Chronic Pancreatitis

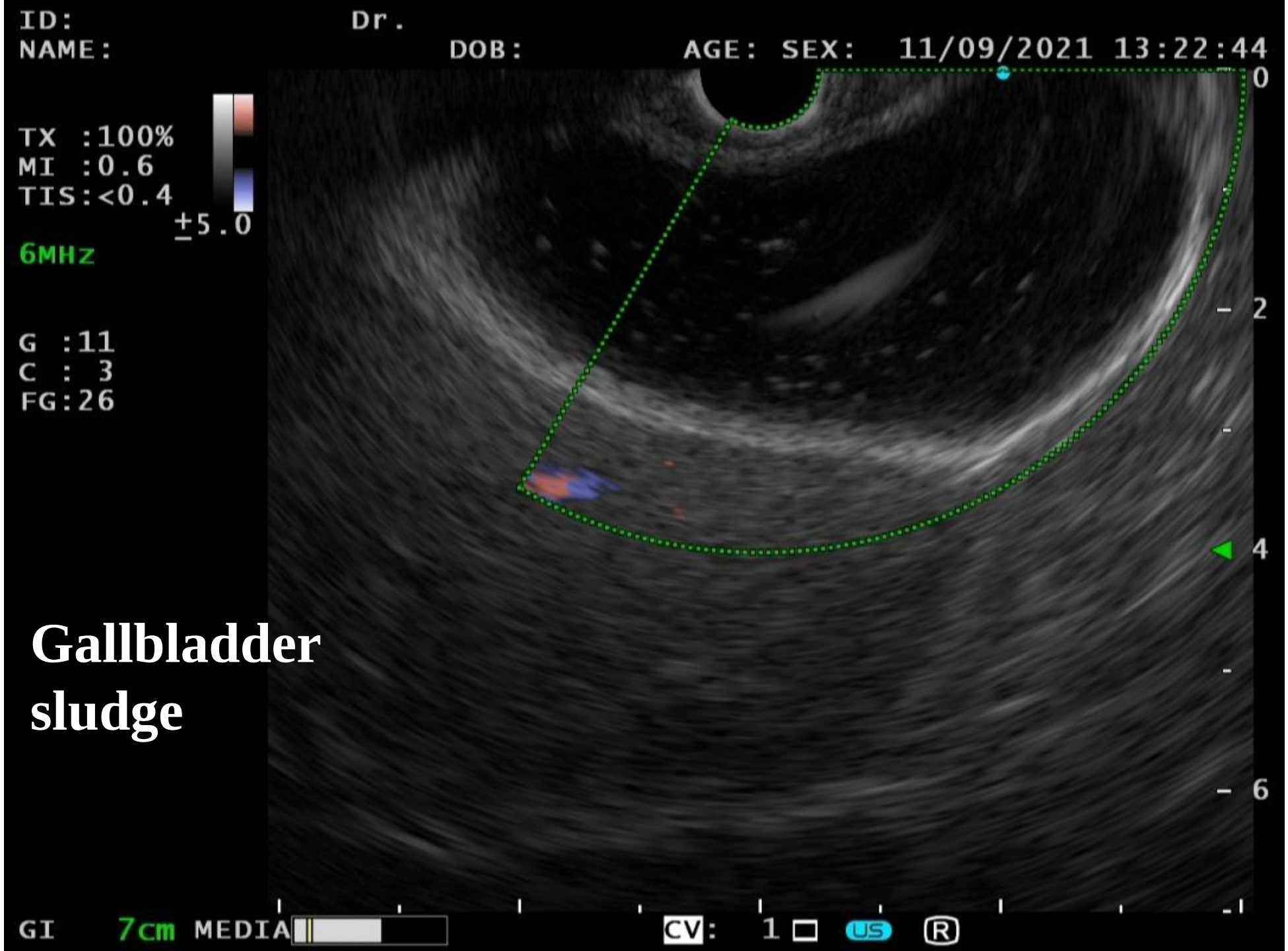
Diagnostic and therapeutic Challenges

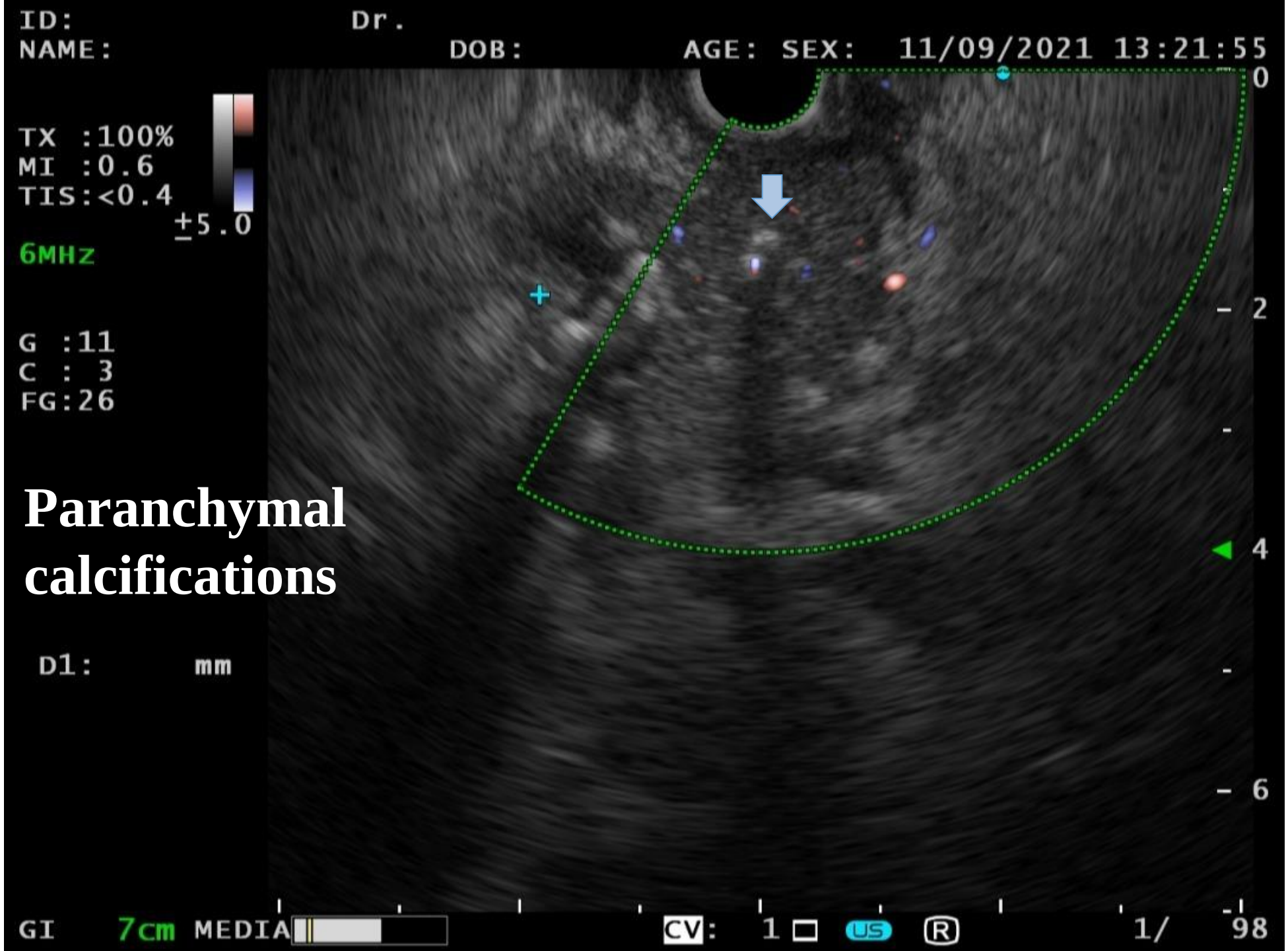
Dr Sadeghi , MD

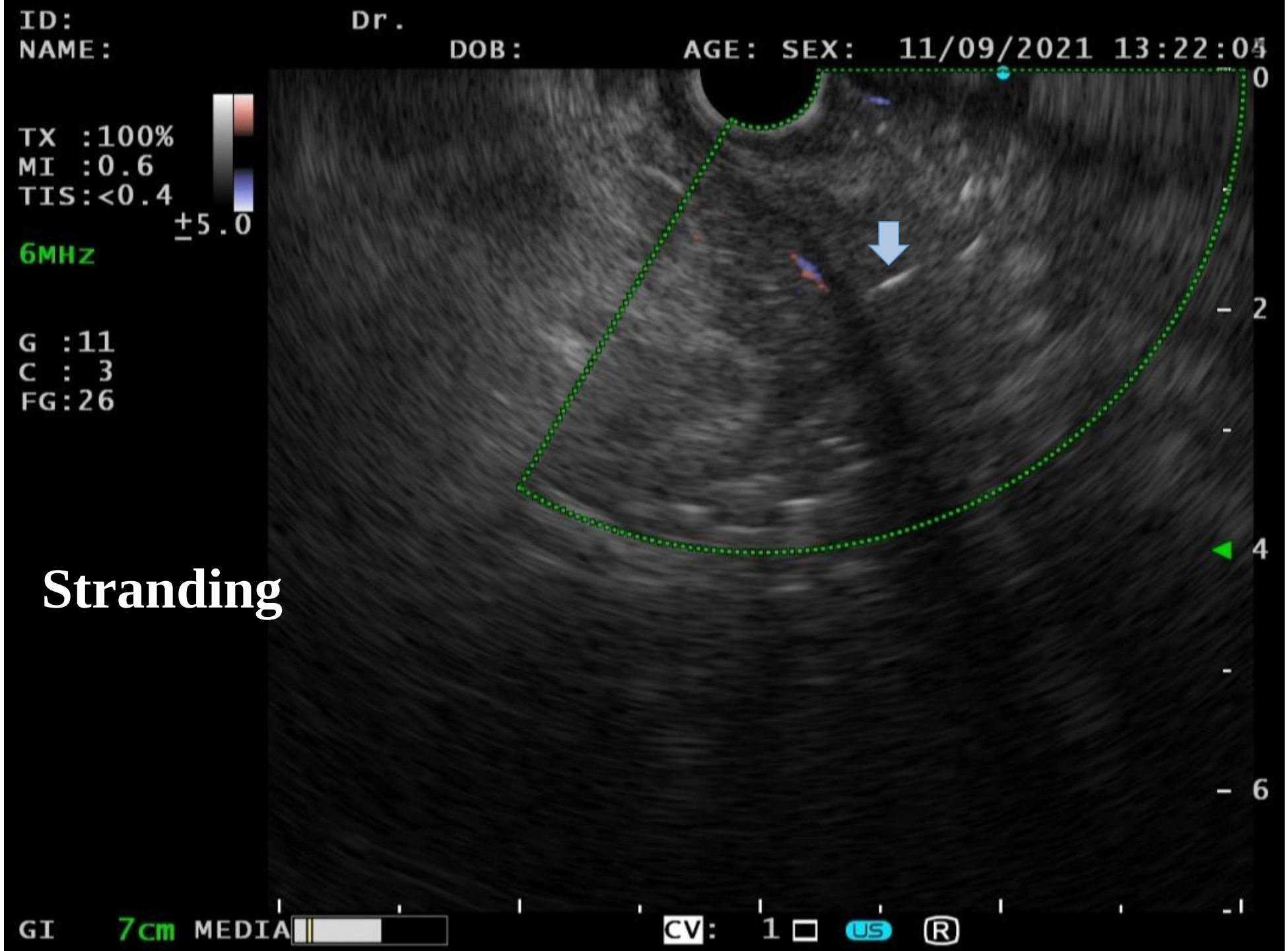
Associate Professor of Gastroenterology and Hepatology

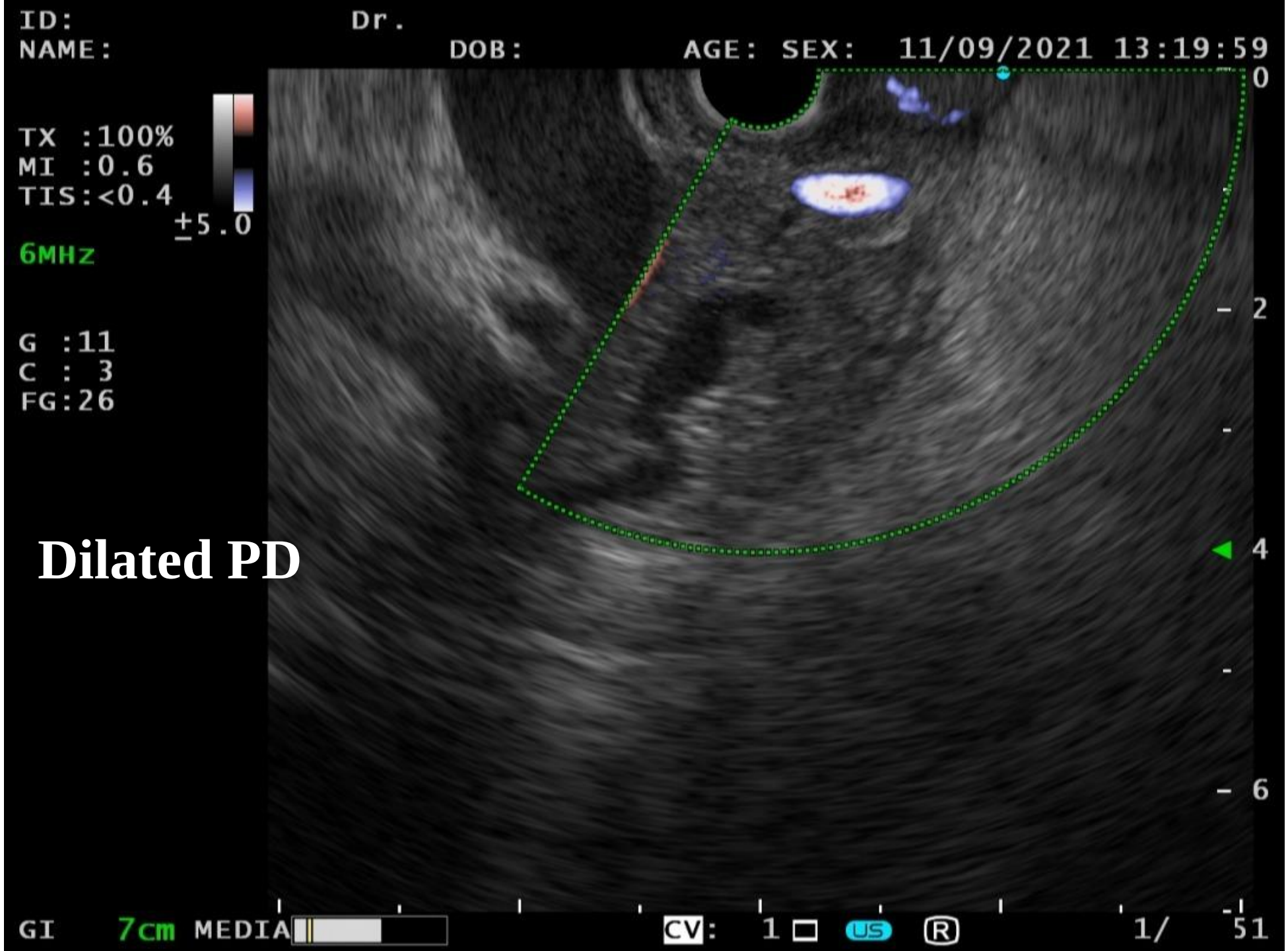
Case ≠1

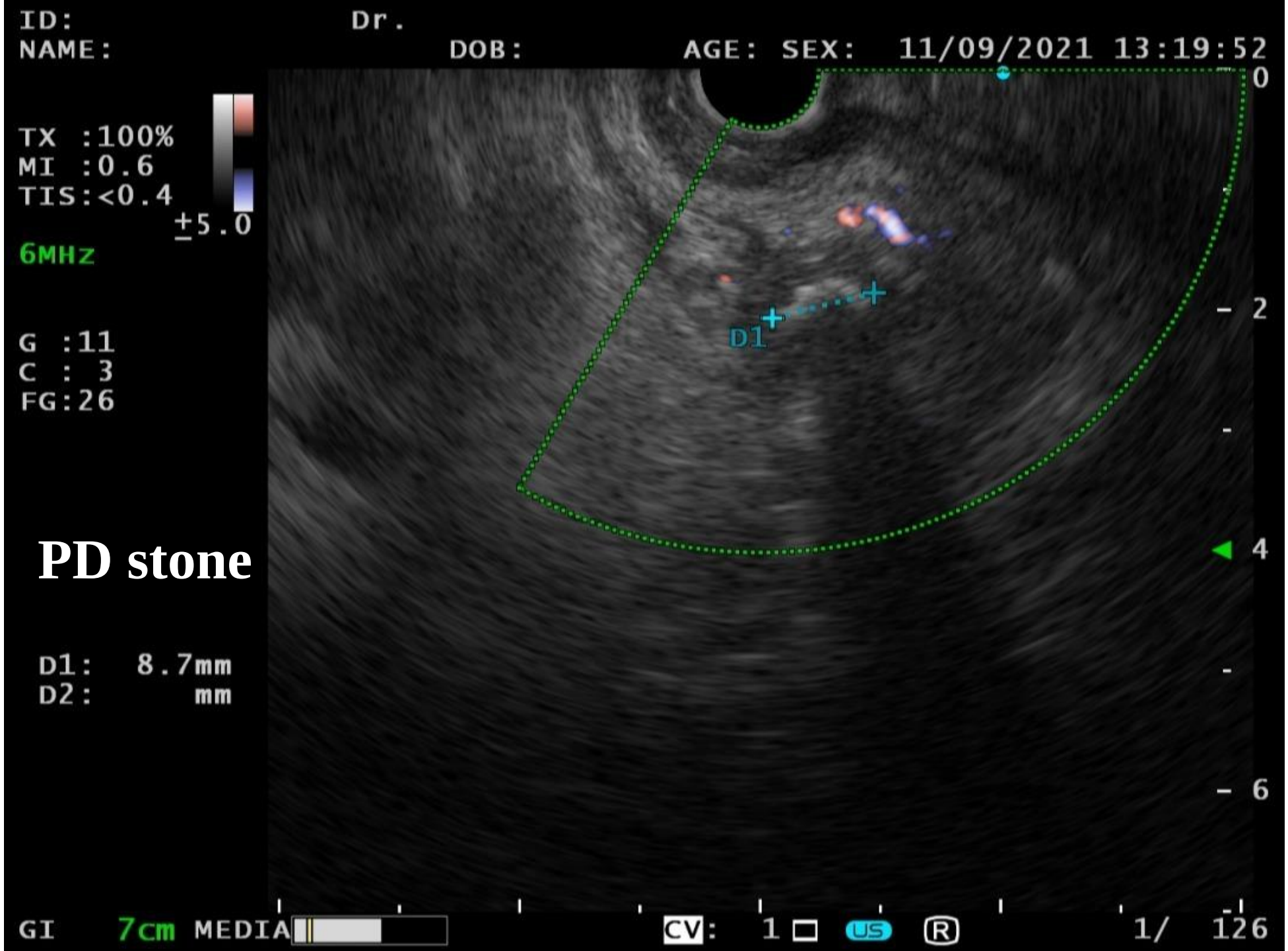
- A 32-year-old female with no history of past medical illness presented to the emergency department with complaints of severe epigastric pain, nausea and vomiting.
- She had no history of alcoholism, smoking, and drug abuse. Abdominal examination revealed epigastric tenderness.
- Laboratory analysis was unremarkable except for the marked elevation of lipase and amylase .
- Abdominal ultrasonography revealed normal-sized liver and biliary ducts with no evidence of gallstone.
- Abdominal CT scan was unremarkable except for peripancreatic hazziness.
- She was managed symptomatically, and improvement in her clinical condition was observed.

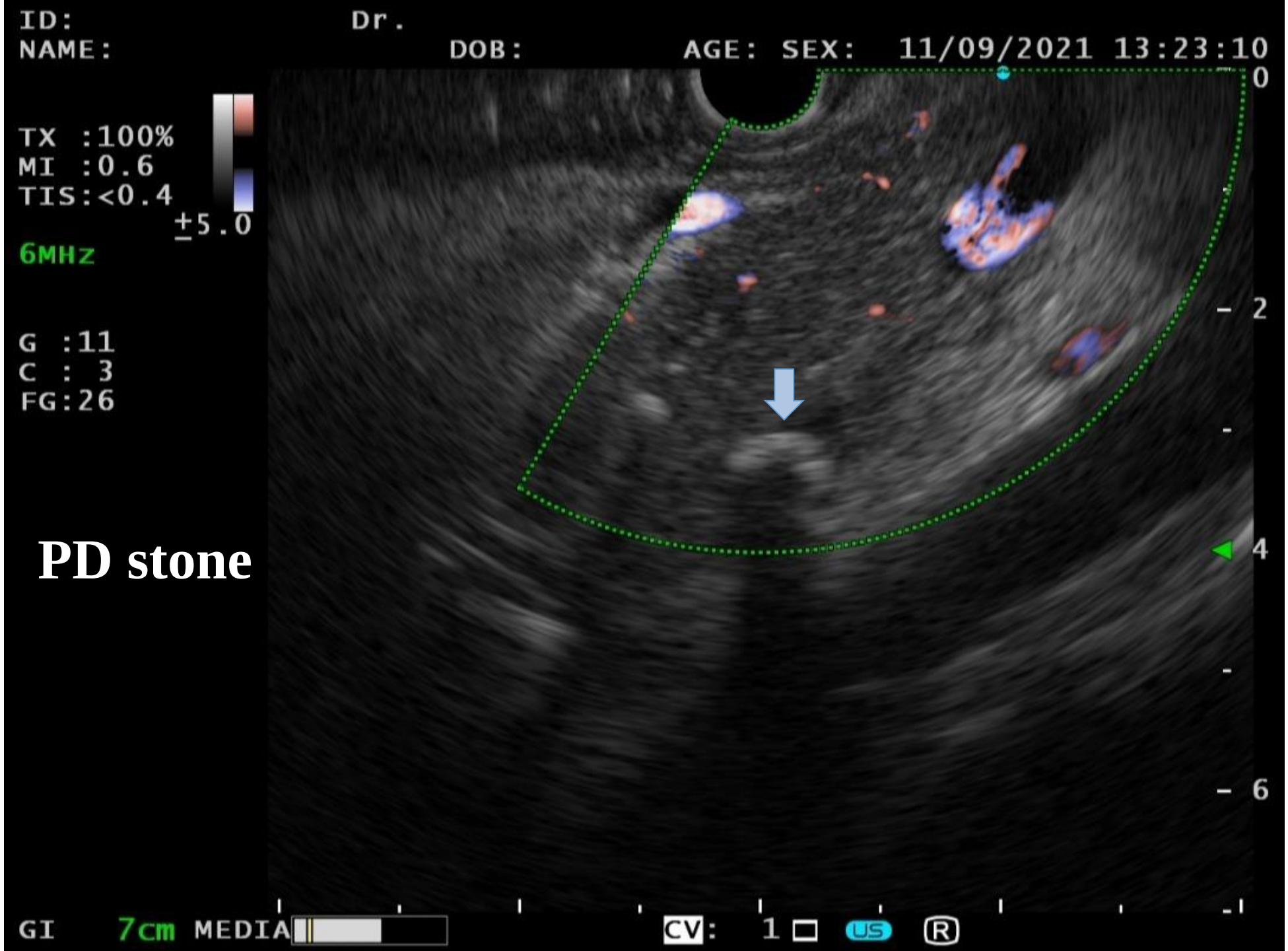

ID:
Dr.
NAME:
DOB:
AGE: SEX:
11/09/2021 13:22:44
TX :100%
MI :0.6
TIS:<0.4
±5.0
6MHz
G :11
C : 3
FG:26
0
2
4
6
Gallbladder sludge
GI
7cm
MEDIA
CV: 1
US
R


ID:
Dr.
NAME:
DOB:
AGE: SEX:
11/09/2021 13:21:55
TX :100%
MI :0.6
TIS:<0.4
±5.0
6MHz
G :11
C : 3
FG:26
Paranchymal calcifications
D1:
mm
0
2
4
6
GI
7cm
MEDIA
CV:
1
US
R
1/
98


ID:
Dr.
NAME:
DOB:
AGE: SEX:
11/09/2021 13:22:04
TX :100%
MI :0.6
TIS:<0.4
±5.0
6MHz
G :11
C : 3
FG:26
Stranding
0
2
4
6
GI
7cm
MEDIA
CV: 1
US
R


ID:
Dr.
NAME:
DOB:
AGE: SEX:
11/09/2021 13:19:59
TX :100%
MI :0.6
TIS:<0.4
±5.0
6MHz
G :11
C : 3
FG:26
Dilated PD
0
2
4
6
GI
7cm
MEDIA
CV:
1
US
R
1/
51


ID:
Dr.
NAME:
DOB:
AGE: SEX:
11/09/2021 13:19:52
TX :100%
MI :0.6
TIS:<0.4
±5.0
6MHz
G :11
C : 3
FG:26
PD stone
D1: 8.7mm
D2: mm
D1
0
2
4
6
GI
7cm
MEDIA
CV: 1
US
R
1/ 126


ID:
Dr.
NAME:
DOB:
AGE: SEX:
11/09/2021 13:23:10
TX :100%
MI :0.6
TIS:<0.4
±5.0
6MHz
G :11
C : 3
FG:26
PD stone
0
2
4
6
GI
7cm
MEDIA
CV: 1
US
R

Case #1

EUS

....

CBD was measured up to 3mm in diameter and contained no stone or sludge.

Gallbladder wall thickness was normal and contained lot of small stones and sludge.

Pancreas: stranding and multiple hyperechoic foci with posterior shadow in pancreatic head and body.

PD was irregular and dilated (5.5mm) and contained one 6mm stone in pancreatic neck.

Diagnosis: Compatible with chronic pancreatitis (two major A and 4minor criteria).

Clinical manifestations

- Abdominal pain, which is the most common clinical symptom of CP, characteristically occurs in the upper abdomen, often radiating to the back.
- Abdominal pain can be divided into two types:
  - (i) type A (more common) is defined as intermittent abdominal pain, with no discomfort in the intermittent period.
  - (ii) type B is a persistent abdominal pain, characterized as long-term, continuous pain or frequent aggravation of pain.
- About 10% of patients have no symptoms of abdominal pain.

Clinical manifestations

- For patients with **pancreatic exocrine insufficiency (PEI)**, there may be no specific symptom in the early stage of the disease. With the progression of the disease, weight loss, malnutrition, and steatorrhea may occur.
- **Pancreatic endocrine insufficiency** manifests as impaired glucose tolerance or diabetes.
- The complications of CP are pseudocysts, common bile duct stenosis, duodenal obstruction, pancreatic fistula, pancreatic portal hypertension, pancreatic ascites and pseudoaneurysm.
- After a diagnosis of CP, about 1.3% of patients progressed into pancreatic cancer during an 8-year follow- up.

Hao L. Dig Liver Dis 2017.

Cross-sectional imaging

CT scan

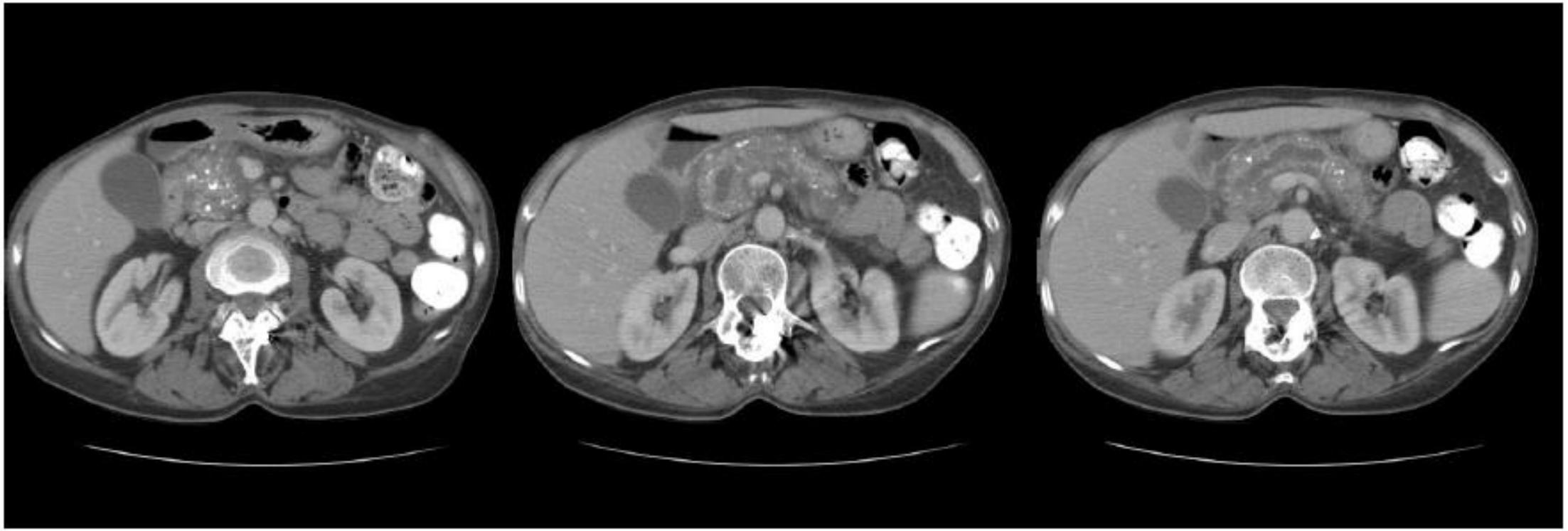
- The diagnostic sensitivity and specificity of a CT test are over 80% and 90%, respectively.
- Multiphase CT protocol for CP include unenhanced scan, pancreatic phase (35–45 seconds after the start of contrast injection) and portal venous phase (55–70 seconds after the start of contrast injection).
- The **characteristic features of CP** are *atrophy, ductal dilatation and calcification.*
- CT is the best modality to find pancreatic calcification, with the potential for detecting even micro-calcifications in the pancreas.
- Ductal dilatation is usually irregular and beaded in CP in contrast to smooth linear dilatation in pancreatic carcinoma.

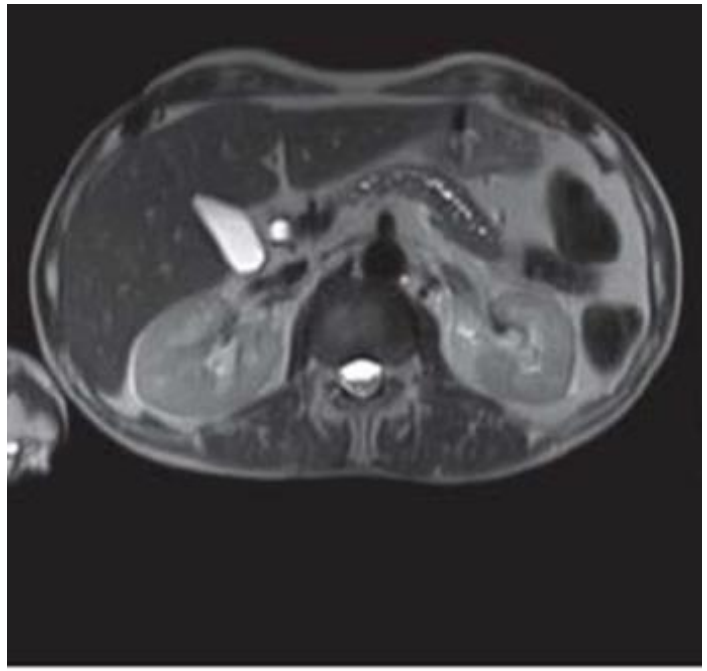
Issa Y. Eur Radiol 2017 .

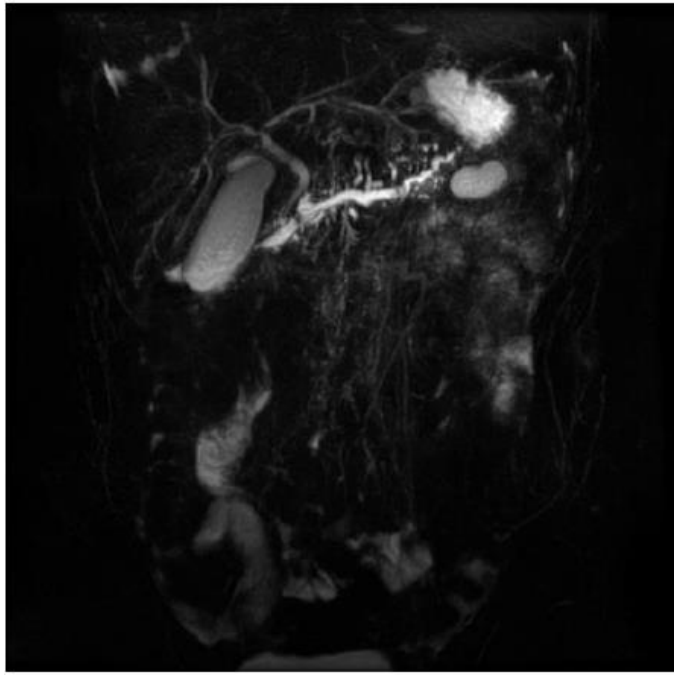
Cross-sectional imaging

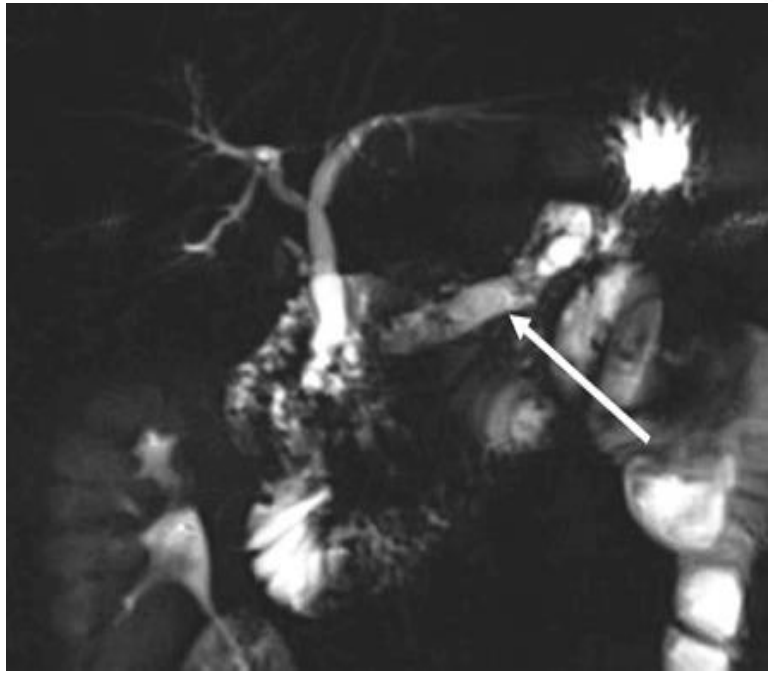
MRI/MRCP

- The combination of **MRI/MRCP** allows the delineation of both the pancreatic parenchyma and the pancreatic duct with high precision.
- The diagnostic value of conventional MRI scan for CP is similar to that of CT.
- MRI is sensitive to pancreatic parenchymal changes (delayed and diminished enhancement of the gland after gadolinium chelates administration), but not as good as CT for detecting calcification and calculus.
- It is very important to realize that these **parenchymal abnormalities may precede the ductal abnormalities.**









Cross-sectional imaging

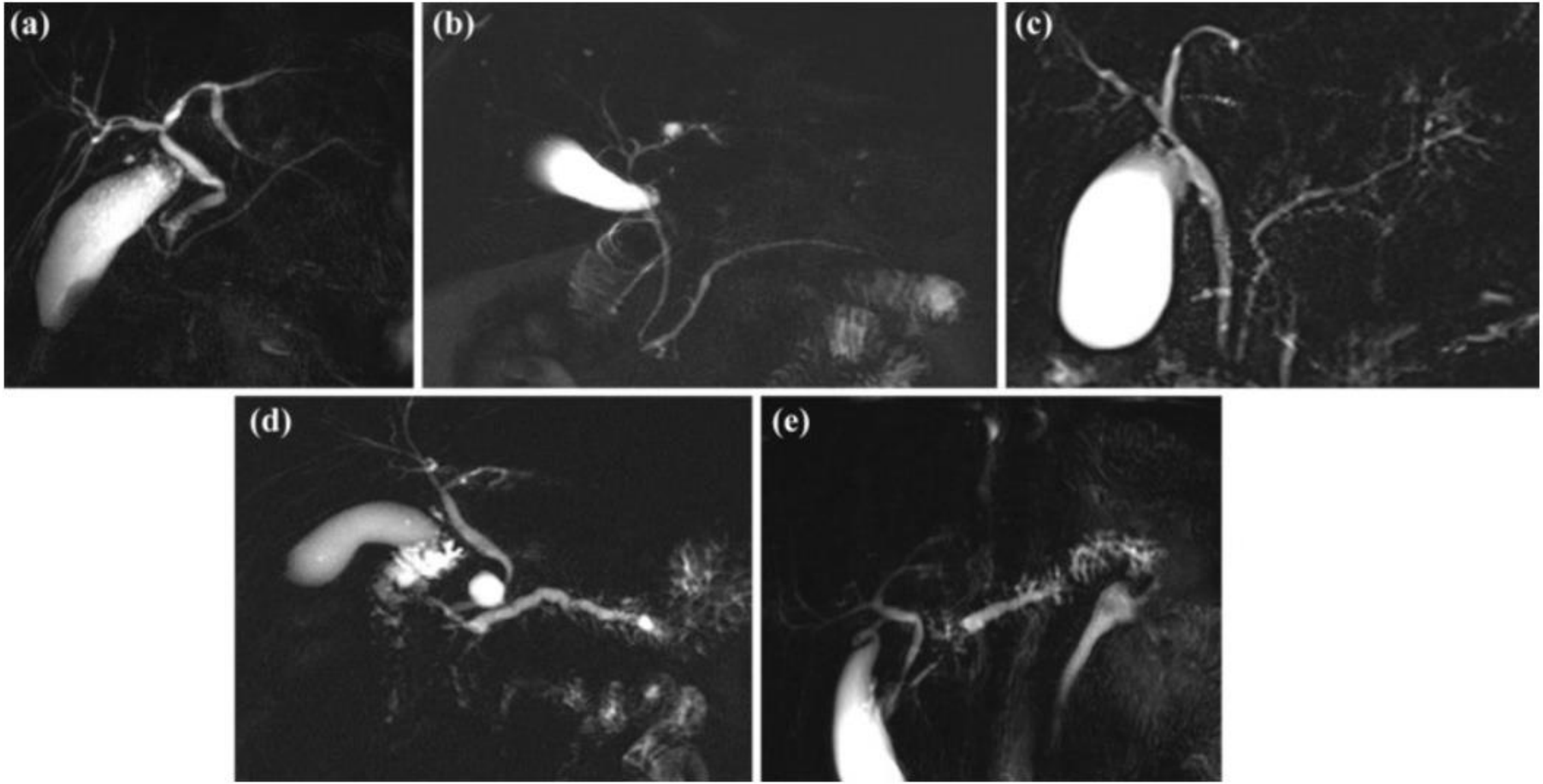
s-MRCP

Secretin creates more physiologic ductal distension on T2 images.

Normal	CP
• MPD is < 3 mm, and tapers smoothly to the tail • Distends about 66% in response to secretin • Returns to baseline in 10 min	• Baseline dilation, irregularity, and loss of tapering of MPD • Due to decreased pancreatic secretion and fibrosis, there in less distension of the PD • Side-branch dilation can be visualized and assessed by Cambridge classification (see below)

1. Normal	Visualization for entire duct system with uniform filling of side branches without acinar opacification
2. Equivocal	Less than three abnormal side branches
3. Mild	Normal main duct More than three abnormal side branches
4. Moderate	As above with enlarged main duct
5. Marked	All of the above plus one or more of: Cyst greater than 10 mm Intraductal filling defects Calculi/pancreatic calcification Duct obstruction (stricture) Severe duct dilatation or irregularity

ACG Clinical Guideline. Am J Gastroenterol 2020



Modified Cambridge Classification for MRCP: a I, normal pancreas; b II, equivocal pancreas; c III, mild disease; d IV, moderate disease; e V, marked disease

Endosonography (EUS)

- **EUS** is the **most sensitive imaging method for diagnosing CP** in its early stage, with a sensitivity exceeding 80% if compared with histological diagnosis.
- Although promising, there are several issues associated with EUS features of CP:
  - A number of conditions such as aging, smoking, obesity, and chronic alcohol consumption may cause similar EUS changes in the pancreas.
  - Another important issue is of high interobserver variability.

Endosonography (EUS)

Rosemont classification

	Rank	Criteria	Feature	Definition
Parenchymal features	1	Major A	Hyperechoic foci with shadowing	Echogenic structures ≥ 2 mm in length and width that shadow
	2	Major B	Lobularity with honeycombing	Well-circumscribed, ≥ 5 mm structures with enhancing rim and relatively echo-poor center, contiguous ≥ 3 lobules
		Minor	Lobularity without honeycombing	Same as above, noncontiguous lobules
	3	Minor	Hyperechoic foci without shadowing	Echogenic structures foci ≥ 2 mm in both length and width with no shadowing
	4	Minor	Cysts	Anechoic, rounded/elliptical structures with or without septations
	5	Minor	Stranding	Hyperechoic lines of ≥ 3 mm in length in at least 2 different directions with respect to the imaged plane
Ductal features	1	Major A	MPD calculi	Echogenic structure(s) within MPD with acoustic shadowing
	2	Minor	Irregular MPD contour	Uneven or irregularoutline and ectatic course
	3	Minor	Dilated side branches	3 or more tubular anechoic structure seach measuring ≥1 mm in width,budding from the MPD
	4	Minor	MPD dilation	≥3.5-mm body or >1.5-mm tail
	5	Minor	Hyperechoic MPD margin	Echogenic, distinct structure greater than 50% of entire MPD inthe body and tail

EUS

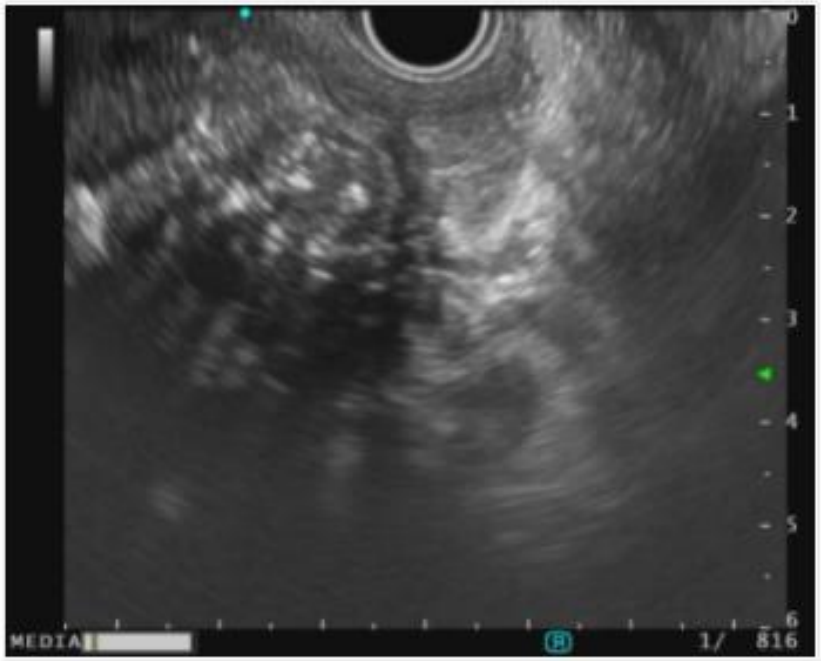
Parenchymal features (major)

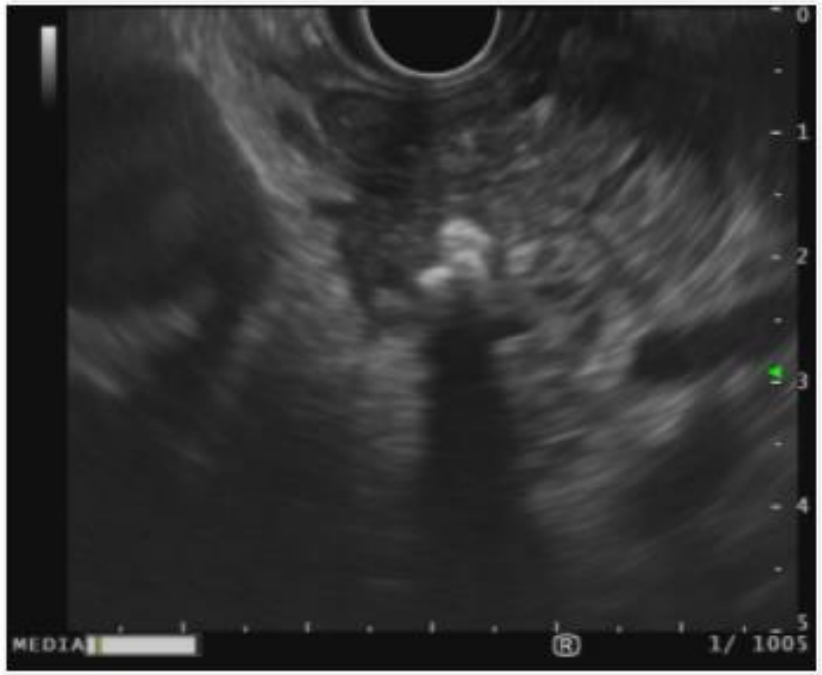
- **Hyperechoic foci with shadowing (Major A):** They have been defined as echogenic structures ≥2 mm in length and width that shadow. They histologically correlate with pancreatic parenchymal calcification.

EUS

Parenchymal features

Hyperechoic foci with and without shadows





EUS

Parenchymal features (major)

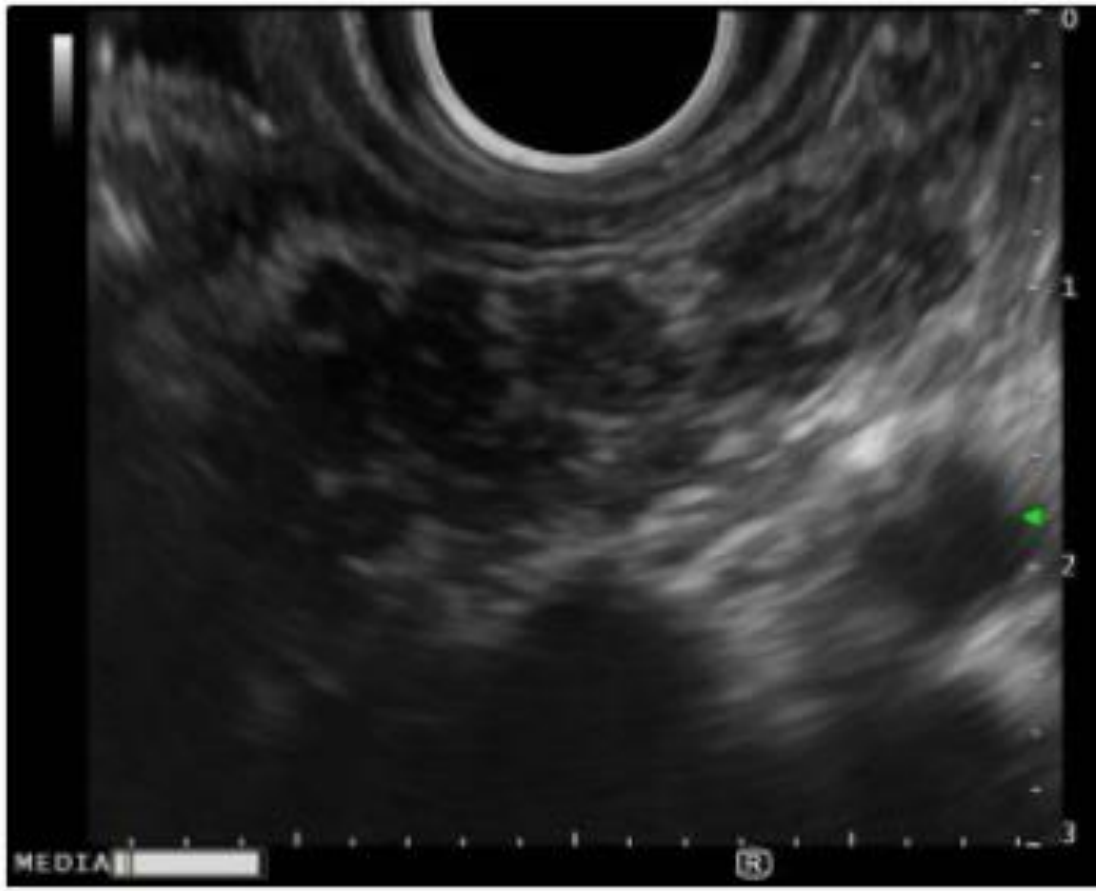
- **Hyperechoic foci with shadowing (Major A):** They have been defined as echogenic structures ≥2 mm in length and width that shadow. They histologically correlate with pancreatic parenchymal calcification.

- **Lobularity with honeycombing (Major B):** At least three contiguous lobules that are present in the body or tail of the pancreas are labeled as "honeycombing" lobularity. The histologically correlate with interlobular fibrosis.

EUS

Parenchymal features

Honeycomb-like lobulation



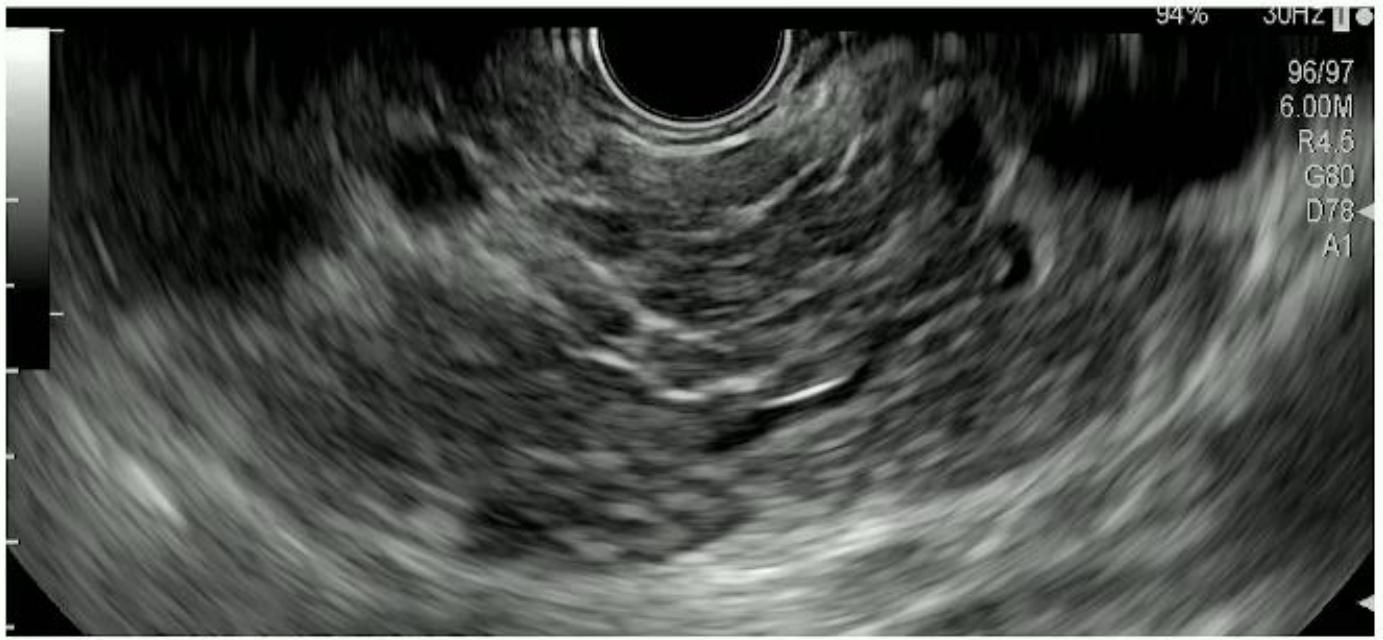
EUS anatomy mistakes

Lobular architecture or increased echogenicity of the pancreas confused with chronic pancreatitis

Lobular architecture of the pancreas is so pronounced that it may seem suspicious of chronic pancreatitis

False aspect of chronic pancreatitis in

- Obese persons
- Diabetes
- Smokers
- Aged persons
- After acute pancreatitis



EUS

Parenchymal features (major)

- **Hyperechoic foci with shadowing (Major A):** They have been defined as echogenic structures ≥2 mm in length and width that shadow. They histologically correlate with pancreatic parenchymal calcification.

- **Lobularity with honeycombing (Major B):** At least three contiguous lobules that are present in the body or tail of the pancreas are labeled as "honeycombing" lobularity. The histologically correlate with interlobular fibrosis.

*** Major paranchymal features should be looked in the body and tail of pancreas only.**

EUS

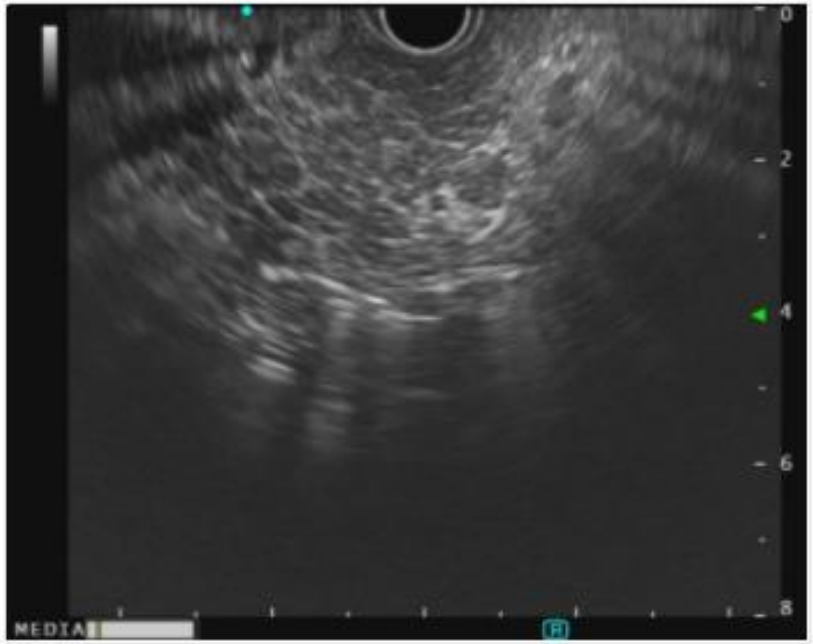
Parenchymal features (minor)

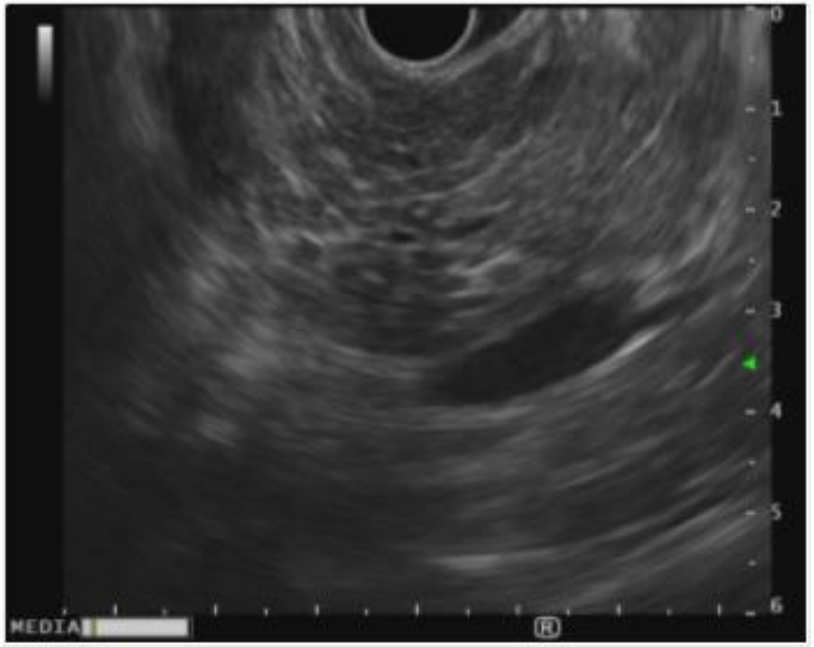
- **Hyperechoic foci without shadowing :** The histologically correlate with focal fibrosis.
- **Lobularity without honeycombing :** Lobules as defined above that are non-contiguous and present in body and tail.
- **Stranding :** At least three strands in at least two different directions are considered necessary. The histologically correlate with bridging fibrosis.

EUS

Parenchymal features

Echo-dense septa (stranding)





EUS

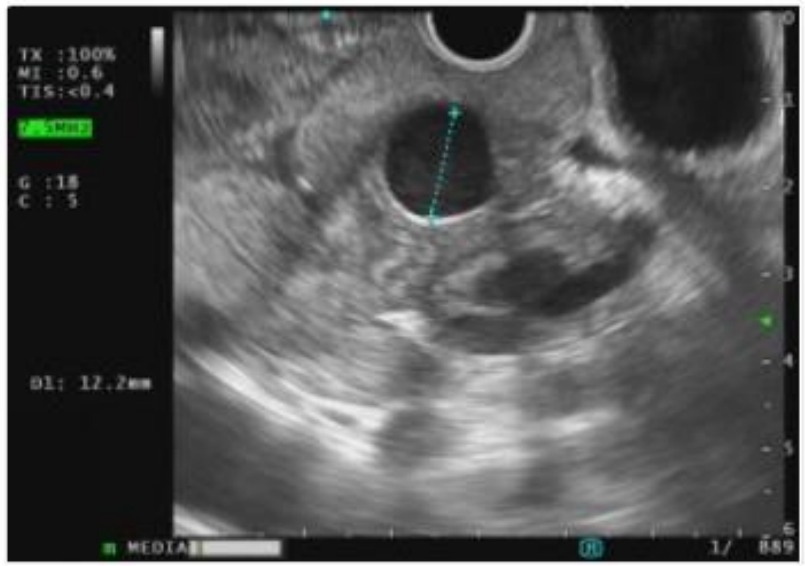
Parenchymal features (minor)

- **Hyperechoic foci without shadowing :** The histologically correlate with focal fibrosis.
- **Lobularity without honeycombing :** Lobules as defined above that are non-contiguous and present in body and tail.
- **Stranding :** At least three strands in at least two different directions are considered necessary. The histologically correlate with bridging fibrosis.
- **Cysts :** Anechoic, rounded/elliptic structures that should measure ≥2 mm in short axis. The histologically correlate with pseudocyst.

EUS

Parenchymal features

Cyst (pseudocyst)



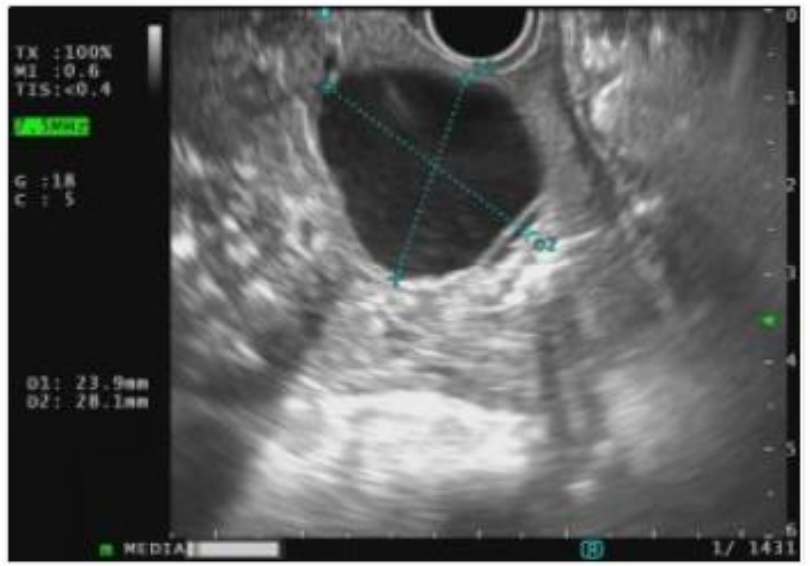


TABLE 2. Consensus-based parenchymal features of CP

Feature	Definition	Major criteria	Minor criteria	Rank	Histologic correlation
Hyperechoic foci with shadowing	Echogenic structures ≥2 mm in length and width that shadow	Major A		1	Parenchymal-based calcifications
Lobularity	Well-circumscribed, ≥5 mm structures with enhancing rim and relatively echo-poor center			2	Unknown
A. With honeycombing	Contiguous ≥3 lobules	Major B			
B. Without honeycombing	Noncontiguous lobules		Yes		
Hyperchoic foci without shadowing	Echogenic structures foci ≥2 mm in both length and width with no shadowing		Yes	3	Unknown
Cysts	Anechoic, rounded/elliptical structures with or without septations		Yes	4	Pseudocyst
Stranding	Hyperechoic lines of ≥3 mm in length in at least 2 different directions with respect to the imaged plane		Yes	5	Unknown

Attendees ranked these features according to predictive value (1 = highest predictor) with an electronic key pad.

EUS

Parenchymal features (minor)

- **Hyperechoic foci without shadowing :** The histologically correlate with focal fibrosis.
- **Lobularity without honeycombing :** Lobules as defined above that are non-contiguous and present in body and tail.
- **Stranding :** At least three strands in at least two different directions are considered necessary. The histologically correlate with bridging fibrosis.
- **Cysts :** Anechoic, rounded/elliptic structures that should measure ≥2 mm in short axis. The histologically correlate with pseudocyst.

*** Minor paranchymal features except cyst should be looked in the body and tail of pancreas only.**

Diagnostic criteria		Major A	Major B	Minor
Pancreas	Parenchyma	Hyperechoic foci with acoustic shadows; body/tail	Honeycomb-like lobulation; body/tail	Lobulation without honeycombing; body/tail Hyperechoic foci without acoustic shadows; body/tail Cysts* Echo-dense septa; body/tail

* anywhere in the head, body and tail

EUS

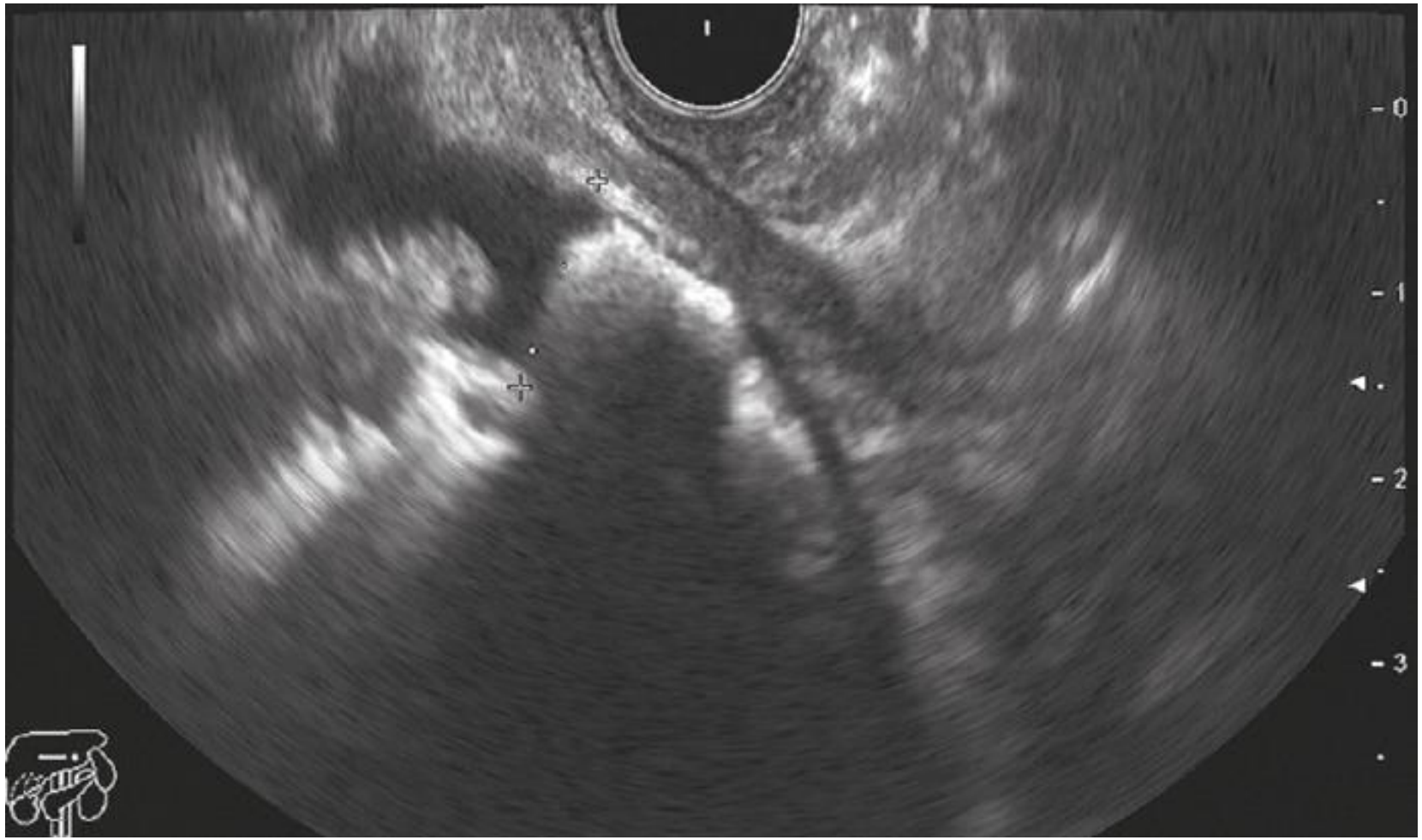
Ductal features (major)

- **Main pancreatic duct (MPD) calculi (Major A):** Echogenic structures within MPD with acoustic shadowing located anywhere in the head, body and tail.

EUS

Ductal features (major)

MPD calculi



EUS

Ductal features (minor*)

- **Irregular MPD contour :** MPD that is uneven or irregular in outline and ectatic in its course.
- **Dilated side branches :** presence of ≥3 tubular anechoic structures each measuring ≥1 mm in width and communicating with MPD.
- **Main pancreatic duct dilatation :** MPD diameter ≥3.5 mm in the pancreatic body or ≥1.5 mm in the pancreatic tail.
- **Hyper echoic duct margin :** Relatively hyperechoic duct wall found in >50% of the entire MPD of the body and tail. The histologically correlate with periductal fibrosis.

EUS

Ductal features (minor)

Irregular dilated MPD with hyperechoic wall

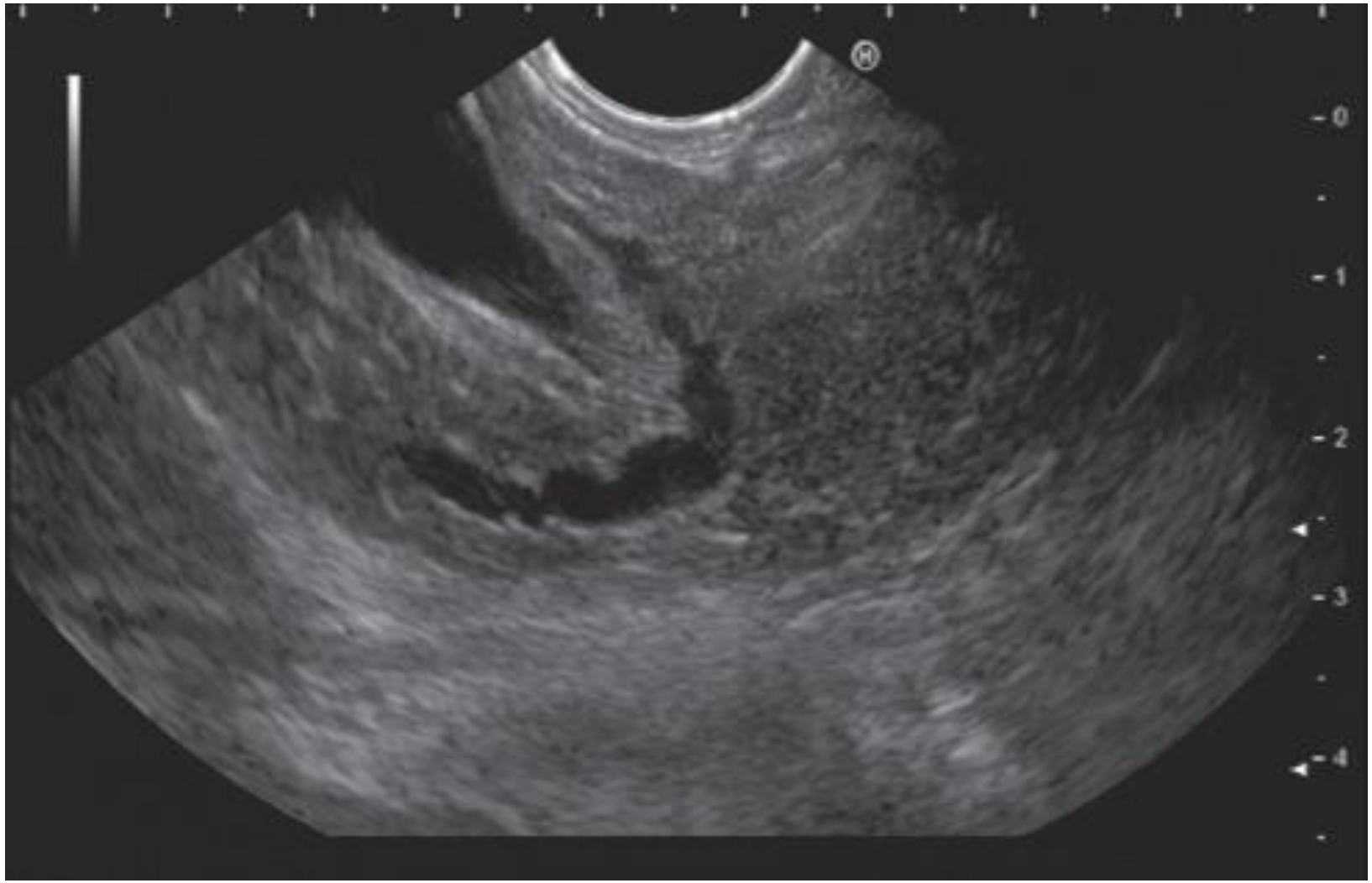


TABLE 3. Consensus-based ductal features of CP

Feature	Definition	Major criteria	Minor criteria	Rank	Histologic correlation
MPD calculi	Echogenic structure(s) within MPD with acoustic shadowing	Major A		1	Stones
Irregular MPD contour	Uneven or irregular outline and ectatic course		Yes	2	Unknown
Dilated side branches	3 or more tubular anechoic structures each measuring $\geq$1 mm in width, budding from the MPD		Yes	3	Side-branch ectasia
MPD dilation	$\geq$3.5-mm body or $>$1.5-mm tail		Yes	4	MPD dilation
Hyperechoic MPD margin	Echogenic, distinct structure greater than 50% of entire MPD in the body and tail		Yes	5	Ductal fibrosis

EUS

Ductal features (minor*)

- **Irregular MPD contour :** MPD that is uneven or irregular in outline and ectatic in its course.
- **Dilated side branches :** presence of ≥3 tubular anechoic structures each measuring ≥1 mm in width and communicating with MPD.
- **Main pancreatic duct dilatation :** MPD diameter ≥3.5 mm in the pancreatic body or ≥1.5 mm in the pancreatic tail.
- **Hyper echoic duct margin :** Relatively hyperechoic duct wall found in >50% of the entire MPD of the body and tail. The histologically correlate with periductal fibrosis.

*** Minor ductal features should be looked in the body and tail of pancreas only.**

Diagnostic criteria		Major A	Major B	Minor
Pancreas	Parenchyma	Hyperechoic foci with acoustic shadows; body/tail	Honeycomb-like lobulation; body/tail	Lobulation without honeycombing; body/tail
				Hyperechoic foci without acoustic shadows; body/tail
				Cysts*
				Echo-dense septa; body/tail
	Duct	Stones in the duct*	None	Irregular duct; body/tail
				Dilated side ducts; body/tail
				Dilated main duct; body/tail
				Hyperechoic contours on the main duct; body/tail

* anywhere in the head, body and tail

Endosonography (EUS)

Rosemont classification

TABLE 4. EUS diagnosis of CP on the basis of consensus criteria*

I. Consistent with CP

A. 1 major A feature (+) ≥3 minor features

B. 1 major A feature (+) major B feature

C. 2 major A features

II. Suggestive of CP†

A. 1 major A feature (+) <3 minor features

B. 1 major B feature (+) ≥3 minor features

C. ≥5 minor features (any)

III. Indeterminate for CP†

A. 3 to 4 minor features, no major features

B. major B feature alone or with <3 minor features

IV. Normal

≤2 minor‡ features, no major features

*EUS diagnosis of CP should be made in the appropriate clinical setting.
†Diagnosis requires confirmation by additional imaging study (ERCP, CT, MRI, or PFT).
‡Excludes cysts, dilated MPD, hyperechoic nonshadowing foci, dilated side branch.

Useful only in appropriate clinical setting

Major A:
Stone

Major B:
Honeycombing

In the absence of major A:

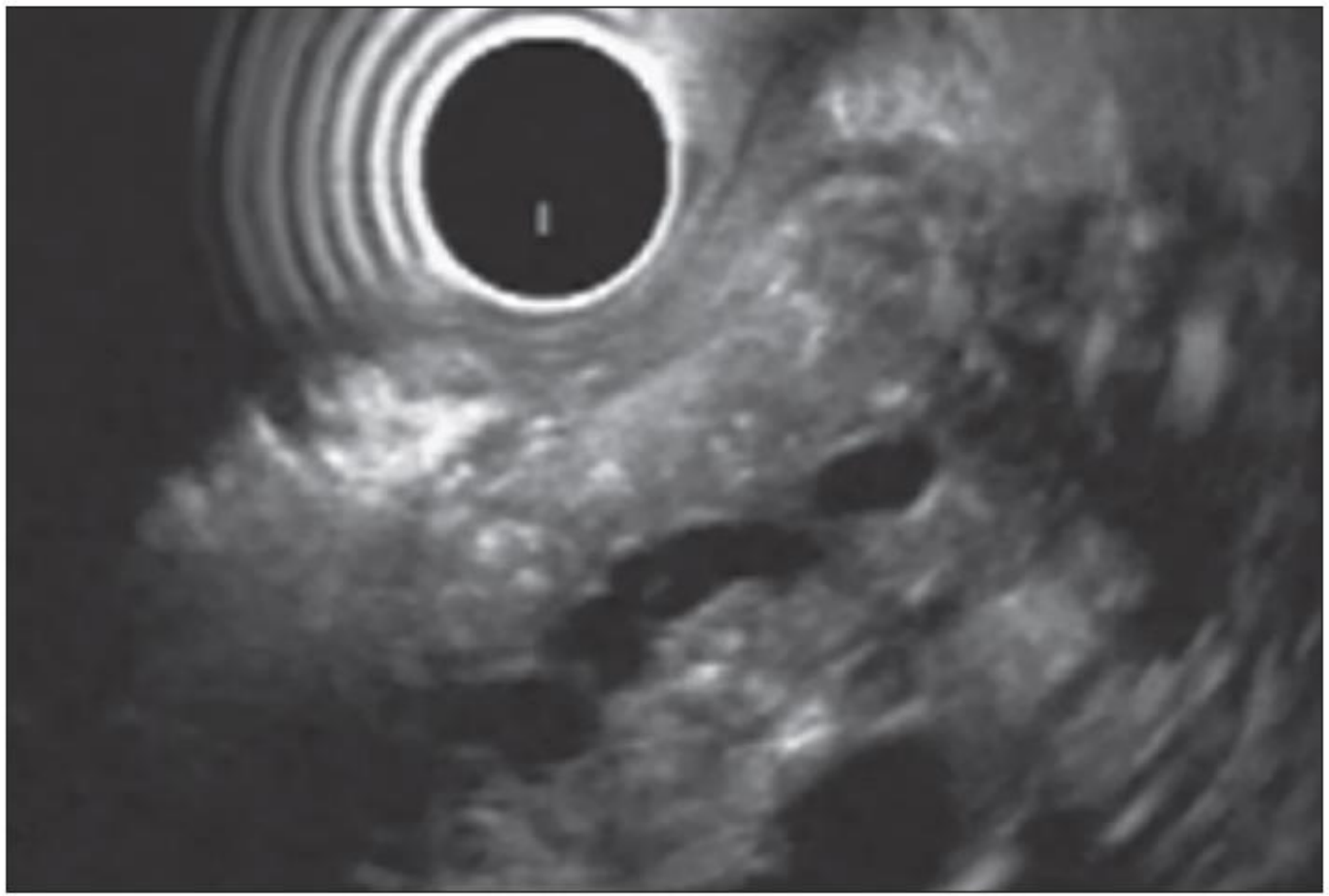
Diagnosis requires confirmation by additional study

Cysts, hyperechoic foci, dilated MPD and dilated side branches:

Are important even as a single minor criteria

EUS

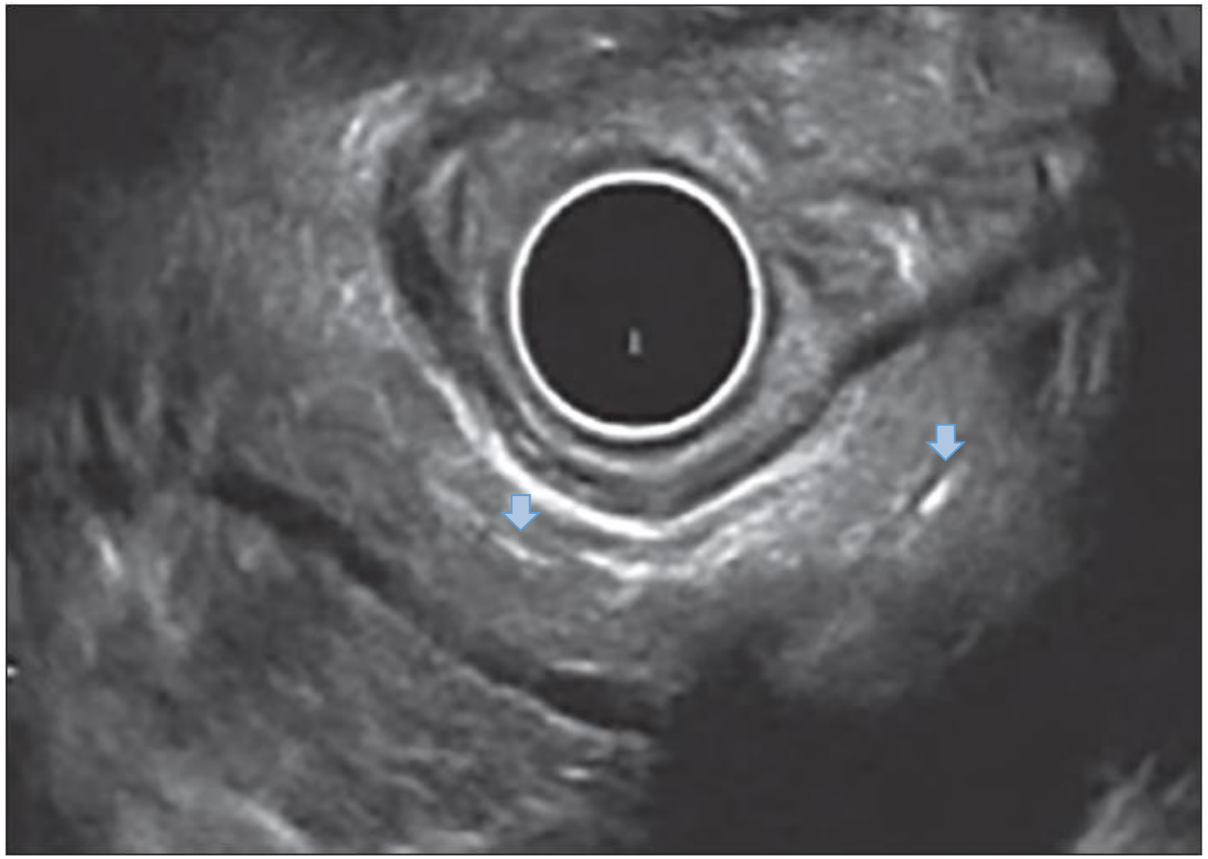
Rosemont criteria



The main pancreatic duct is dilated with an irregular contour and hyper echoic wall.
The pancreatic parenchyma shows hyper echoic foci with as well as without shadowing.
One Major A and 4 Minor endoscopic ultrasound features and is **consistent with (characteristic for) chronic pancreatitis.**

EUS

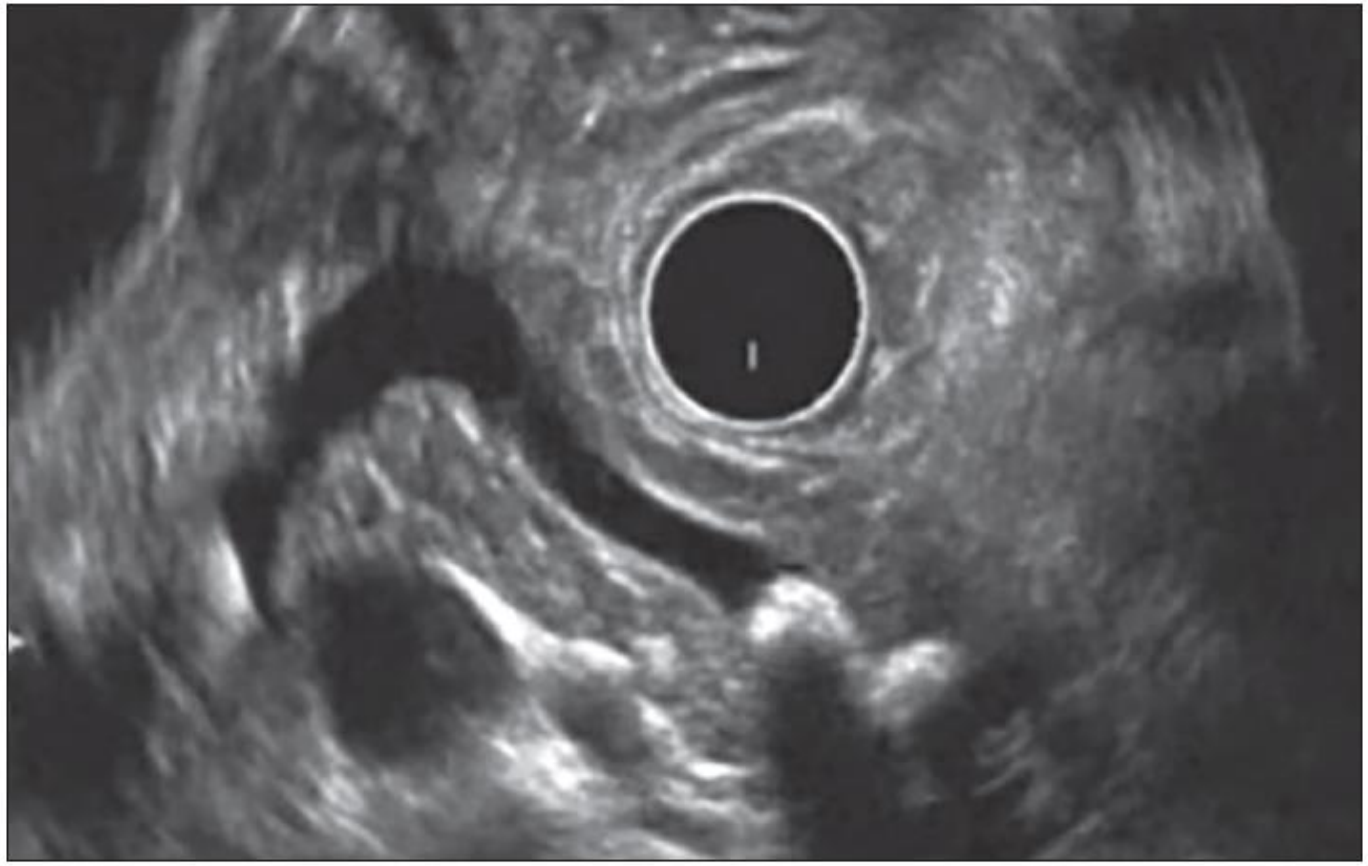
Rosemont criteria



The main pancreatic duct is dilated with hyper echoic wall. The duct is seen communicating with cyst.
The pancreatic parenchyma shows stranding.
Thus, this patient has only 4 Minor endoscopic ultrasound features and is **indeterminate for chronic pancreatitis.**

EUS

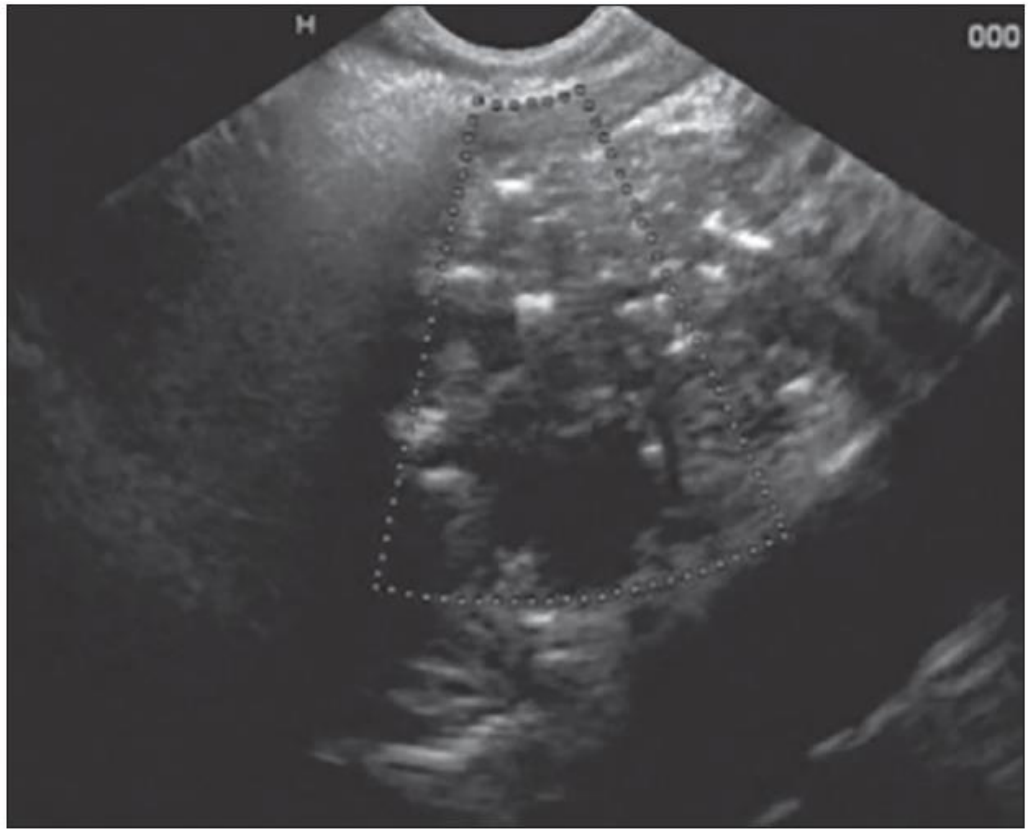
Rosemont criteria



The main pancreatic duct is dilated with hyperechoic wall and has multiple echogenic structures.
The pancreatic parenchyma shows hyperechoic foci without shadowing and stranding.
Thus, this patient has one Major A and 4 Minor endoscopic ultrasound features and is **consistent with chronic pancreatitis.**

EUS

Rosemont criteria



The main pancreatic duct is dilated.
The pancreatic parenchyma shows hyper echoic foci with as well as without shadowing.
Thus, this patient has one Major A and 2 Minor endoscopic ultrasound features and is **suggestive of chronic pancreatitis.**

EUS

Key points

- The normal pancreas has a diffusely speckled "salt and pepper" pattern of the body and tail with a barely visualized single, smooth and anechoic MPD.
- A number of conditions such as aging, smoking, obesity, and chronic alcohol consumption may cause EUS changes similar to CP. Therefore, EUS findings should be interpreted in appropriate clinical context.
- With the current advanced EUS imaging systems, **side branches of MPD** can also be seen in normal individuals especially the elderly and only if side branches are ≥1 mm, they are considered to be abnormal.

EUS

Key points

- Even in normal individuals the **MPD can be mildly tortuous** and therefore the MPD should be carefully evaluated for a gradual decrease in its diameter from the head to tail, which is an important feature of the normal duct. The duct of alternating sizes or beading is abnormal.

- The **dorsal and ventral pancreas** can have different echogenicity with the dorsal anlage of the pancreas being more echogenic than the ventral pancreas.

- **Isolated EUS findings** like lobularity in the head with normal body and tail of pancreas are generally reported as normal.

EUS

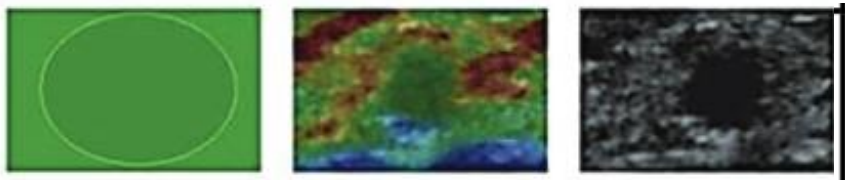
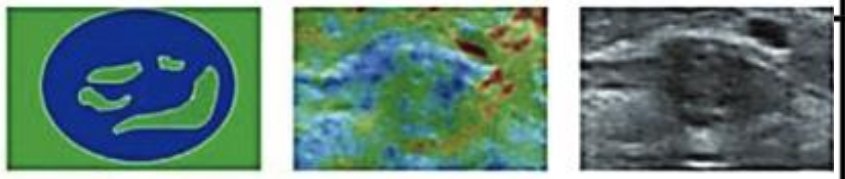
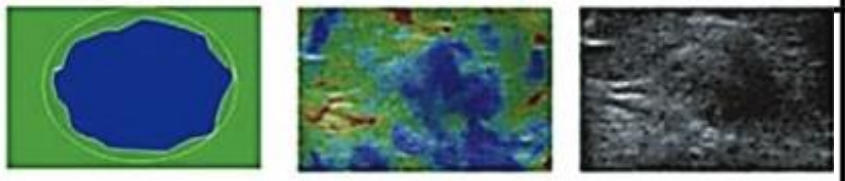
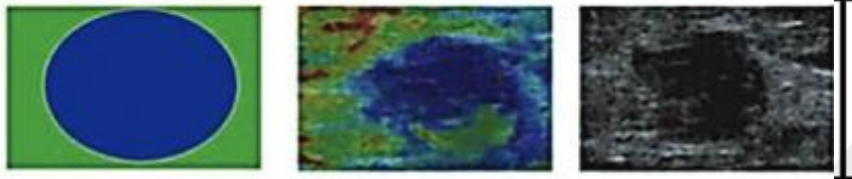
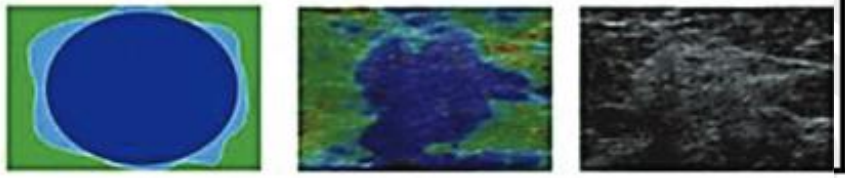
Elastography

- **Quantitative EUS elastography** appear promising technique for diagnosis of CP.

- In a study on EUS elastography in CP, region B selected was the normal surrounding gastroduodenal wall and **strain ratio cut-off of 2.25** yielded an accuracy of 91.1% for diagnosis of CP.

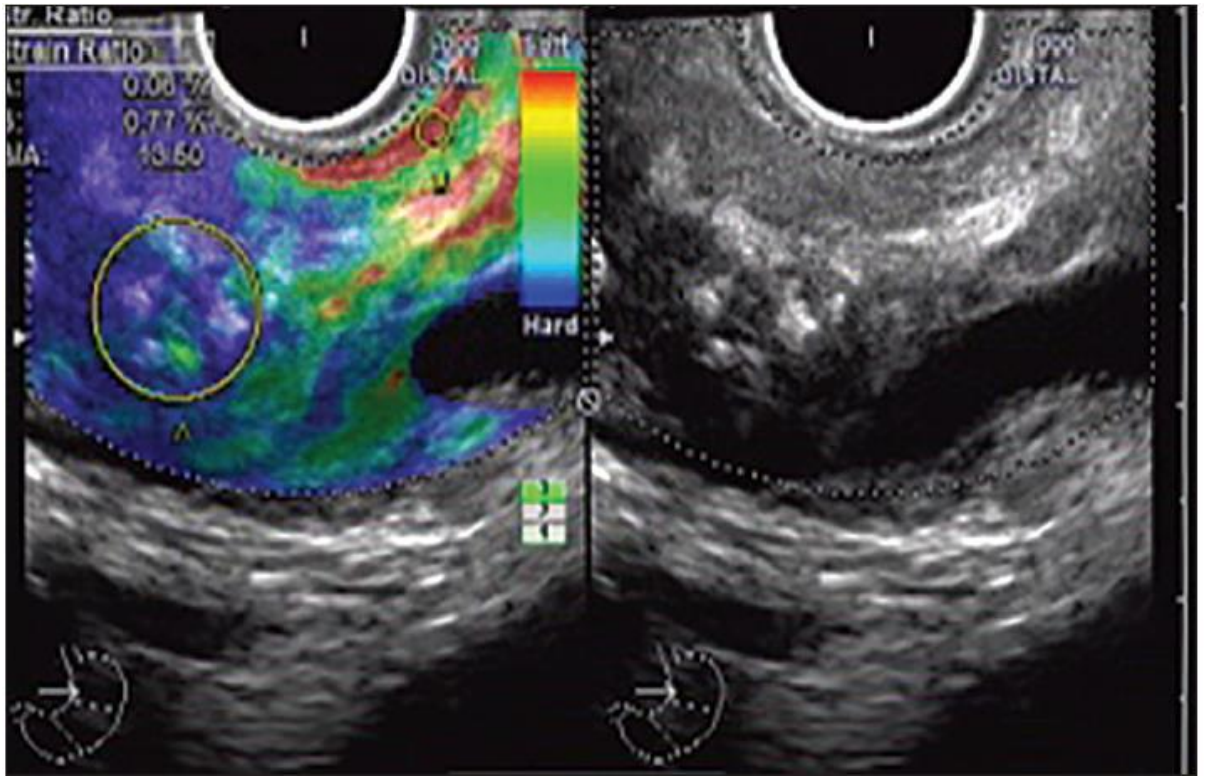
Iglesias-Garcia. Endoscopy 2013

EUS-elastography: 5-point TSUKUBA Scoring method

Tsukuba Elasticity Score 1		Entire area is evenly shaded green, as is surrounding tissue	**Benign**
Tsukuba Elasticity Score 2		Lesion area shows a mosaic pattern of green and blue.	
Tsukuba Elasticity Score 3		Central part of the area is blue (stiff), and peripheral part is green (soft).	**Intermediate** (Probably Benign)
Tsukuba Elasticity Score 4		Entire area is blue (stiff).	**Malignant**
Tsukuba Elasticity Score 5		Entire area and its surrounding area are blue (stiff).	

EUS

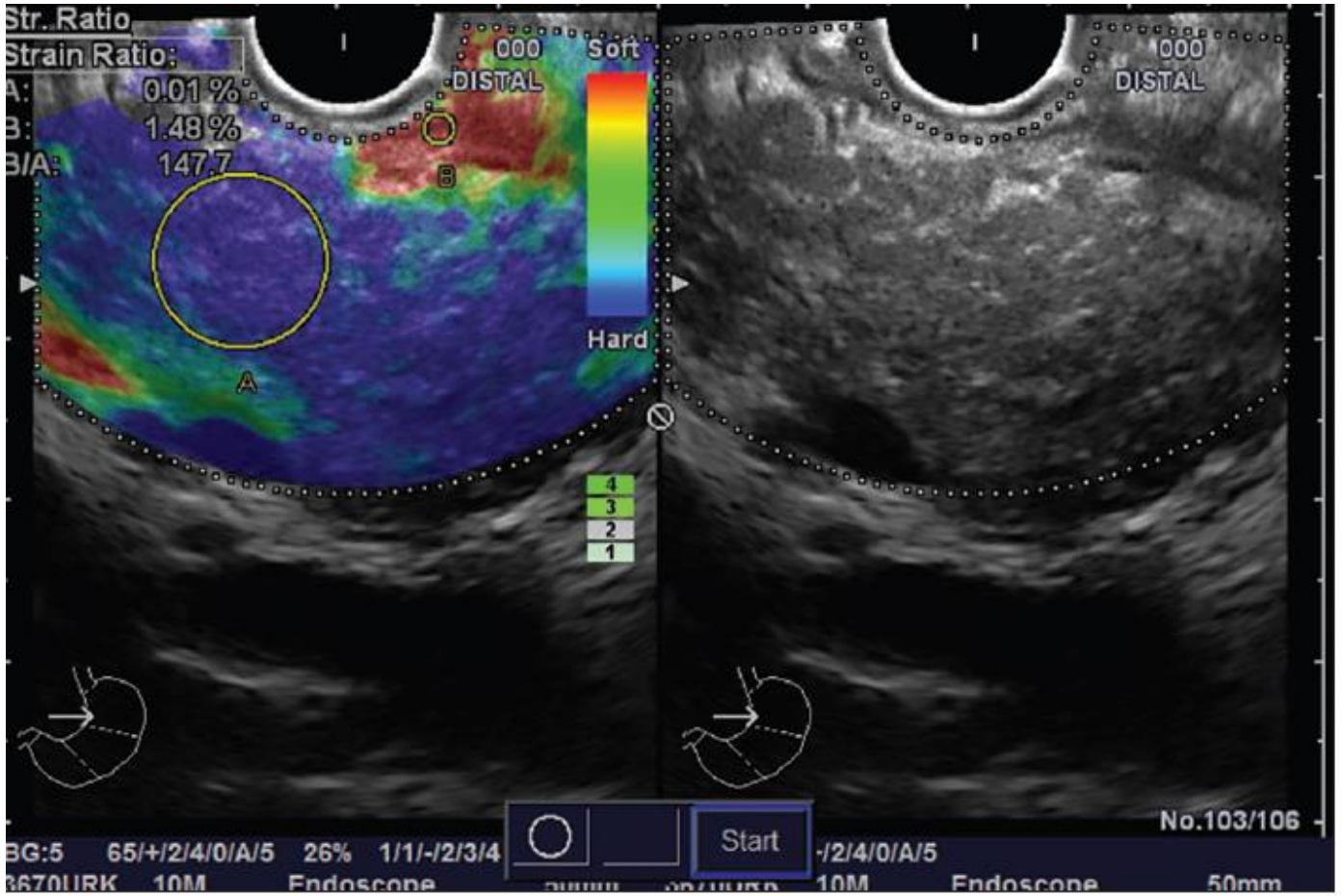
Elastography



A stable EUS image for at least 5 s is obtained for EUS quantitative analysis. The region of interest for the elastographic evaluation is manually selected to include the targeted area of the pancreas (region A) and soft (red) reference area corresponding to normal gastric wall (region B). A strain ratio of 13.6 has been obtained

EUS

Elastography



The EUS shows stranding with echogenic foci and lobularity (Right side). A strain ratio of 147.7 has been obtained

Recommendation

- We recommend CT or MRI (MRI/MRCP protocol) for the first-line diagnosis of CP. Either test should be the first choice for the diagnosis of CP.

- **Endoscopic ultrasonography (EUS)**, because of its invasiveness and lack of specificity, **should be used only if the diagnosis is in question after cross-sectional imaging is performed.**

(strong recommendation, low quality of evidence)

ACG Clinical Guideline. Am J Gastroenterol 2020

Pancreatic exocrine function tests

- **Exocrine pancreatic insufficiency (EPI)** should be suspected in those with long-standing CP or in those with CP and weight loss, malnutrition, diarrhea, steatorrhea, osteoporosis, or osteopenia.

- **In fact, a clinical suspicion is often sufficient to make the diagnosis without formal fecal fat measurement in the proper clinical context.**

Pancreatic exocrine function tests

- Simple and reliable methods for the diagnosis of EPI are lacking, though **typical symptoms and imaging demonstrating CP allow the diagnosis EPI.**

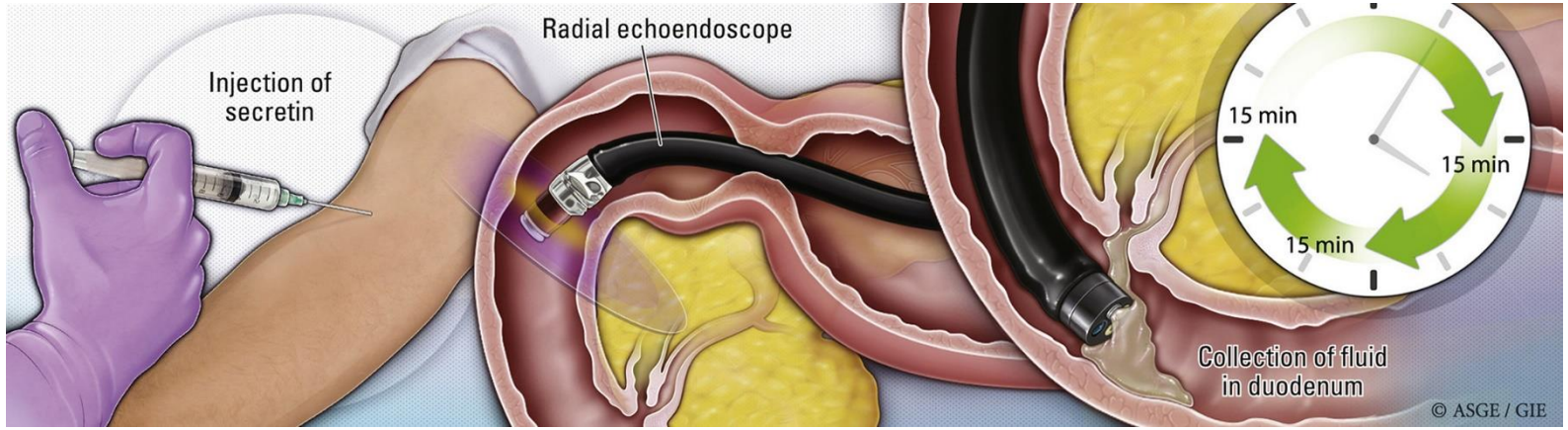
- **Pancreatic function testing** is an important means of diagnosing EPI; however, its role in establishing the diagnosis of CP is complementary.

As most patients with CP do not have clinically significant EPI, the sensitivity of pancreatic function testing to make the diagnosis of CP is low.

Pancreatic exocrine function tests

- The **direct tests** include secretin test, augmented secretin test, secretin-cholecystokinin test.

- They are considered the gold standard test for the evaluation of pancreatic exocrine function. However, it is used rarely in the clinical practice due to its high cost and invasiveness.



Pancreatic exocrine function tests

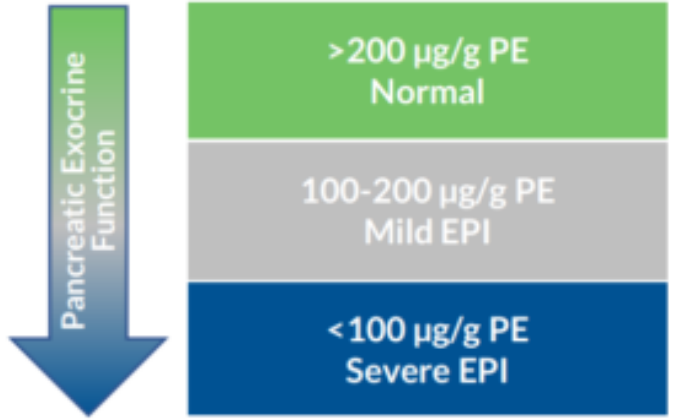
- The **indirect test** can be applied to testing stool, breath, urine or blood, with relatively low sensitivity and specificity.

- The two most common methods for testing pancreatic exocrine function are the fecal elastase- 1 test (FEL-1) and the 13 C mixed triacylglycerol breath test.

- **FEL-1** is used in clinical practice as it is less invasive and readily available and **is a suitable first-line test for PEI.**

Pancreatic exocrine function tests

- A FEL-1 result of <200 µg/g stool suggests moderate PEI, while <100 µg/g suggests severe PEI.
- The **sensitivity of an FEL-1 level of <200 µg/g** for PEI, when tested in patients with known risk factors, has been shown to be 25%–65% in mild PEI and 82%–100% in severe PEI.
- The **specificity of an FEL-1 level of <200 µg/g** has been shown to be 55%–100% (although 6 out of 7 studies show specificity >90%).



Mary E Phillips. BMJ open gastroenterology 2021

Test characteristics of direct and indirect pancreatic function tests

Hormonal tests of pancreatic function		
CCK stimulation test (acinar cell stimulation measuring trypsin and/or lipase)	Direct acinar cell function Detects subtle EPI	Cumbersome Not widely available Specialized laboratory testing required Patient discomfort with Dreiling tube placement 2–3 hr test
Secretin stimulation test (ductal cell stimulation measuring bicarbonate)	Direct ductal cell function Performed endoscopically Uses laboratory autoanalyzer 60 min test Measures ductal secretory ability	Not widely available Prone to measurement error Risk and cost of endoscopy
Nonhormonal tests of pancreatic function		
Fecal elastace-1	Universally available Easily obtainable Noninvasive	Moderate sensitivity Limited specificity in diarrhea Limited use in mild disease
^{13}C-mixed triglyceride test	Easily obtainable High sensitivity (90%)	Not universally available Long test duration—4–6 hr
Serum trypsinogen/trypsin	Universally available Easily obtainable Noninvasive Quantifiable for tracking function over time	Does not measure digestive tract enzymes Elevated with pancreatic pain

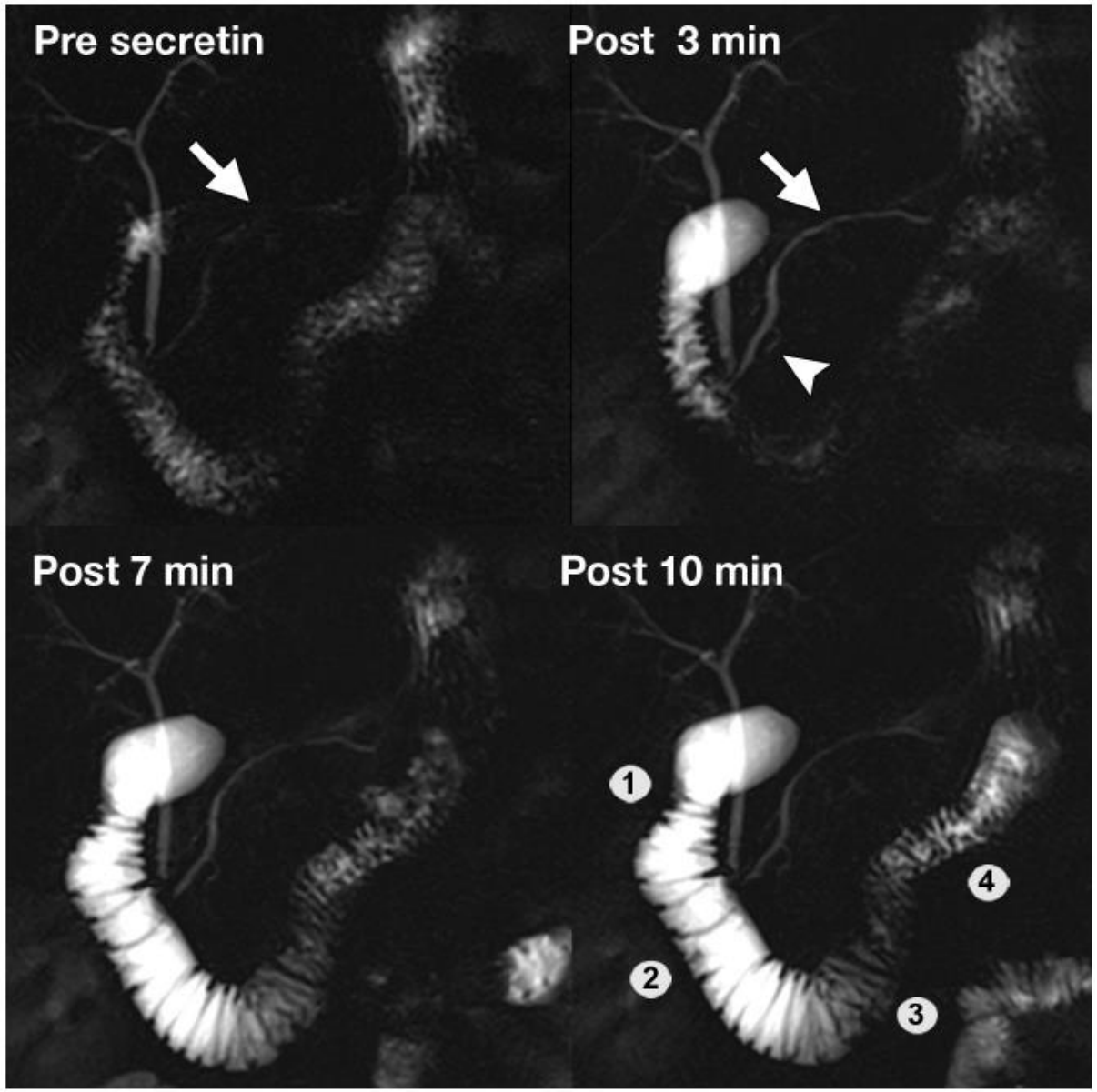
s-MRCP

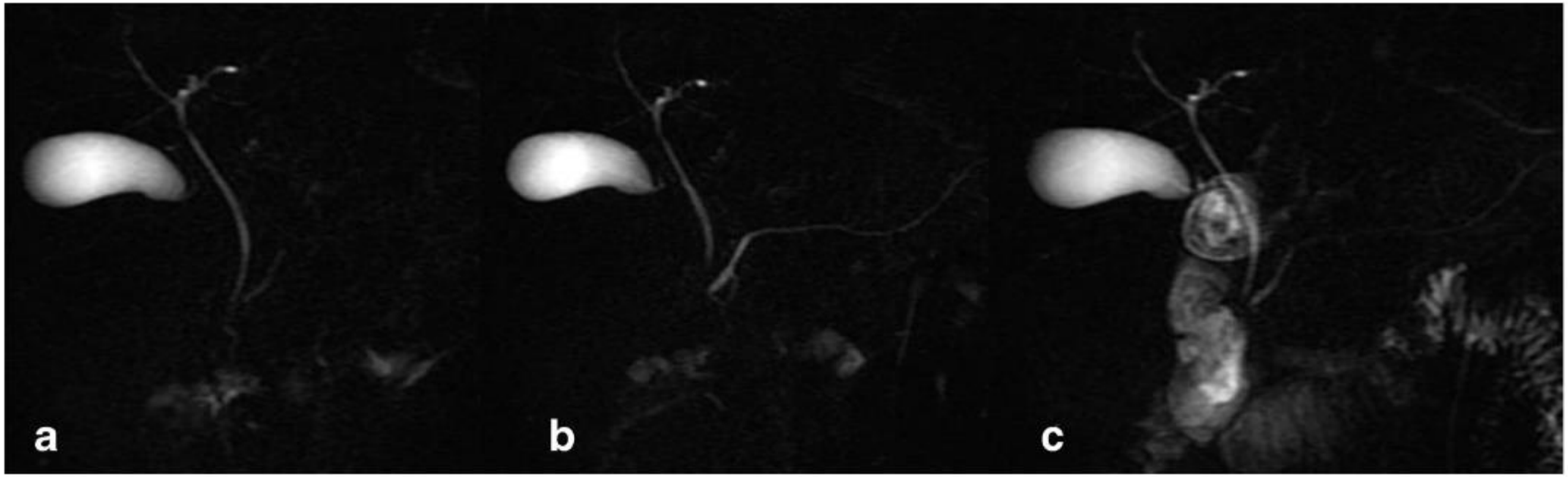
Secretin-stimulated MRCP can be used to evaluate pancreatic exocrine function, by semi- quantitatively assessing the increase in fluid in the duodenum.

Performing **secretin-enhanced MRCP** is suggested when the diagnosis of CP following cross-sectional imaging or EUS is not confirmed and the clinical suspicion remains high.

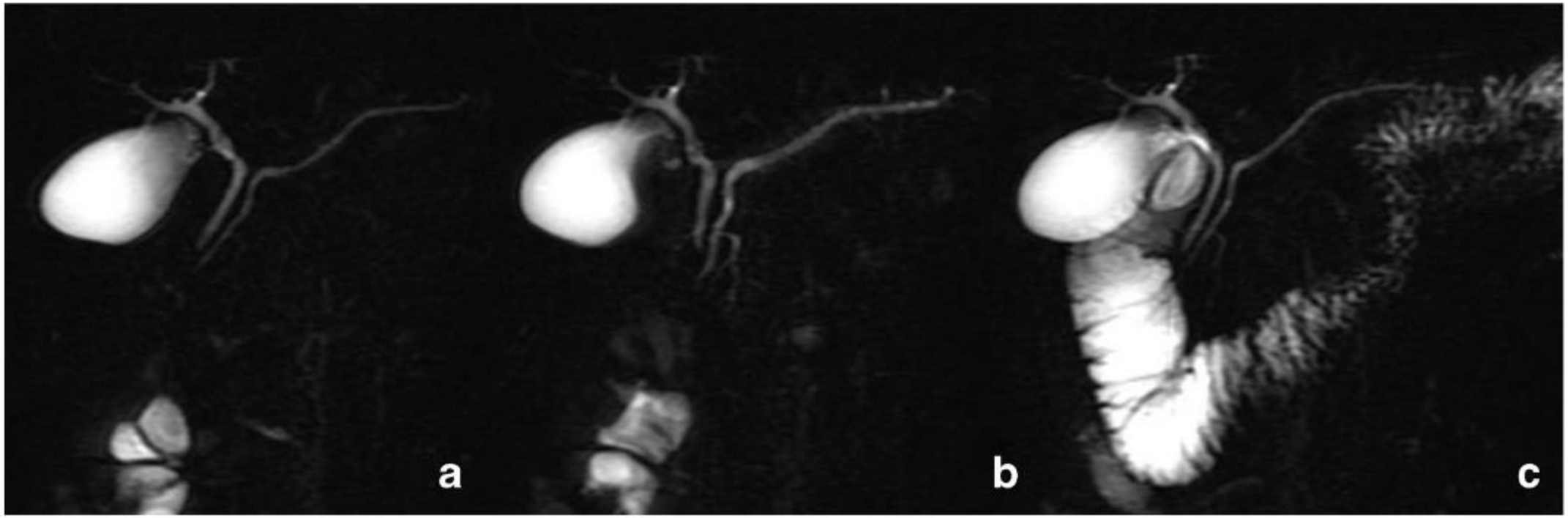
It is a reliable non-invasive alternative technique for secretin-stimulated endoscopic pancreatic function testing (ePFT).

s-MRCP





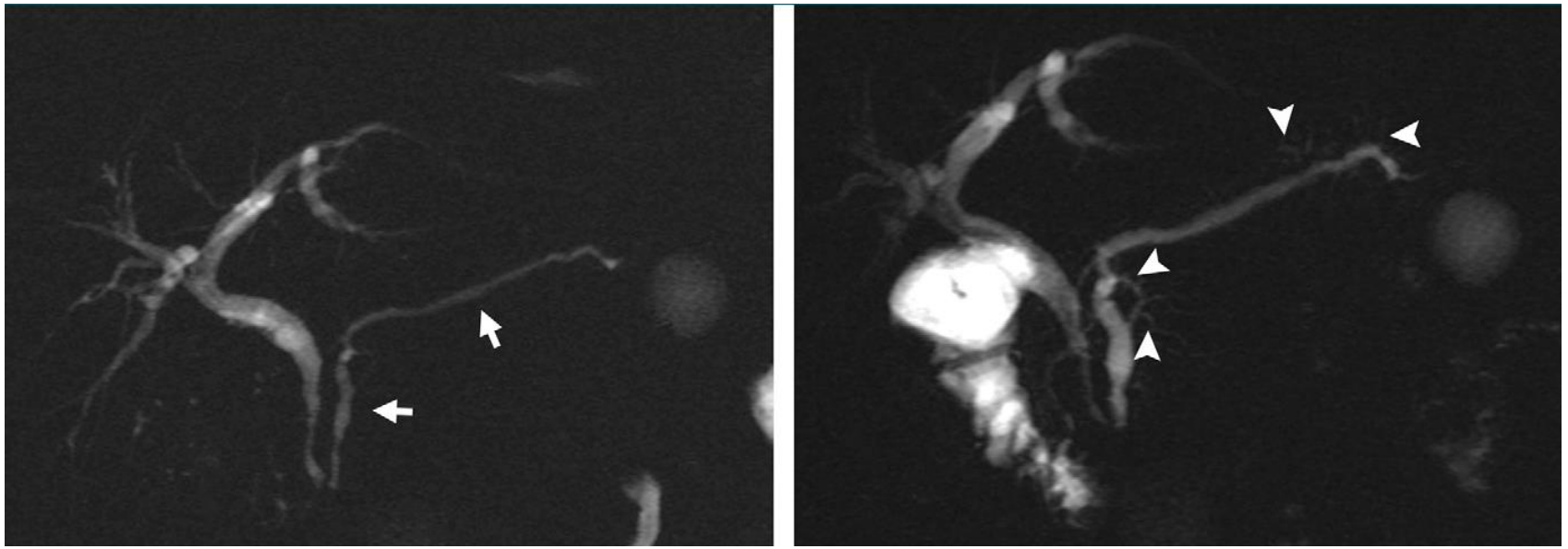
Normal findings. MRCP performed before secretin injection shows a normal main pancreatic duct (**a**), which demonstrates a regular dilation 3 min after secretin stimulation (**b**) and normal duodenal filling beyond the genu inferius after 15 min (**c**)



Mild PEI (chronic pancreatitis). MRCP obtained before secretin injection (**a**) shows a normal main pancreatic duct. Three minutes after secretin stimulation (**b**), MRCP reveals side branch dilation, particularly at the level of the head and tail diagnosed as mild chronic pancreatitis. MRCP obtained 15 min after secretin injection (**c**) demonstrates normal duodenal filling beyond the genu inferius, interpreted as **preserved pancreatic exocrine reserve.** **Mild severity (Cambridge criteria); Mild PEI.**

Cross-sectional imaging

s-MRCP



Secretin-enhanced MRCP in mild PEI (chronic pancreatitis).

(a) Before secretin administration shows a normal size of the Wirsung duct with irregular margins (arrows).

(b) Three minutes after secretin administration, the Wirsung duct (arrows) is enlarged as well as the Santorini duct along all their length. **Multiple dilated side branches are visible** in the head and the body-tail of the pancreas (arrowheads), suggesting mild chronic pancreatitis. **Duodenal filling can be observed** up to the genu inferius. **Moderate severity (Cambridge criteria); Mild PEI.**

ACG Clinical Guideline. Am J Gastroenterol 2020

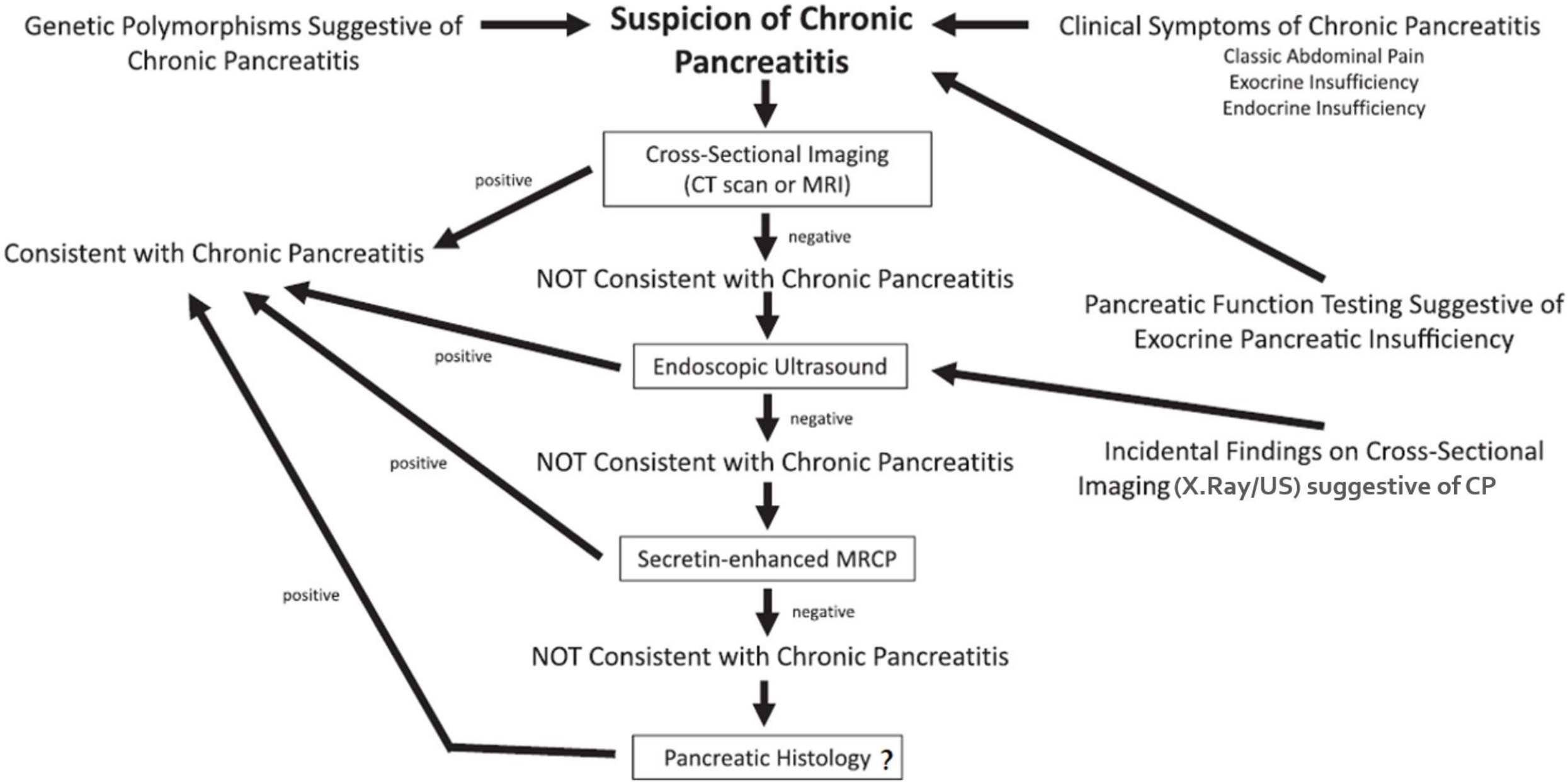
Genetic test

- Genetic testing is highly recommended for CP patients who are diagnosed with idiopathic CP or adolescents (onset age younger than 20 years old) with CP or with a family history of pancreatic disease.

- The peripheral venous blood is withdrawn to test the *PRSS1*, *SPINK1*, *CTRC* and *CFTR* genes.

Histology

- Pancreatic fine needle aspiration biopsy can be done under CT, abdominal ultrasound, or EUS guidance.
- Due to its invasive characteristics, biopsy, which is mainly used for the differential diagnosis of CP and pancreatic cancer (in the presence of pancreatic mass), is **not routinely performed in the clinical practice for diagnosis of CP.**


Genetic Polymorphisms Suggestive of Chronic Pancreatitis
Suspicion of Chronic Pancreatitis
Clinical Symptoms of Chronic Pancreatitis
Classic Abdominal Pain
Exocrine Insufficiency
Endocrine Insufficiency
Cross-Sectional Imaging (CT scan or MRI)
positive
Consistent with Chronic Pancreatitis
negative
NOT Consistent with Chronic Pancreatitis
Pancreatic Function Testing Suggestive of Exocrine Pancreatic Insufficiency
positive
Endoscopic Ultrasound
negative
NOT Consistent with Chronic Pancreatitis
Incidental Findings on Cross-Sectional Imaging (X.Ray/US) suggestive of CP
positive
Secretin-enhanced MRCP
negative
NOT Consistent with Chronic Pancreatitis
positive
Pancreatic Histology ?

Case ≠2

- A 52-year old man with a history of recurrent acute pancreatitis related to alcohol presents with several months of postprandial abdominal pain, bloating and loose bowel movements. He has lost 7kg in the past 2 months. He denies oily stools. A pancreatic protocol CT scan appeared normal.
- What is the best next step in diagnostic approach?
  1. Secretin-CCK test
  2. Fecal elastase test
  3. 72-hour fecal fat test
  4. EUS

EUS

Case ≠3

- A 48 years old man who has consumed 90 g of alcohol and 20 cigarettes daily over the last 30 years, with history of recurrent pancreatitis is referred to you because of continuous epigastric pain radiating to the back.
- Stool consistency type 5 or 6 according to the Bristol Stool Form Scale. Not infrequently stools are bulky and difficult to flush, have a pale and oily appearance, and can be especially foul-smelling.
- You refer the patient for an abdominal CT scan, which shows an atrophic pancreas with dilated main pancreatic duct and diffuse small calcifications. A single calcification of 5 mm in size is impacted into the main pancreatic duct at the level of the head of the pancreas. What would you do next to confirm the diagnosis of chronic pancreatitis?

No further imaging or function tests are needed

Chronic Pancreatitis

Indications of treatment

Established indication

↓

Pain relief

Increased intraductal / Parenchymal pressure
Neural remodeling / Neuropathy
Pancreatic ischemia
Acute inflammation

Possible indications

↓

Improvement of Endocrine / Exocrine function
Delay progression of the disease

Pancreatic stones

Special features

Radio-opaque stones ~ 90%

- Hard
- Spiculed
- Impacted
- Associated with strictures / Complex pathology
- Sometimes inaccessible

Radiolucent / Small radio-opaque stones ~ 10%

Endotherapy of Chronic Pancreatitis

Success of ESWL and ERCP in symptomatic PD stones

Success of extracorporeal shock wave lithotripsy and ERCP in symptomatic pancreatic duct stones: a systematic review and meta-analysis

Authors
Nadine C.M. van Huijgevoort*,[1], Joyce V. Veld*,[1], Paul Fockens[1], Marc G. Besselink[2], Marja A. Boermeester[2], Marianna Arvanitakis[3], Jeanin E. van Hooft[1]

van Huijgevoort Nadine CM et al. Success of extracorporeal... Endoscopy International Open 2020; 08: E1070–E1085

Systematic review and meta-analysis

486 studies screened
22 studies included

Results of pooled data

Complete duct clearance after ESWL + ERCP – 69.8%
Complete absence of pain during follow up – 64.2%
Complete stone fragmentation – 86.3%
Post procedure pancreatitis – 4%
Post procedure cholangitis – 0.5%

Stricture predominant disease

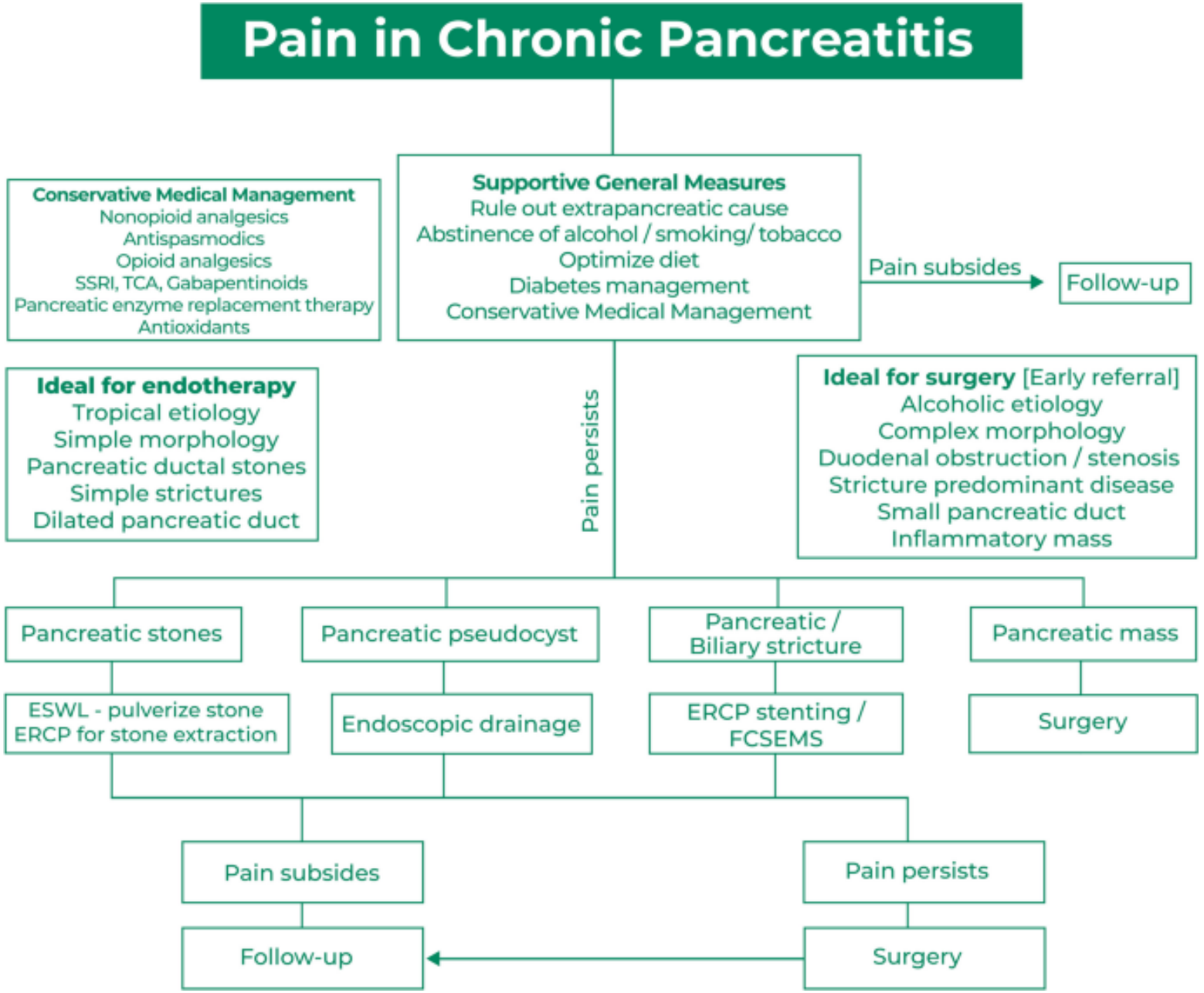
Most commonly accepted stenting protocol

- Start with 5/7/10 Fr whichever is possible
- Reach a diameter of at least 10 Fr as soon as possible
- Remove after 1 year and assess stricture
- If stricture persists - Multiple stent regime or surgical consult

Recommendation - Grade C
ESGE guidelines (2014, 2019)

PD stone

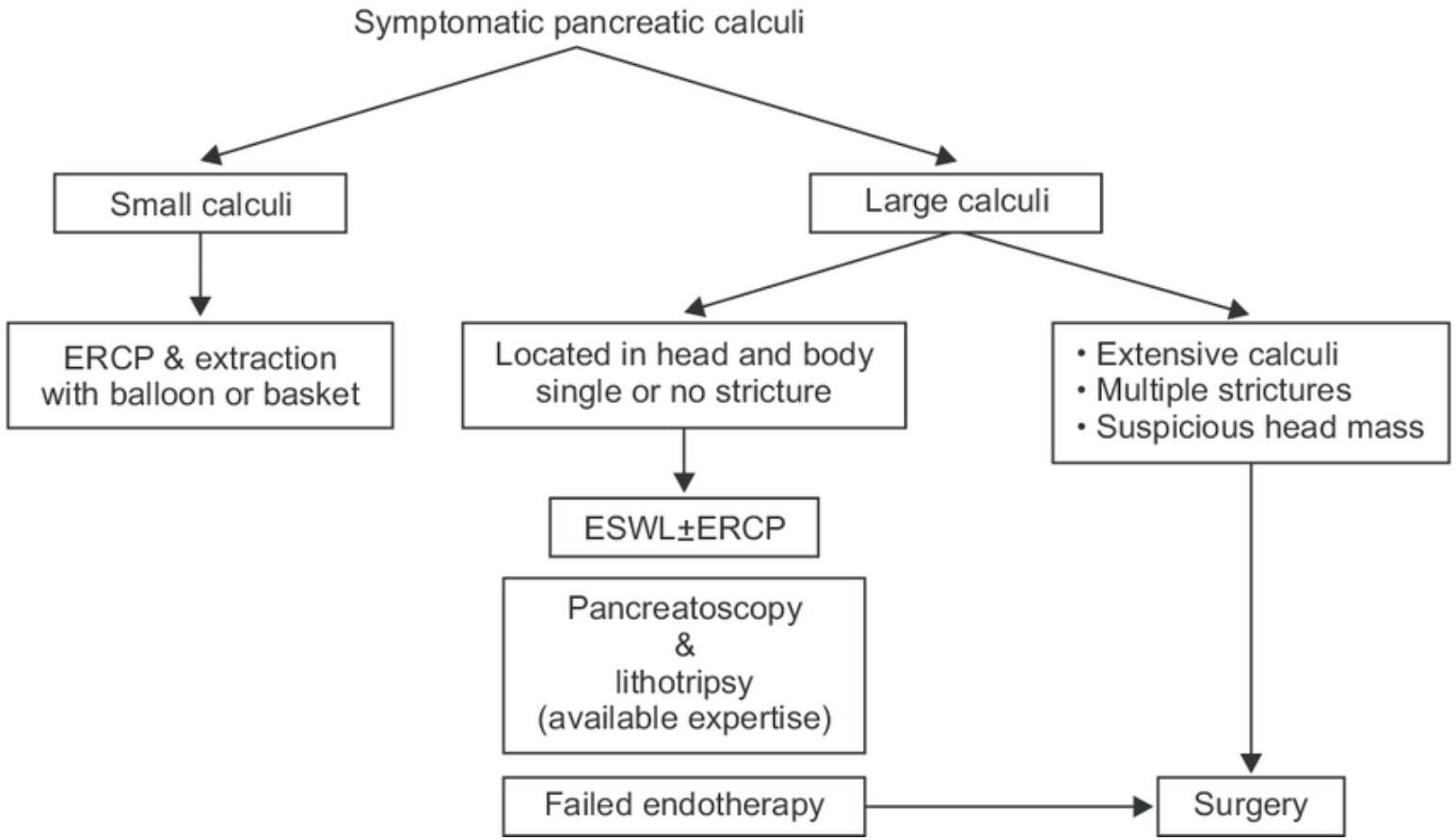
Treatment



Maydeo A. Current Gastroenterology Reports 2023

PD stone

Treatment

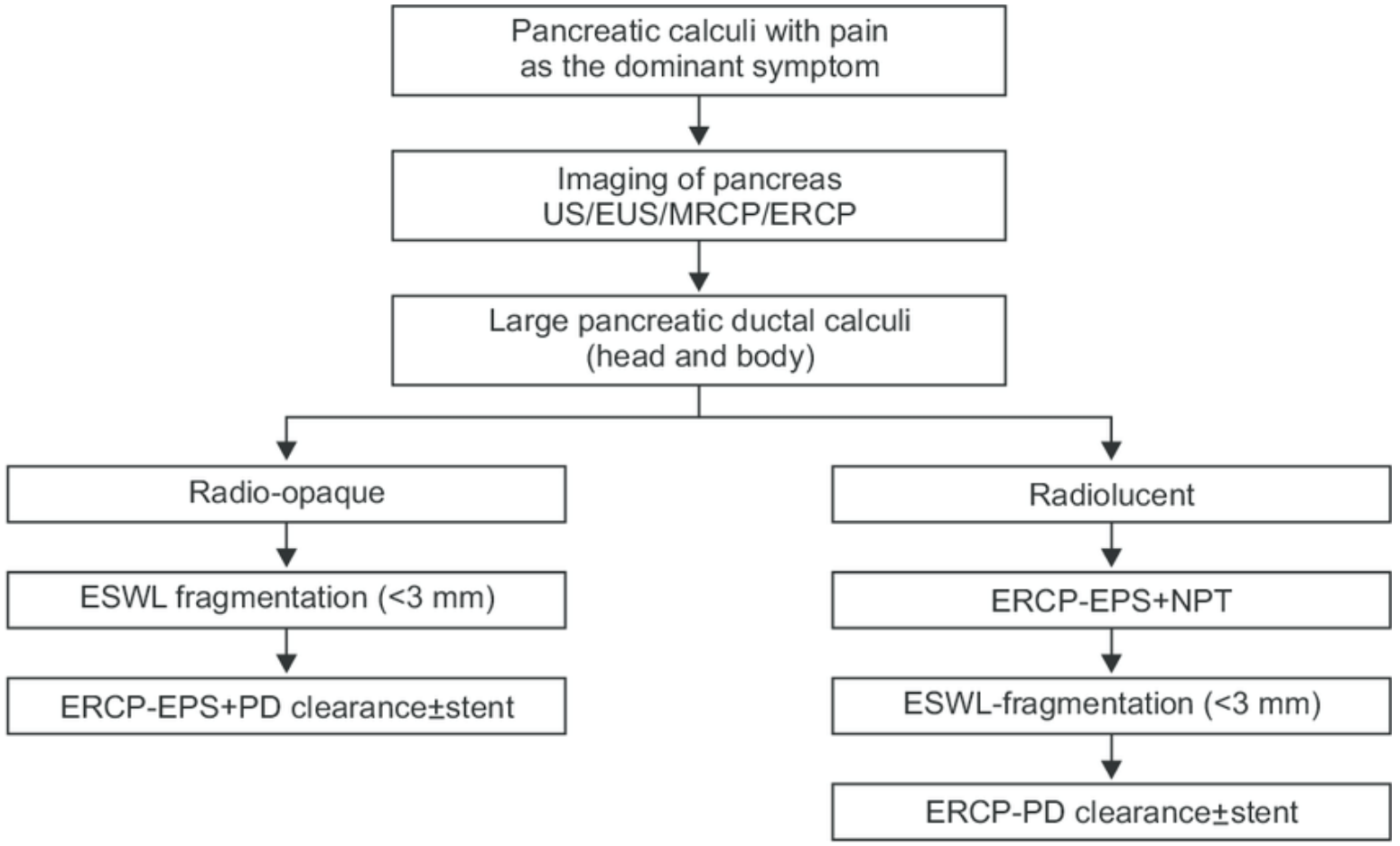


Small and floating calculi, <5 mm can be extracted by the standard technique of ERCP and pancreatic sphincterotomy (PS) followed by balloon trawl or basket. However stones >5 mmin size are often impacted and difficult to extract by the above mentioned standard technique. These calculi need to be fragmented or pulverized to facilitate their extraction.

Tandan M. Gut and Liver 2016.

PD stone

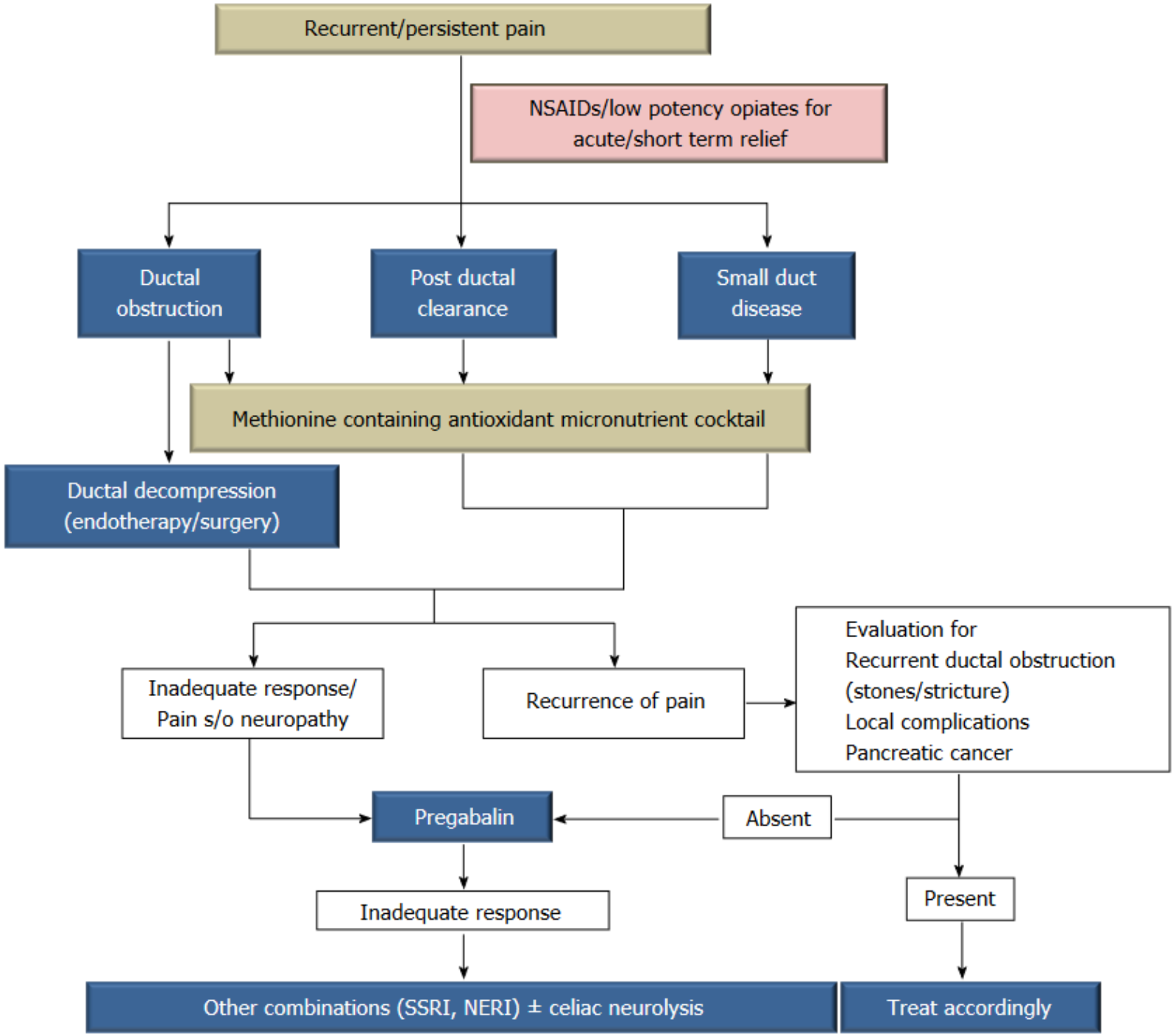
Treatment



Tandan M. Gut and Liver 2016.

PD stone

Treatment



Endotherapy of Chronic Pancreatitis

Endotherapy or Surgery ?

- Fluoroscopy / MRCP – Essential before planning (CT/EUS)
- ESWL - Mandatory for radioopaque stones
- Judicious stenting protocol for stricture morphology
- Defined end points for stone clearance / stricture resolution

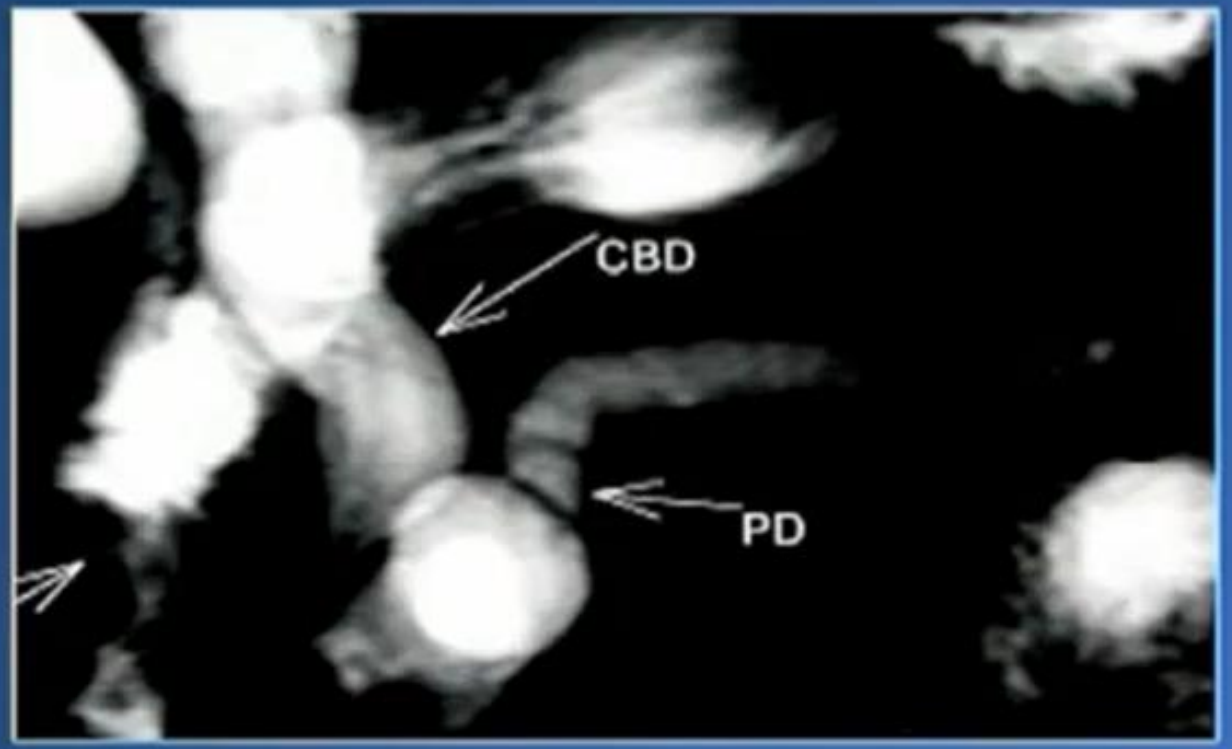
Surgery

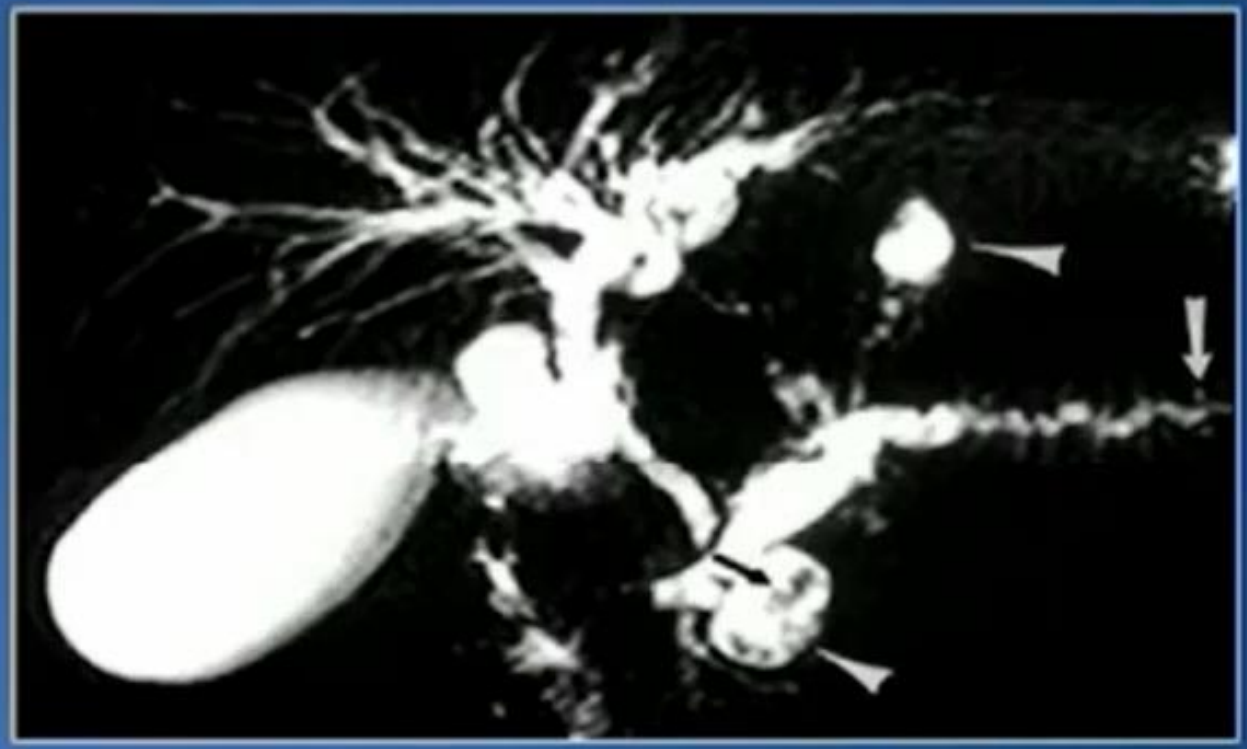
Alcohol etiology
Complex morphology
Small duct disease
Stricture predominant disease

Endotherapy

Tropical etiology
Simple morphology
Stone / Simple strictures
Dilated ducts

Pseudocysts associated with Chronic pancreatitis





Only around 9% - 10% resolve spontaneously
40% - 60% - Communication with MPD

Transpapillary stenting – 1st line of treatment (Recom. Grade A)

Barkin J GIE 1989;35:62-64, Baron TH GIE 2002:56:7-17
Barthet M GIE 2008:67:245-252, Andren-Sandberg A JOP 2004:5:64-70


THANK
YOU