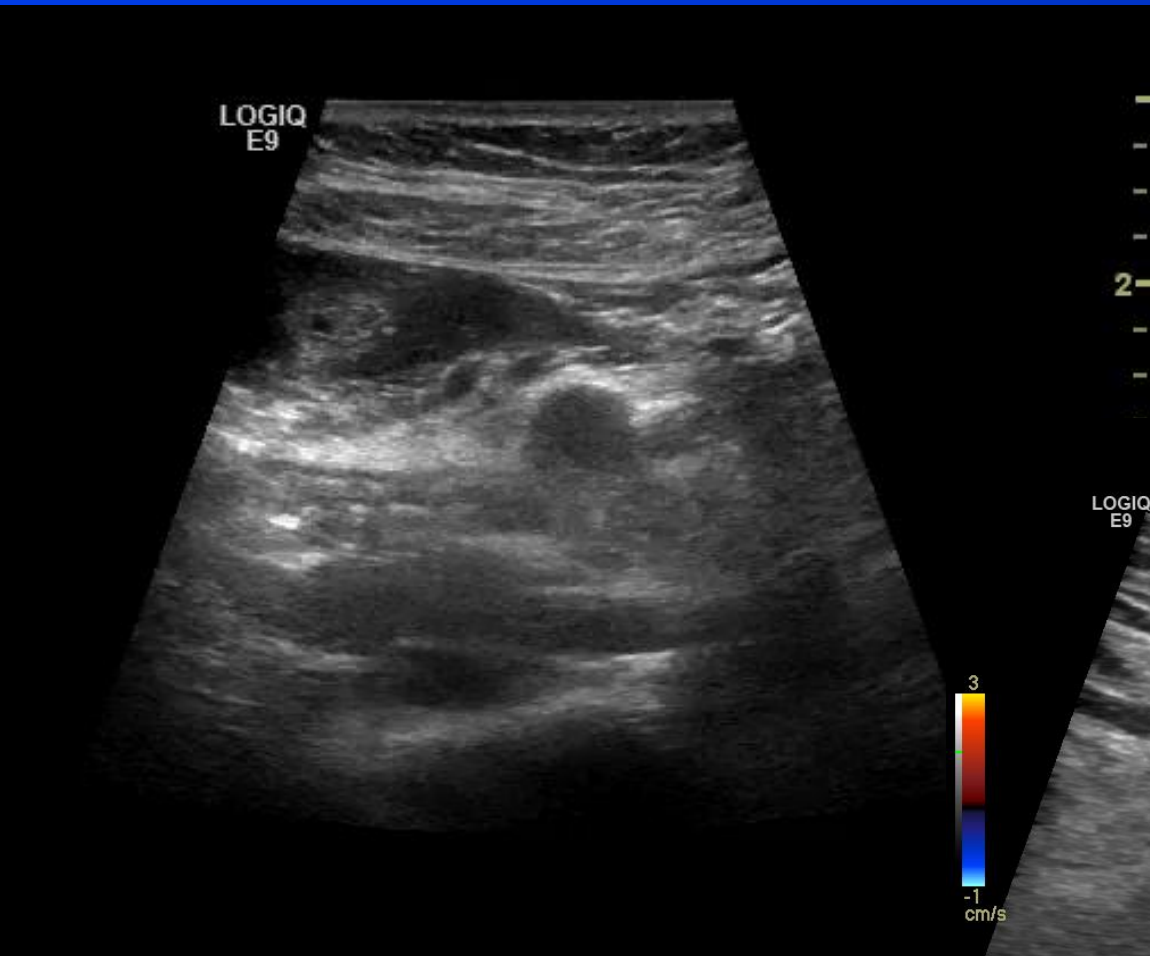


Patient History

- Female, born 1961
- Watery diarrhea since spring 2009
- Weightloss 10 kg
- CT: One lesion in the tail of the pancreas
- EUS: Showed 2 lesions in the pancreas
- External ultrasound...

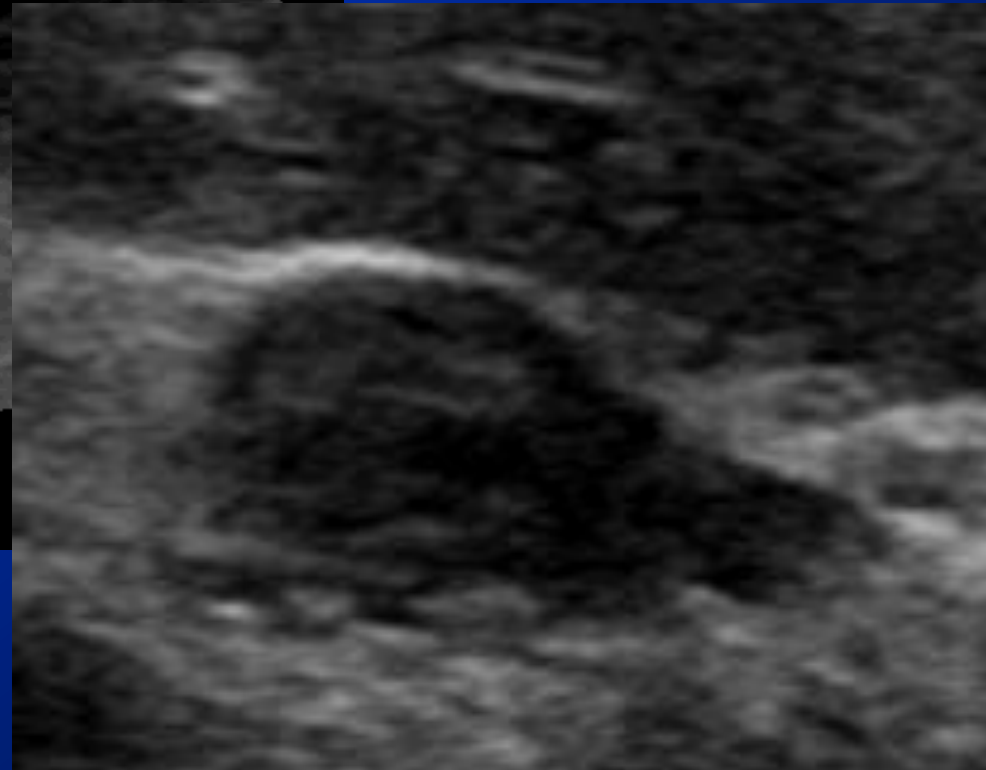
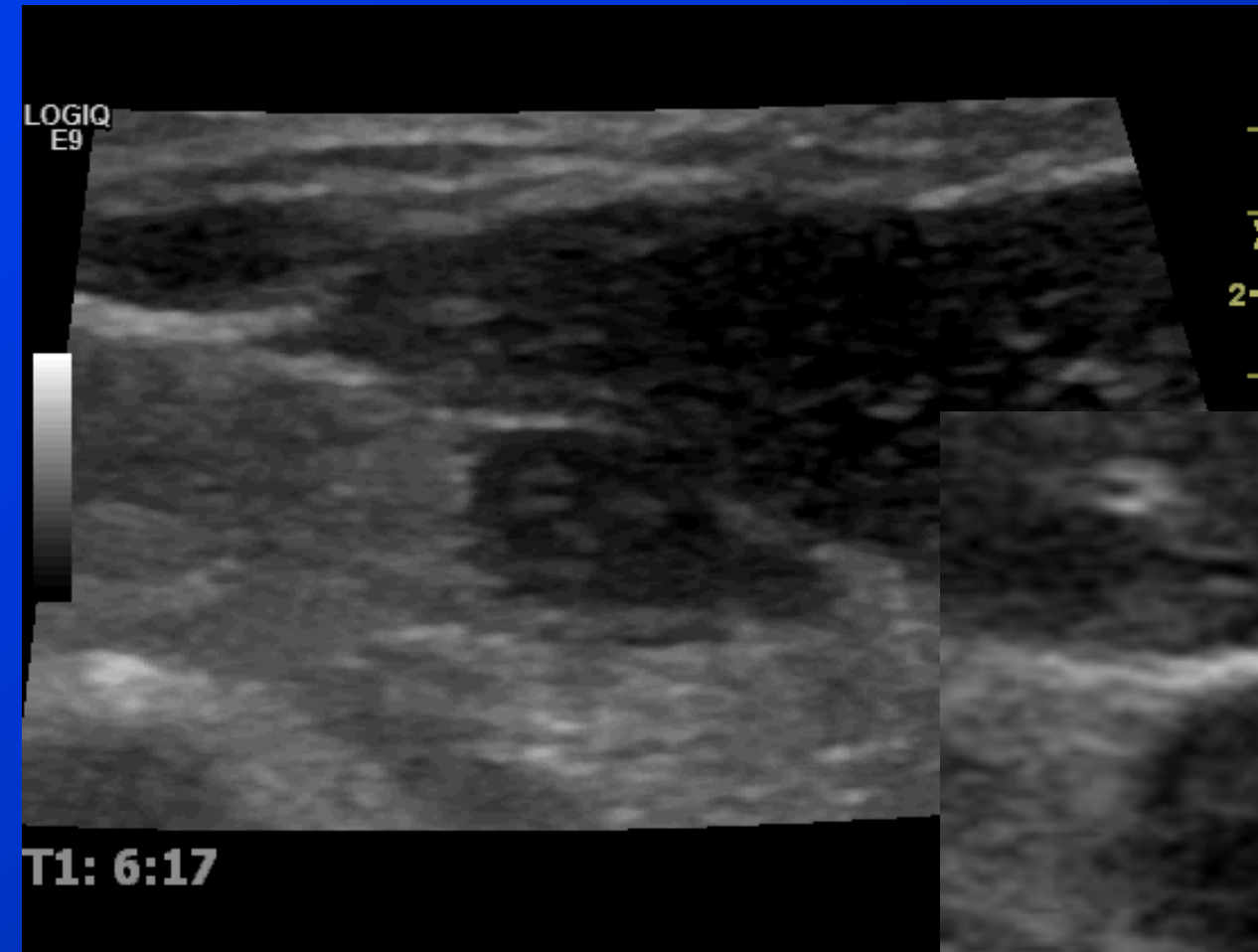


B-mode Pancreas: 4 Lesions !



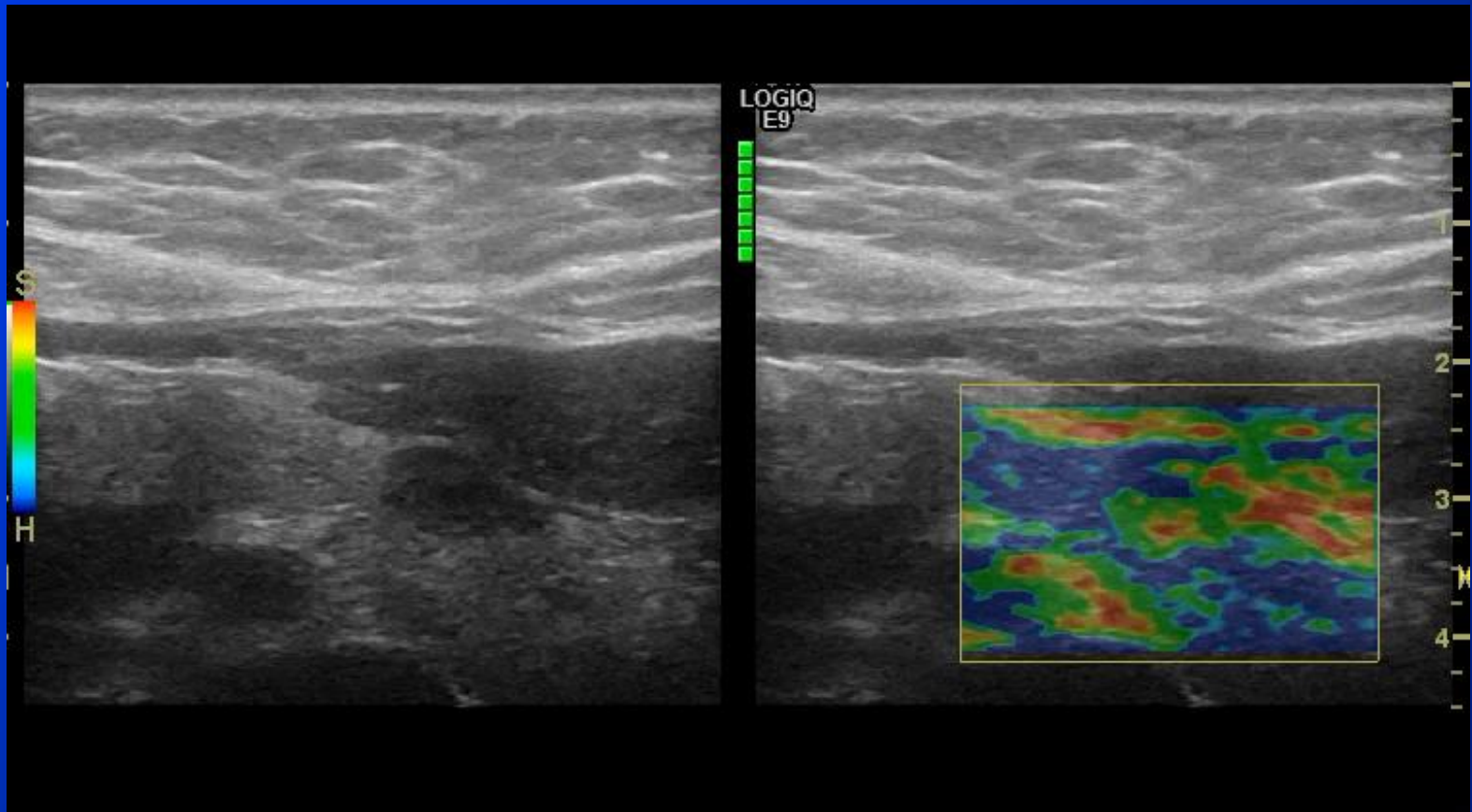


Tumor with Cystic Components



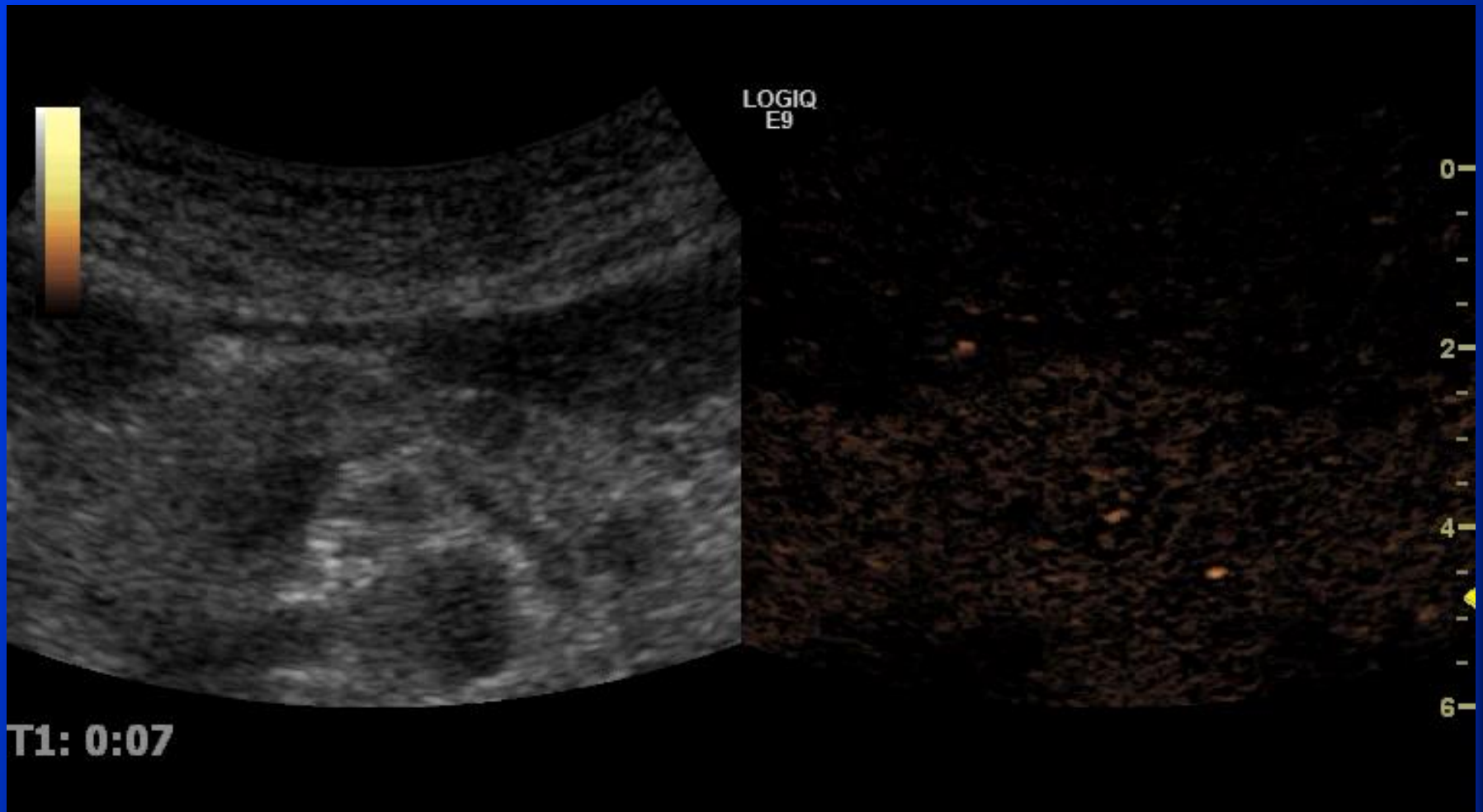


Elastography of Pancreatic Tumor





CEUS with 3,5 MHz CLA probe





MEN-1 Pancreatic Tumor





Conclusion

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



An image....



... says more than a thousand words