Preoperative assessment of pancreatic tumor resectability

المدرس الدكتور : تارا فاروق كريم
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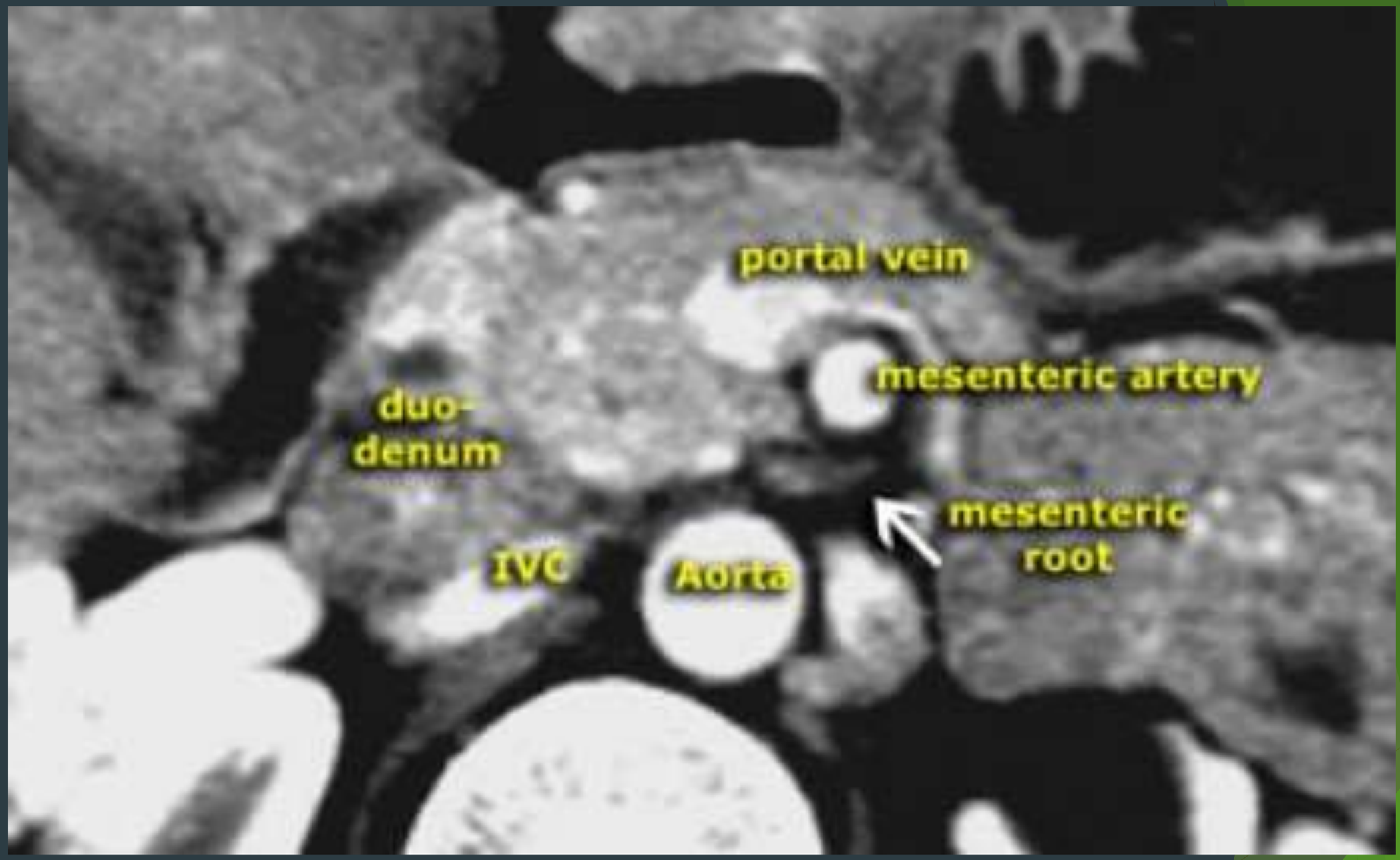
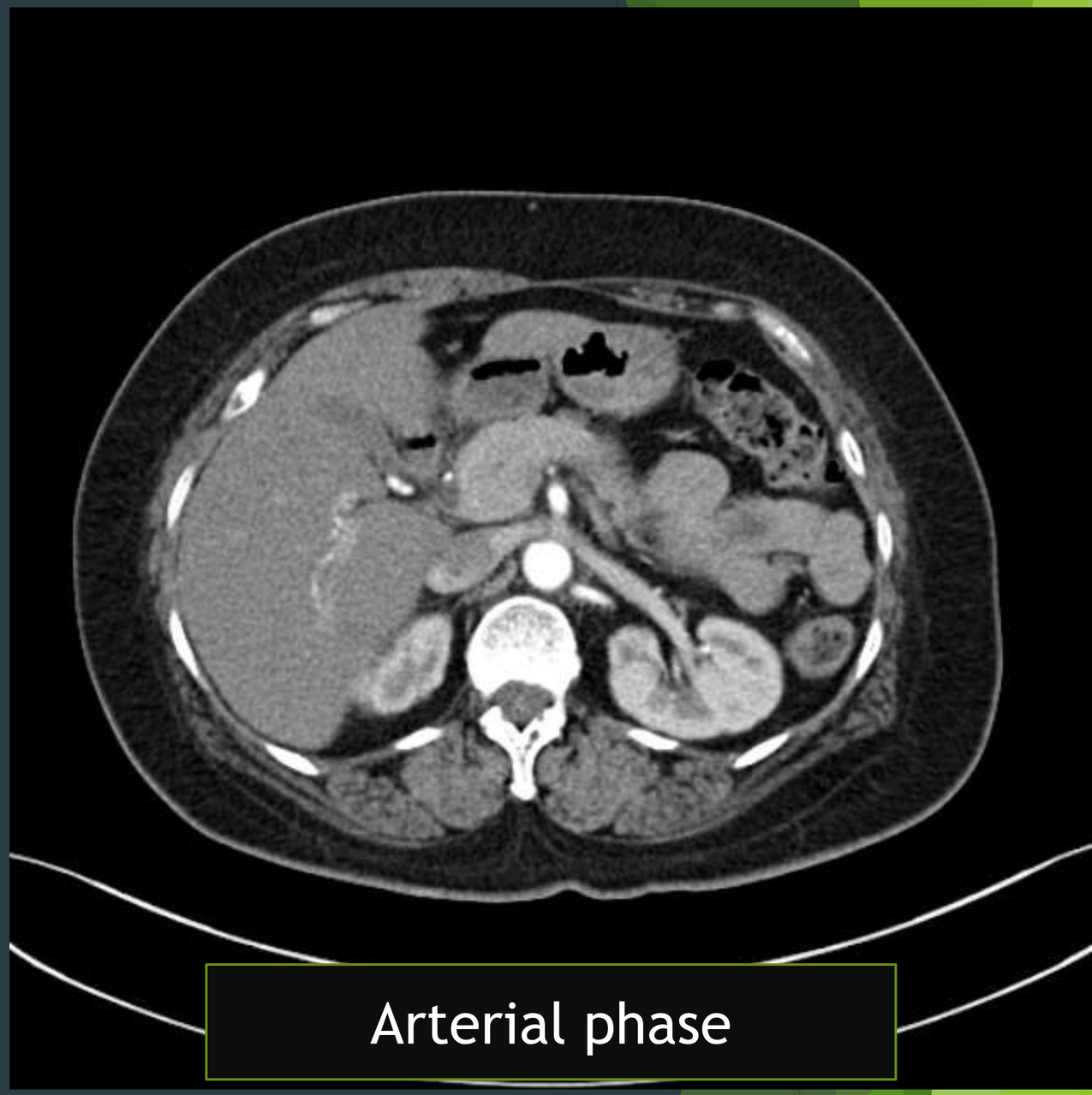
Quick review of pancreatic CT anatomy



The pancreatic head is surrounded by the portal vein, SMA, mesenteric root, duodenum, IVC and aorta

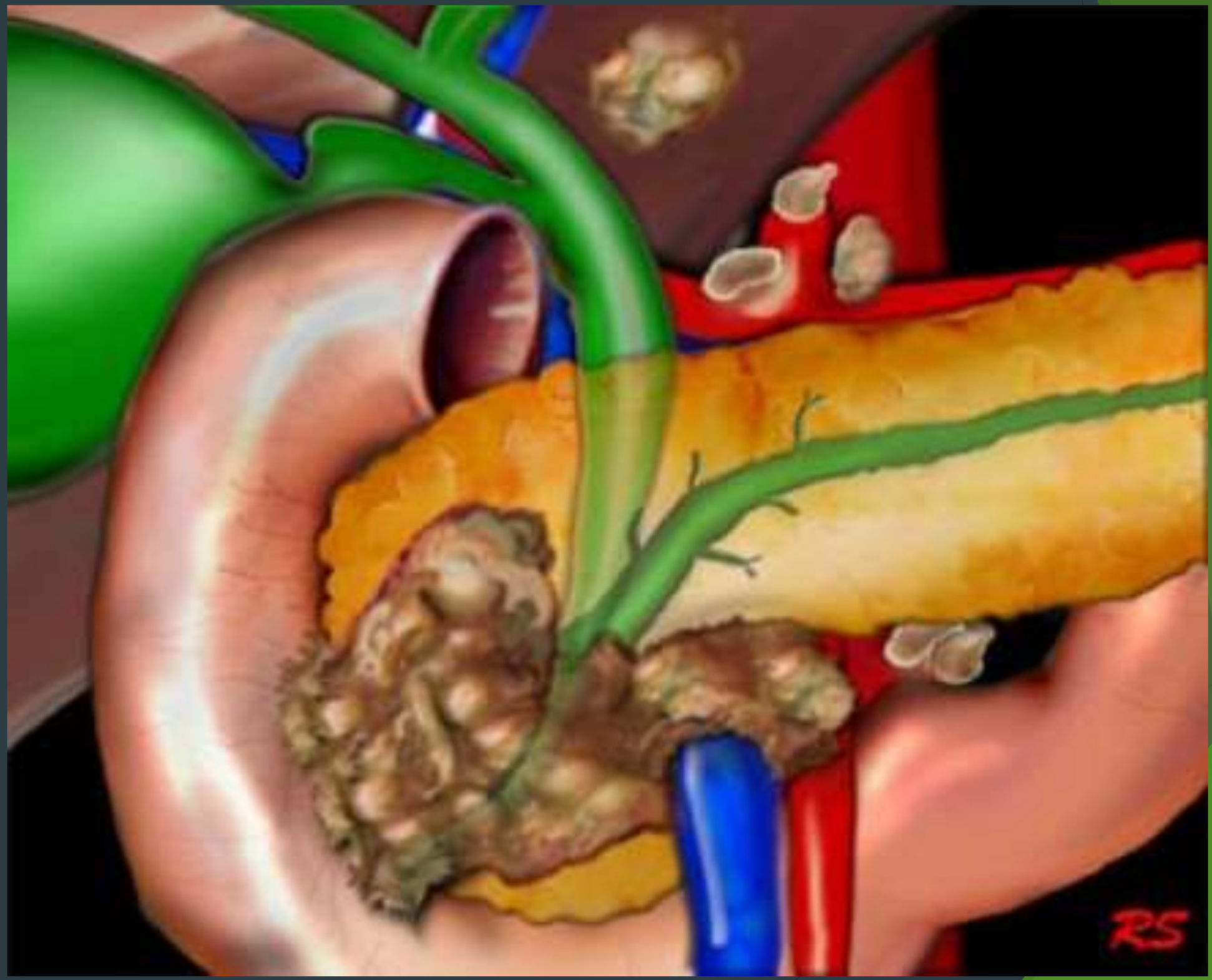


Arterial phase

Neoplastic Solid Lesions

1. Pancreatic Adenocarcinoma.
2. Pancreatic Neuroendocrine Tumor(NETs).
3. Solid Pseudopapillary Epitheleal neoplasm (SPEN).
4. Pancreatoblastoma.
5. Pancreatic Lymphoma.
6. Metastases to the Pancreas.

Pancreatic ductal adenocarcinoma



Accounts for 95% of all pancreatic exocrine malignancies.

Poor prognosis with less than 5% survival at 5 years.

Less than 20% of patients are candidates for curative surgery.

- **CT scan** with dual-phase pancreatic protocol is the preferred method for initial imaging evaluation in patients in whom PDA is suspected .
- **MRI is** equally sensitive and specific in staging pancreatic cancer and can be used interchangeably with CT scan.
- However,
- It is not as widely used as the primary imaging modality in most centers because of cost and availability.
- MR imaging is predominantly utilized for problem solving in patients with isoattenuating pancreatic lesions or to better characterize indeterminate liver lesions identified at prior CT examinations.
- **Endoscopic ultrasonography (US)** can assist in the detection of small tumors and in patients when the primary tumor is not visualized or is isoattenuating on CT images . Endoscopic US with FNA has an established role in cytohistologic confirmation before treatment initiation and in negative cross-sectional evaluation with CT or MR imaging and persistent strong clinical suspicion of PDA

Pancreatic CT protocol

- Water should be used as oral contrast material.
- A pre-contrast scan of the pancreas is performed to look for calcifications within the pancreas, which may indicate the presence of a focal pancreatitis.
- 120 - 150 ml contrast is given at an injection rate of 3-5 ml/s.

- Arterial phase imaging (20-40 seconds after contrast injection) (called the pancreatic phase).
- Portal phase imaging (50–70 seconds after injection)

The importance of the arterial phase images

- Differentiating vascular neoplasms (as NET) from adeno carcinoma.
- Some adenocarcinomas maybe more conspicuous on the arterial phase images
- Vascular maps with determination of vascular tumor involvement .

The importance of venous phase images

- Identify distant metastatic disease and loco-regional lymphadenopathy.
- Evaluate portal vein and SMV.
- Optimally evaluate solid organs of the abdomen.

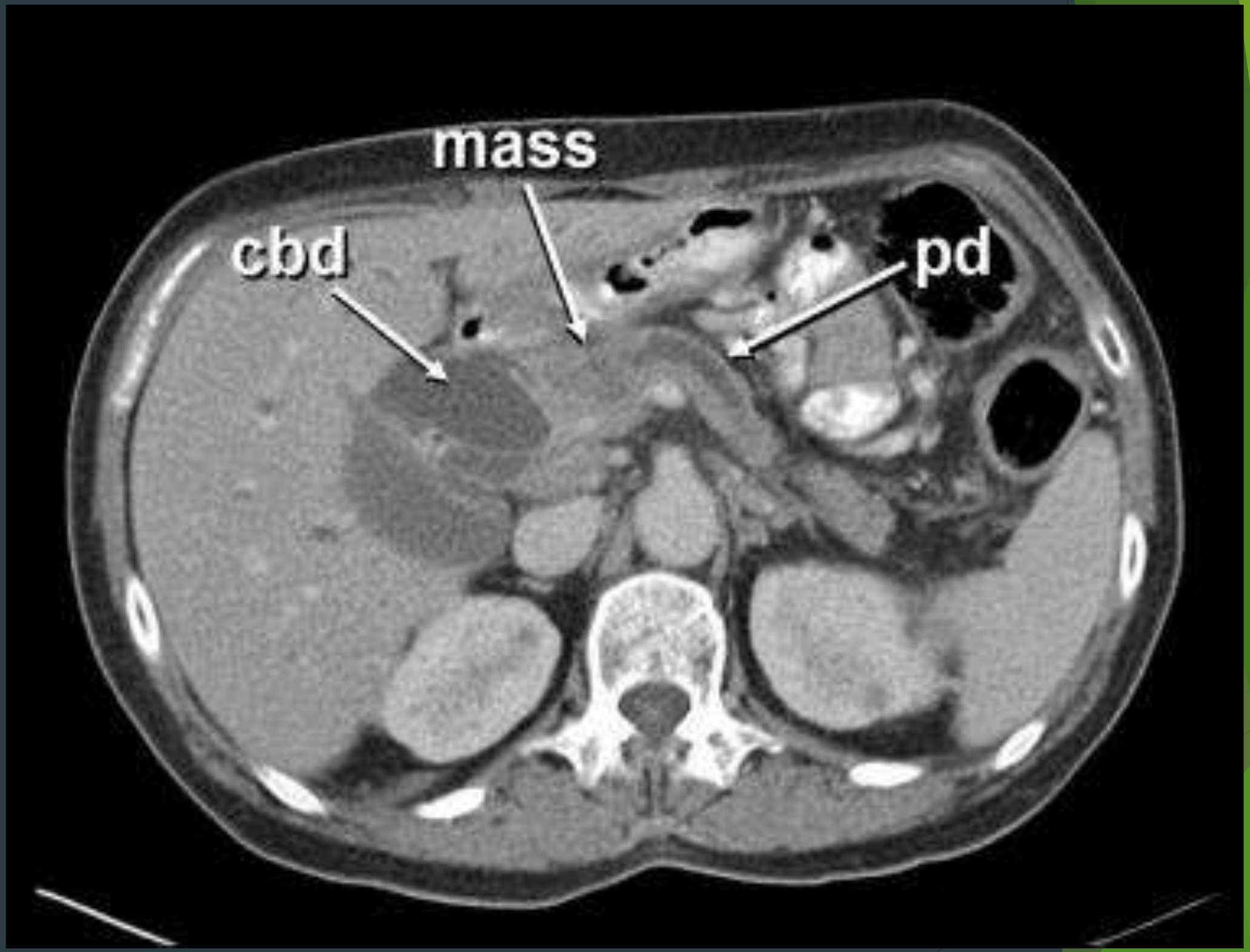
CT appearance of PDAC

- Hypodense , poorly marginated , have tendency to encase vessels and involve CBD and pancreatic duct

Secondary signs :

- Pancreatic duct dilatation.
- Biliary duct dilatation.
- Double duct sign.
- Abrupt cut-off the dilated pancreatic duct.
- Upstream pancreatic artrophy.
- Abnormal contour of the pancreas.

- Secondary signs are most important in 5-10% of pancreatic cancers which are iso-attenuating to the pancreatic parenchyma in both arterial and venous phase images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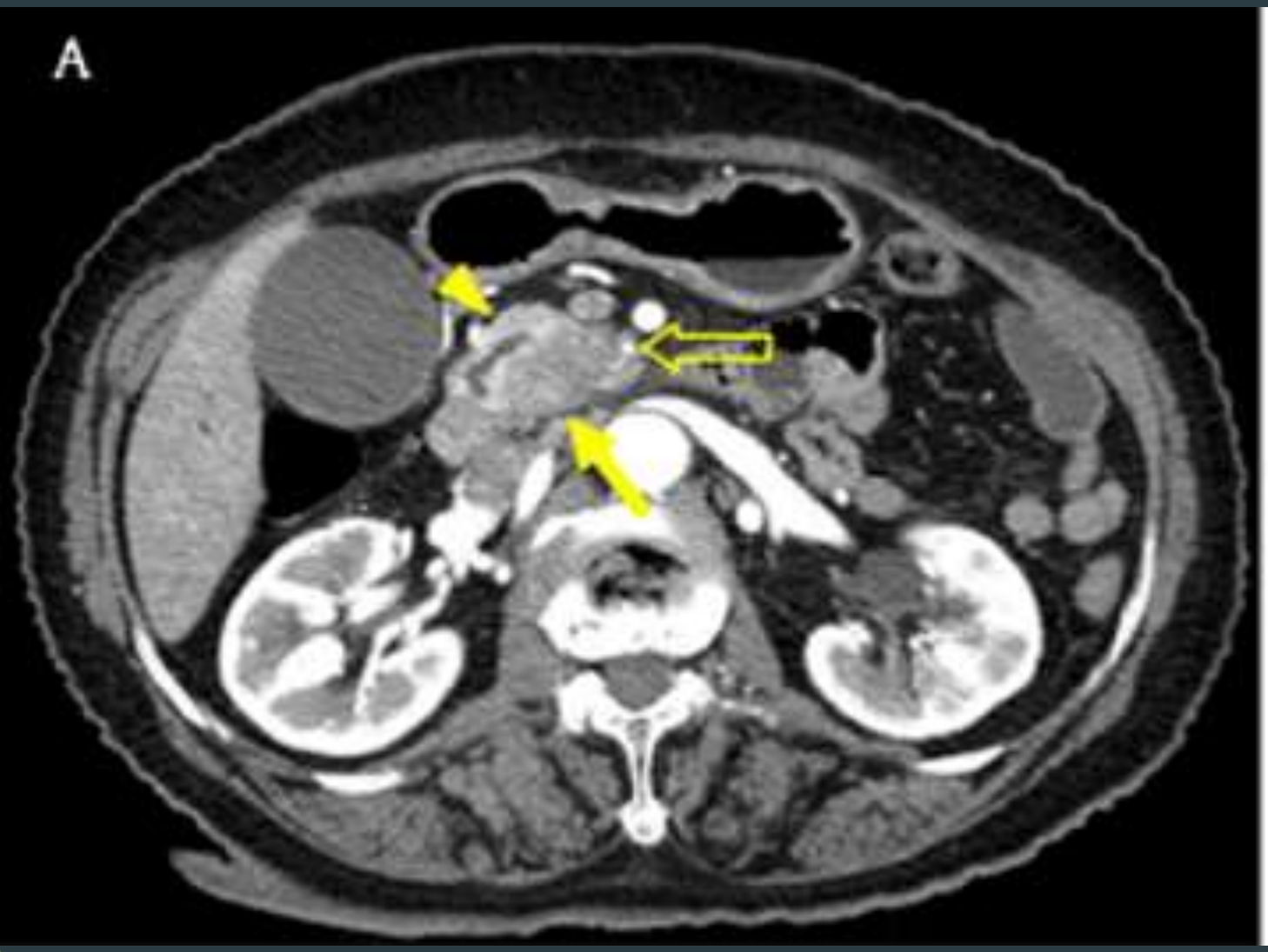
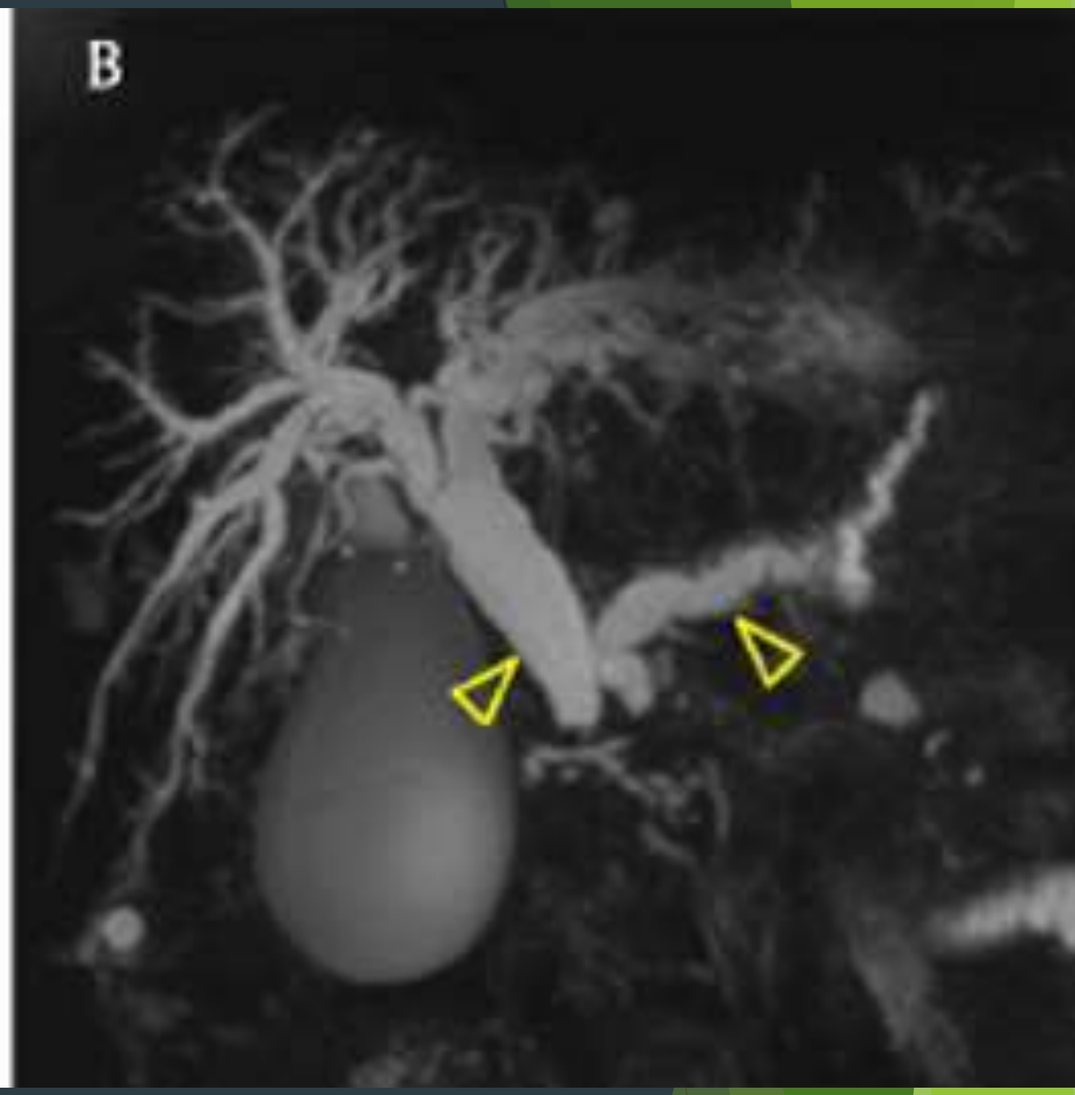
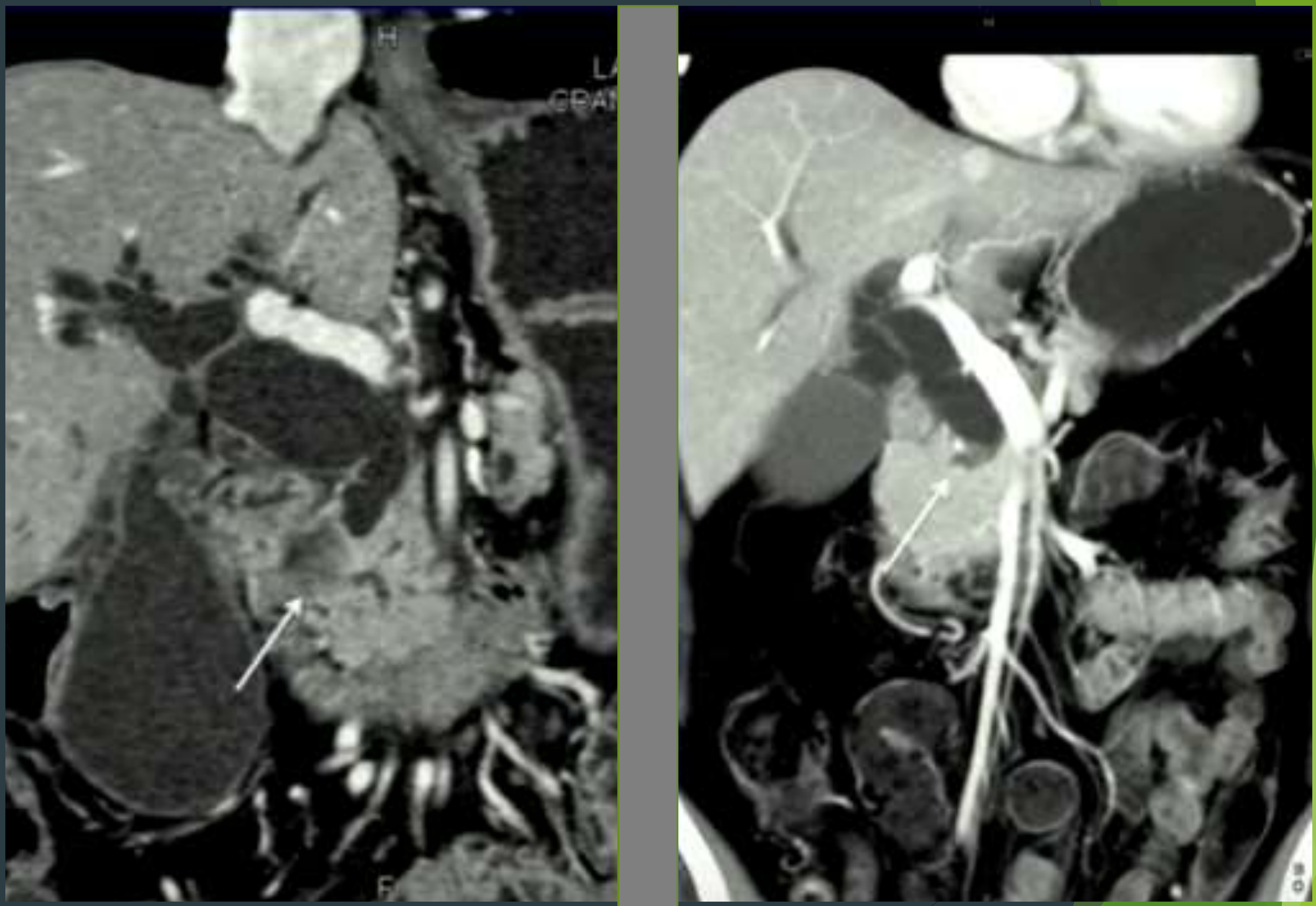
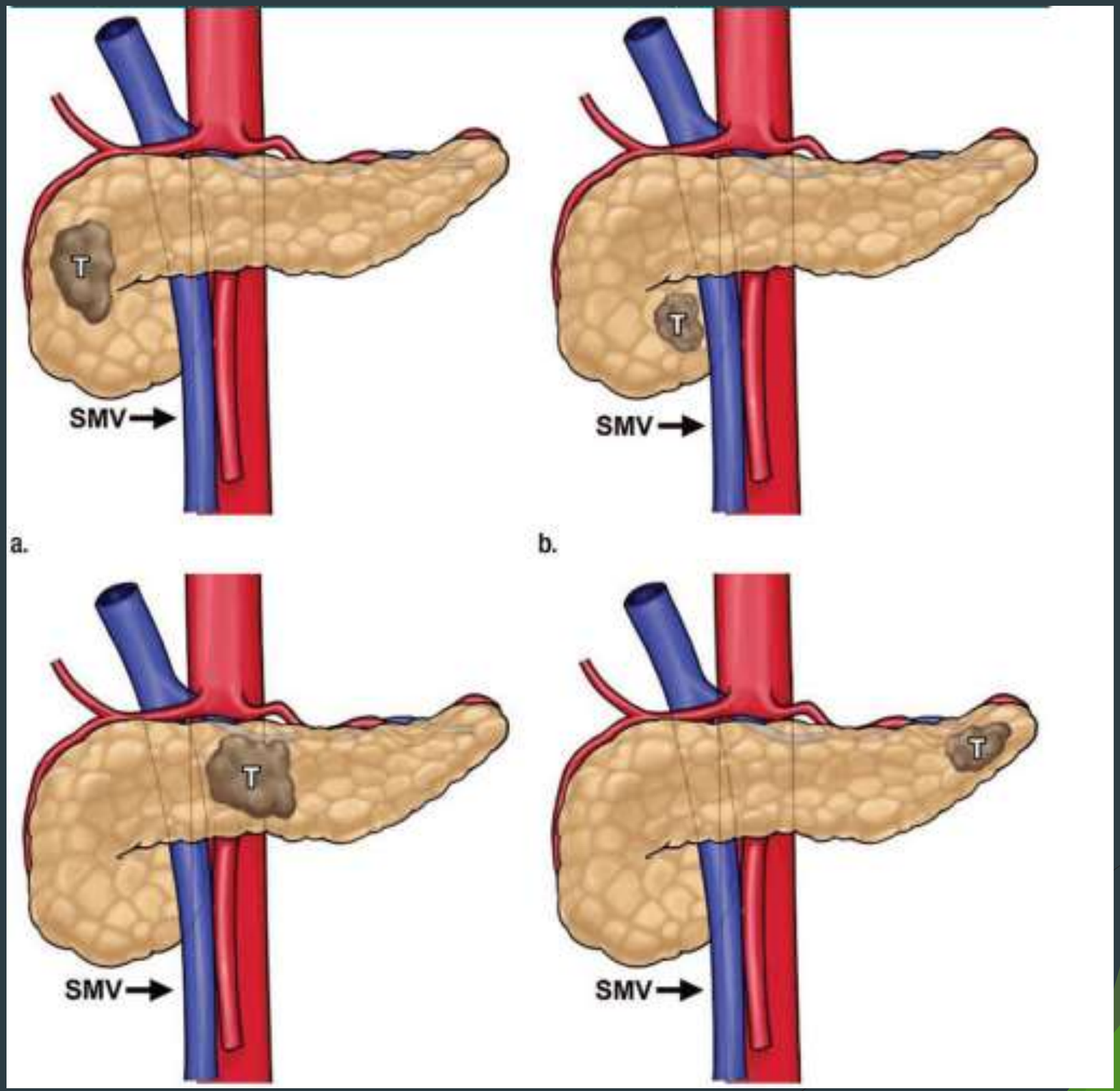




A 79-year-old woman with pancreatic ductal adenocarcinoma. (A) Axial pancreatic phase CT image shows low attenuating mass (arrow) in the pancreatic head (B) Magnetic resonance cholangiopancreatography (MRCP) image shows dilatation of the bile and pancreatic ducts, the so-called **double duct sign** (open arrowheads). Note the abrupt narrowing of both bile and pancreatic ducts.



The location



Resectable or Irresectable (That's the question)

Accurate detection and staging are essential for ensuring appropriate selection of patients who will benefit from surgery and for preventing unnecessary surgeries in patients with unresectable disease.

If the tumor is **correctly** determined to be resectable , survival is 15-20% after 5 years.

If the tumor is **incorrectly** thought to be resectable ,survival after Whipple is no better than chemoradiation .

- The positive predictive value of CT for determining non resectability is very high (89%–100%); however, it is lower for predicting resectability (45%– 79%)

CT is effective for liver lesions >1 cm (sensitivity is 91%)

Sensitivity for carcinomatosis is only 23-37%

Resectable

1) Limited ingrowth into the peripancreatic fat.
2) The presence of peripancreatic lymphnode metastases.
3) Tumor ingrowth into the duodenum or the gastroduodenal artery (the duodenum can be resected en-bloc with the tumor).
4) When there is contiguity between the tumor and the portal or superior mesenteric vein, but the vessel is surrounded by tumor for less than half the circumference.

Not resectable

1) Tumor ingrowth into inferior vena cava or aorta.
2) The presence of hepatic metastases, peritoneal metastases or para-aortic lymphnode metastases .
3) Mesenteric lymph node not immediately adjacent to the pancreas.
4) Ingrowth into the celiac axis, hepatic artery or superior mesenteric artery.

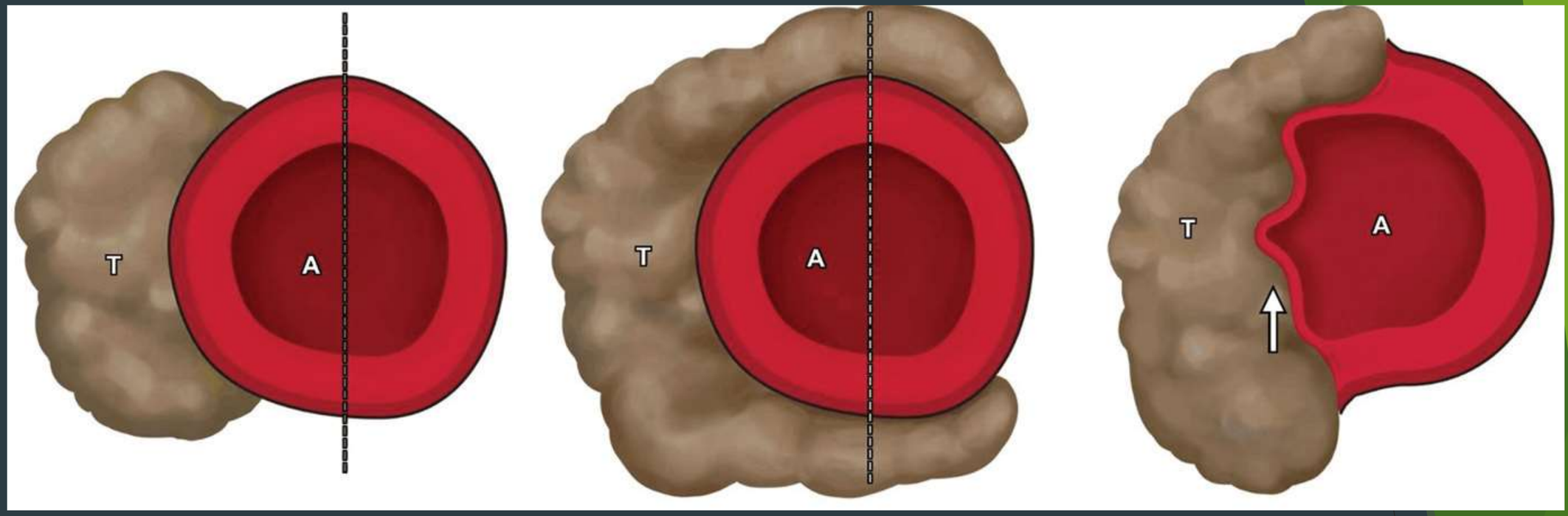
NCCN Criteria for PDA Staging

Stage	Arterial	Venous
Resectable	Clear fat planes around CA, SMA, and HA	No SMV/portal vein distortion
Borderline resectable	Gastroduodenal artery encasement up to the hepatic artery with either short segment encasement or direct abutment of the hepatic artery without extension to the CA. Tumor abutment of the SMA not to exceed greater than 180° of the circumference of the vessel wall	Venous involvement of the SMV or portal vein with distortion or narrowing of the vein or occlusion of the vein with suitable vessel proximal and distal, allowing for safe resection and replacement
Unresectable*‡	Aortic invasion or encasement. Based on tumor location: Pancreatic head—More than 180° SMA encasement, any CA abutment, IVC Pancreatic body/tail—SMA or CA encasement greater than 180°	Unreconstructible SMV/portal vein occlusion

Note.—CA = celiac axis, HA = hepatic artery, IVC = inferior vena cava.

* The presence of distant metastasis, including metastases to lymph nodes beyond the field of resection, renders the patient unresectable irrespective of the type of vascular involvement.

‡ Extension to adjacent structures such as transverse colon or mesocolon, stomach, spleen, adrenal gland, or kidney is not a definite contraindication to surgical resection, since these structures can be resected along with the primary tumor.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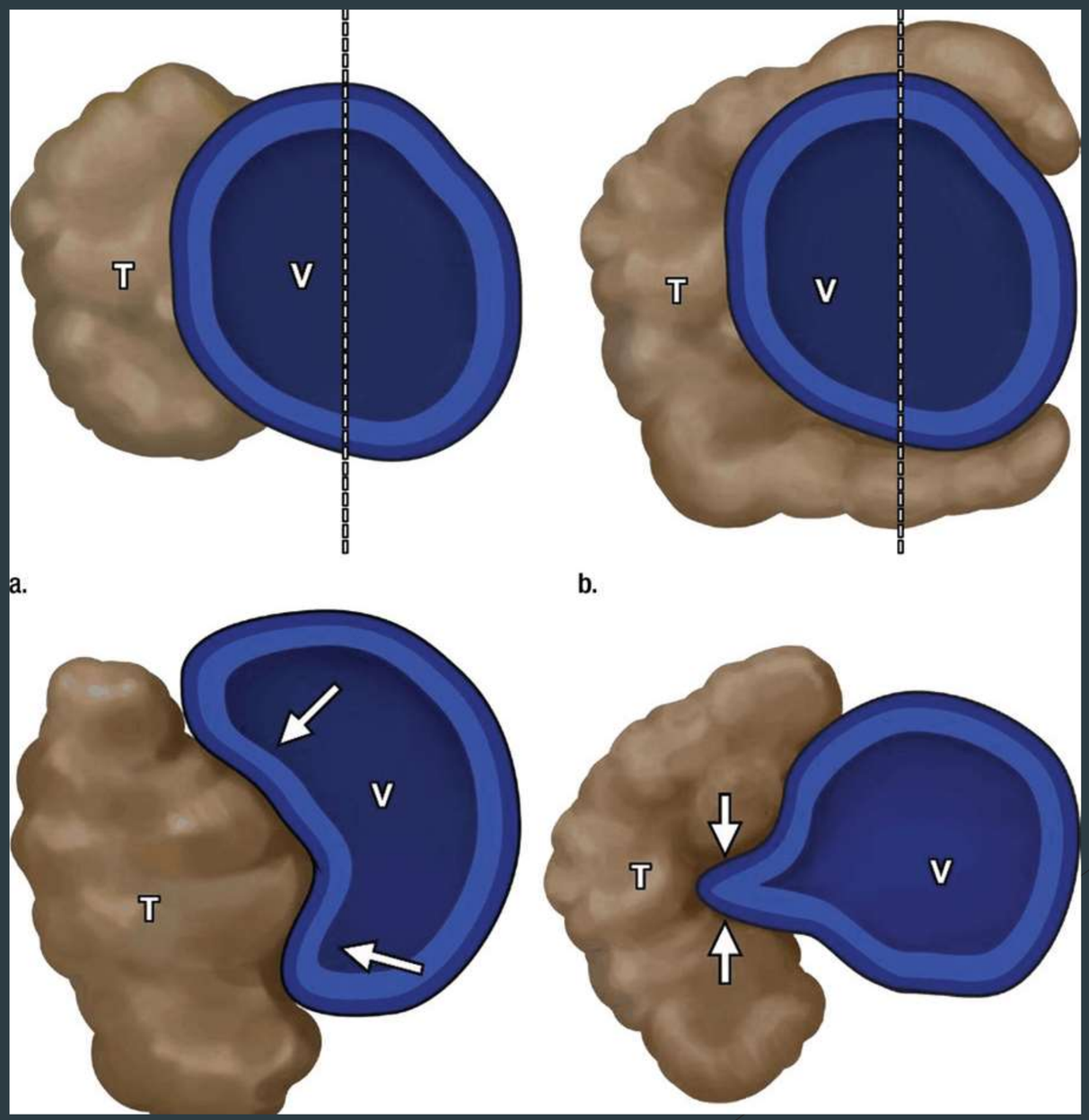
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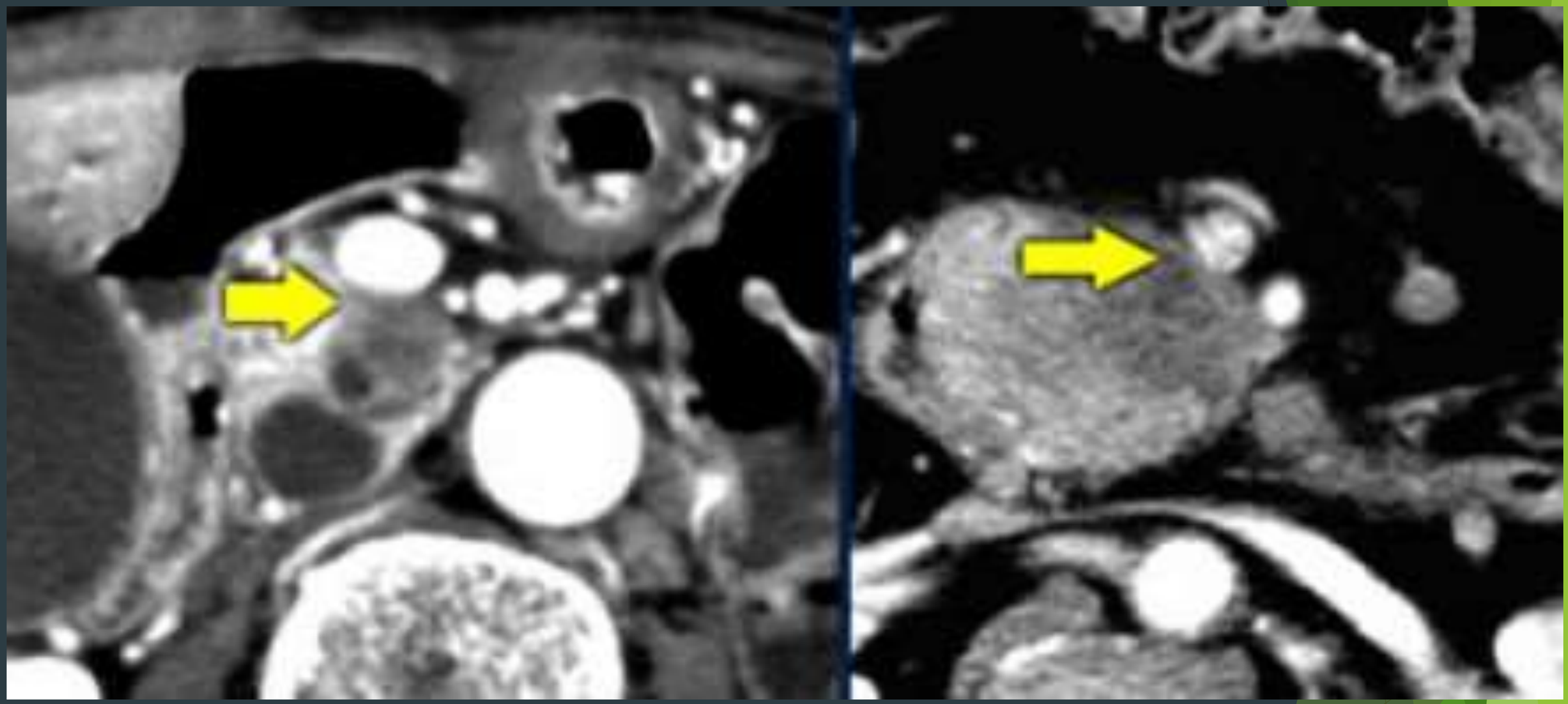
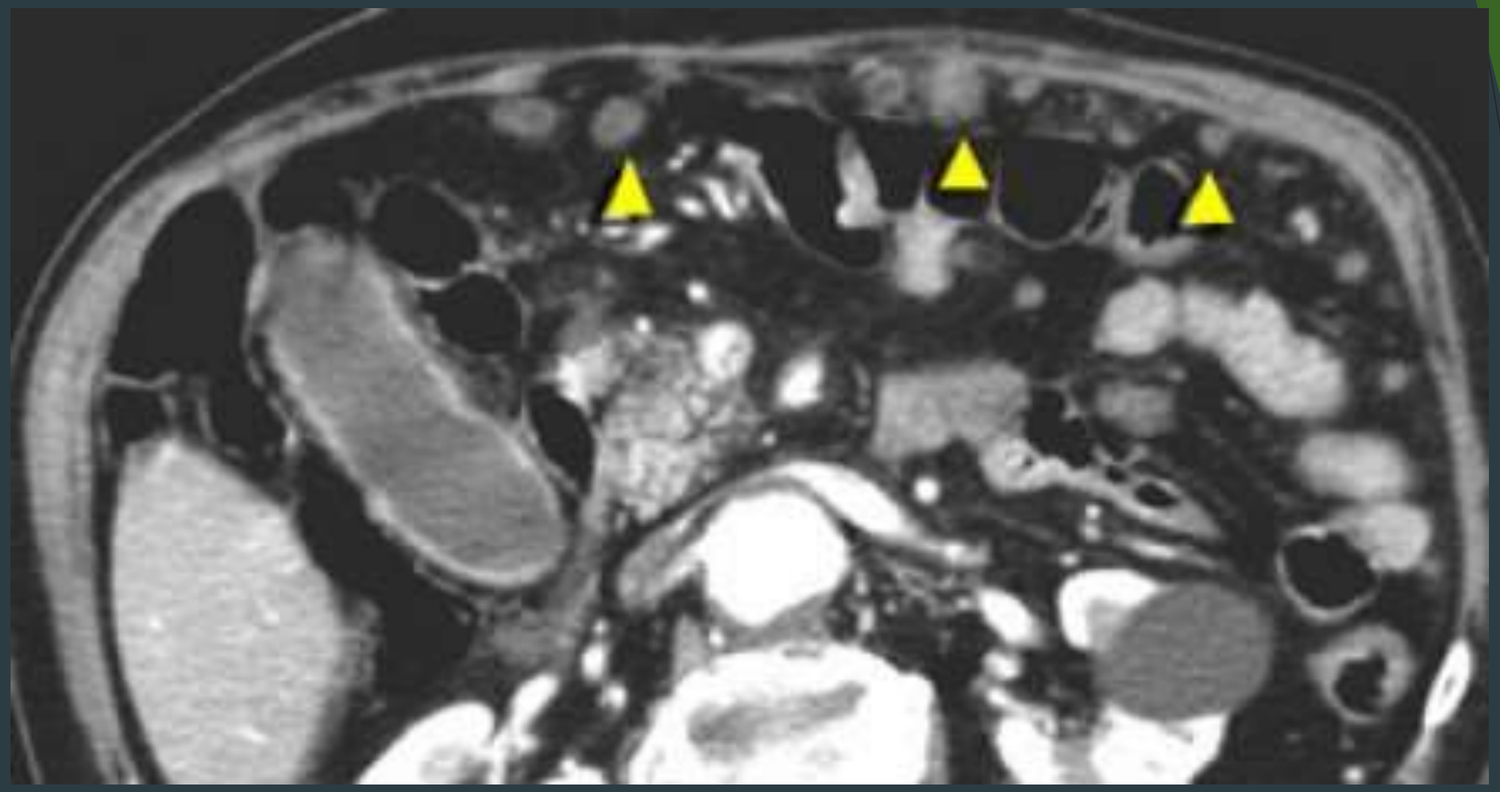
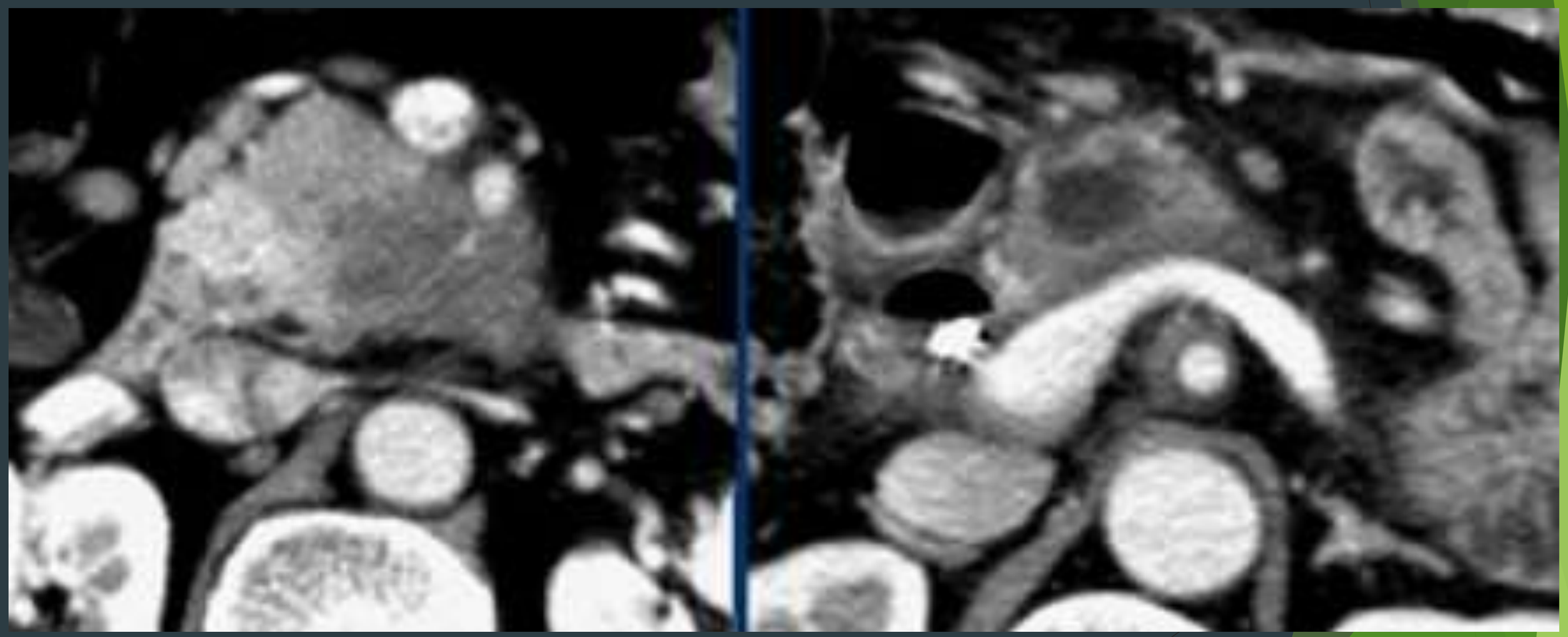
Resectable

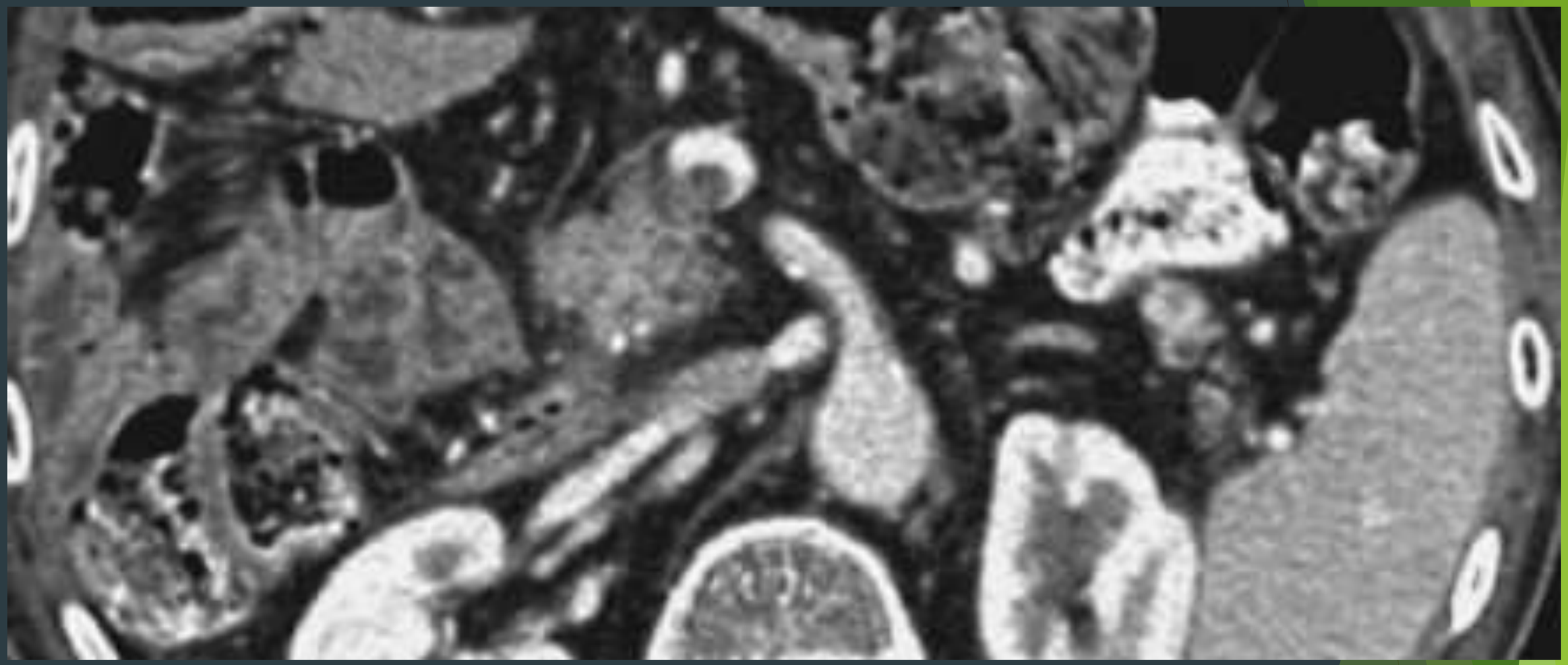






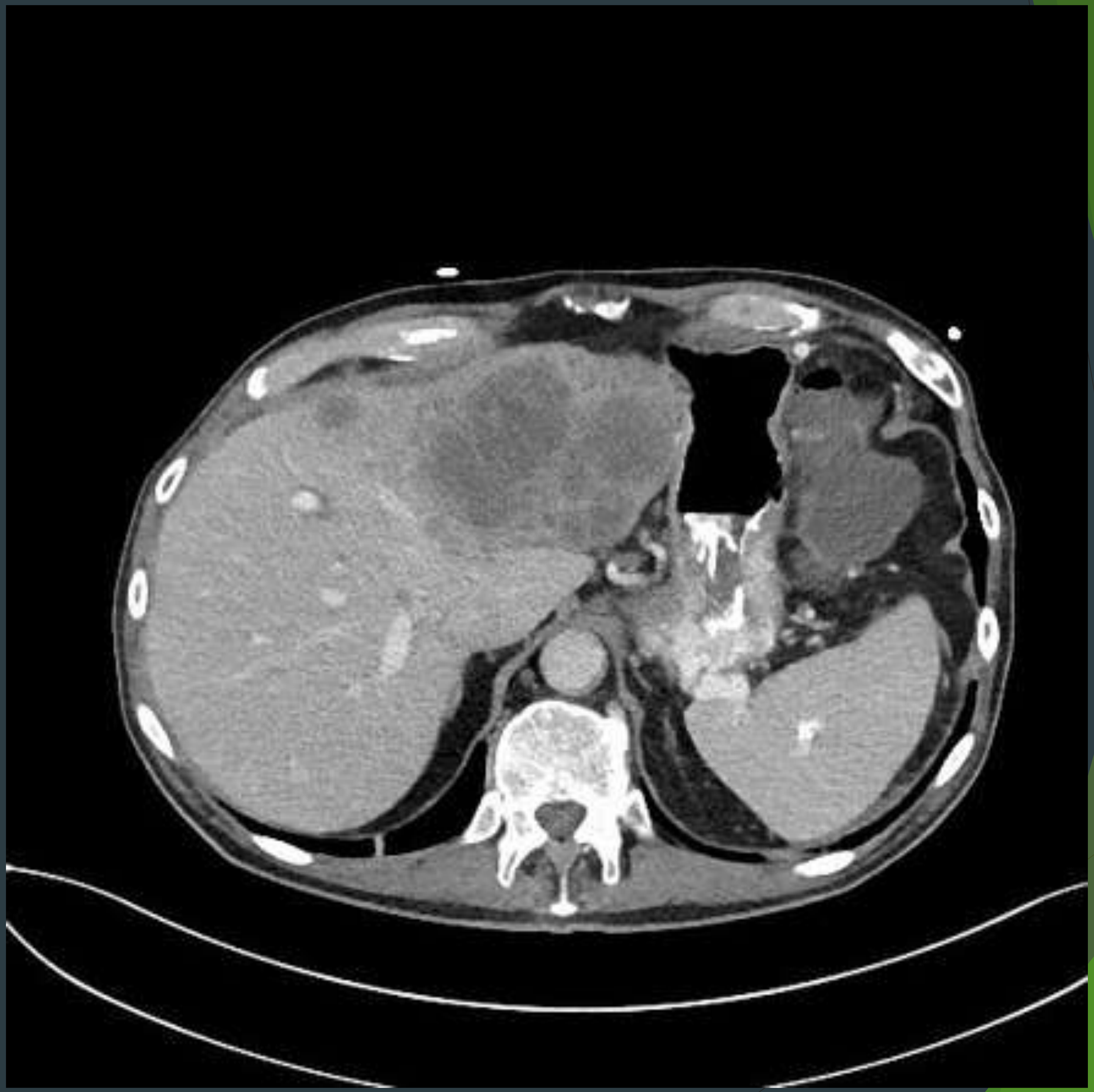
Irresectable tumor surrounding the SMA >180

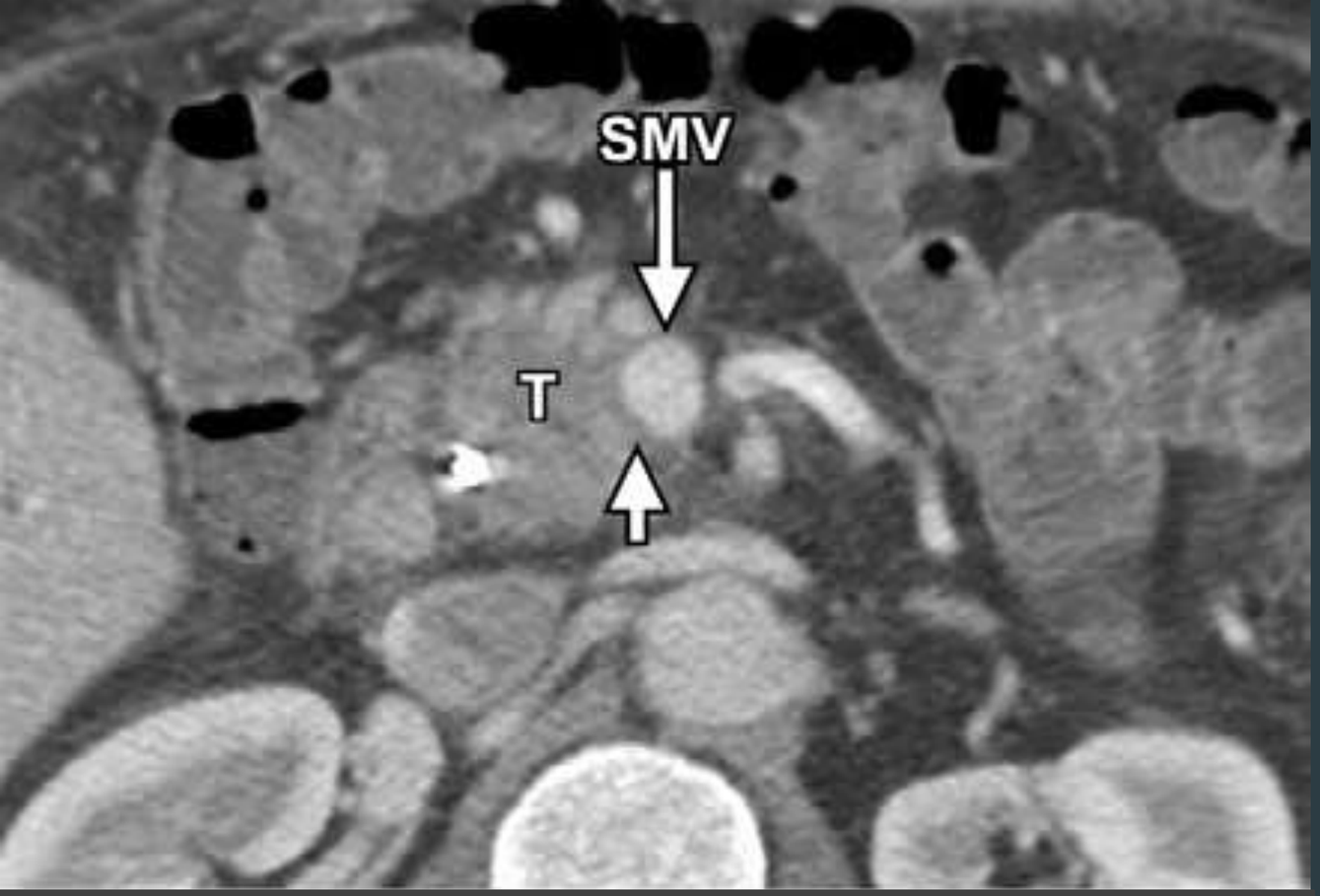
Irresectable tumor totally surrounding the SMA

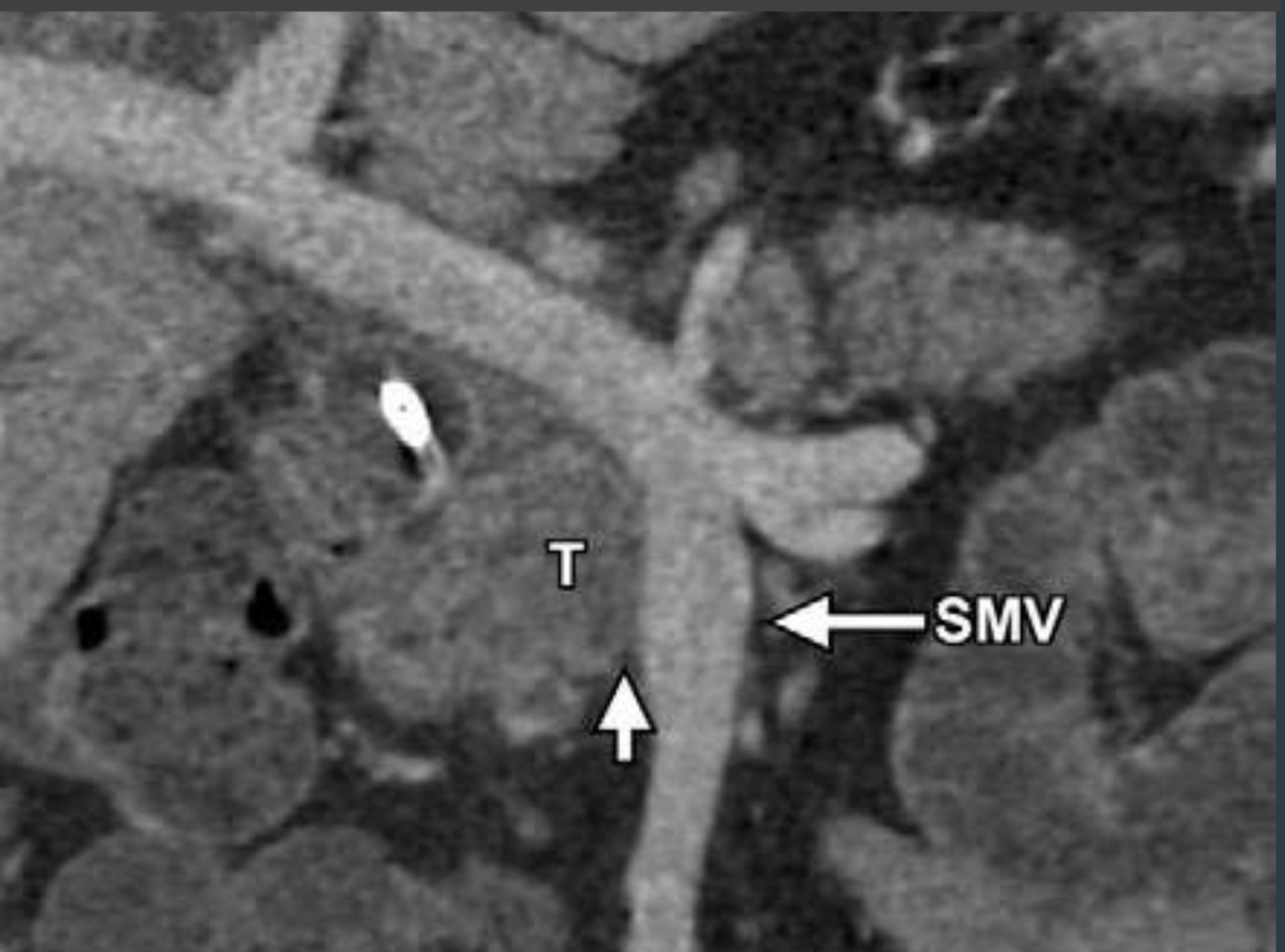


Tumor thrombus is present in the lumen of the superior mesenteric vein

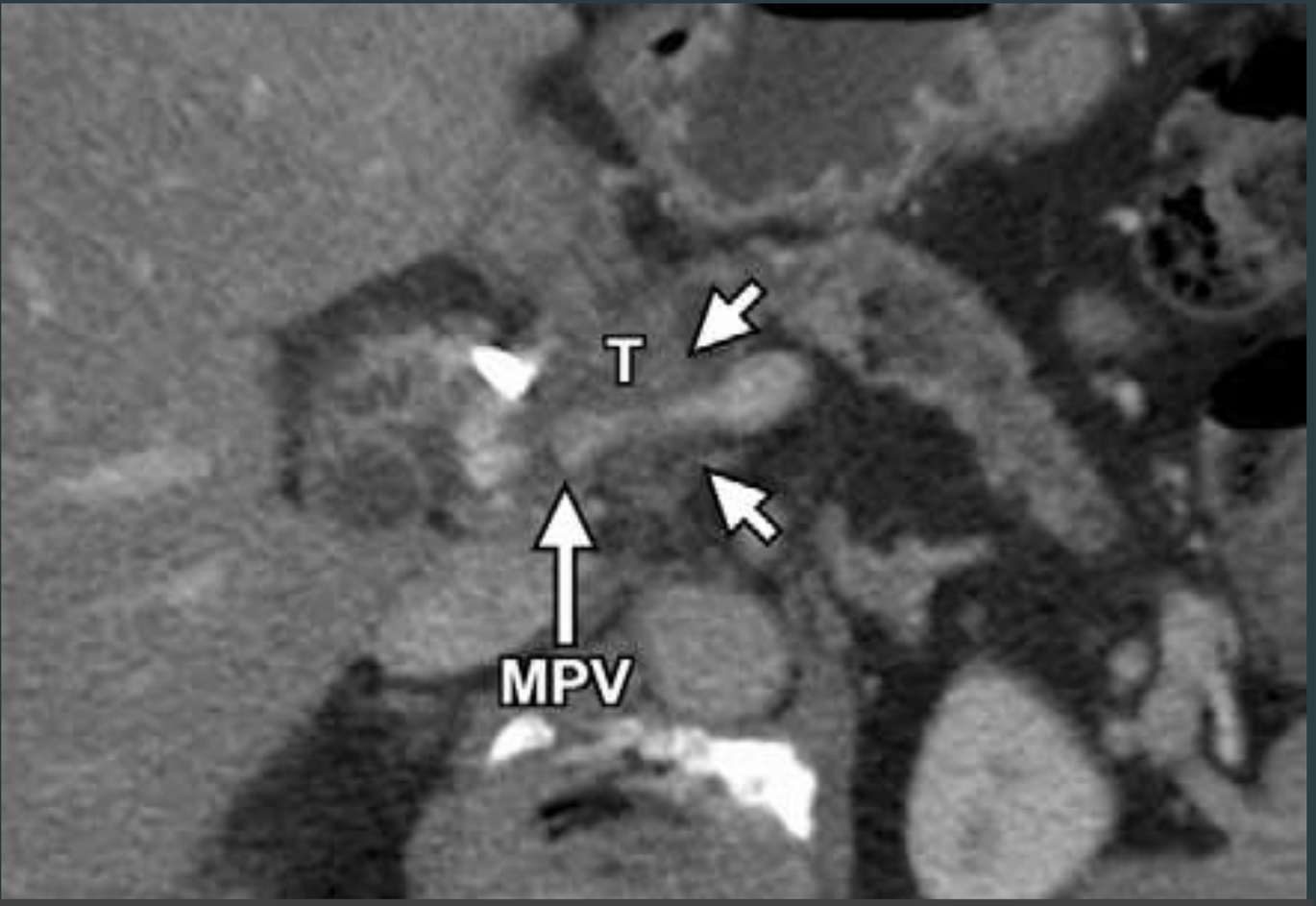
Teardrop sign of the SMV

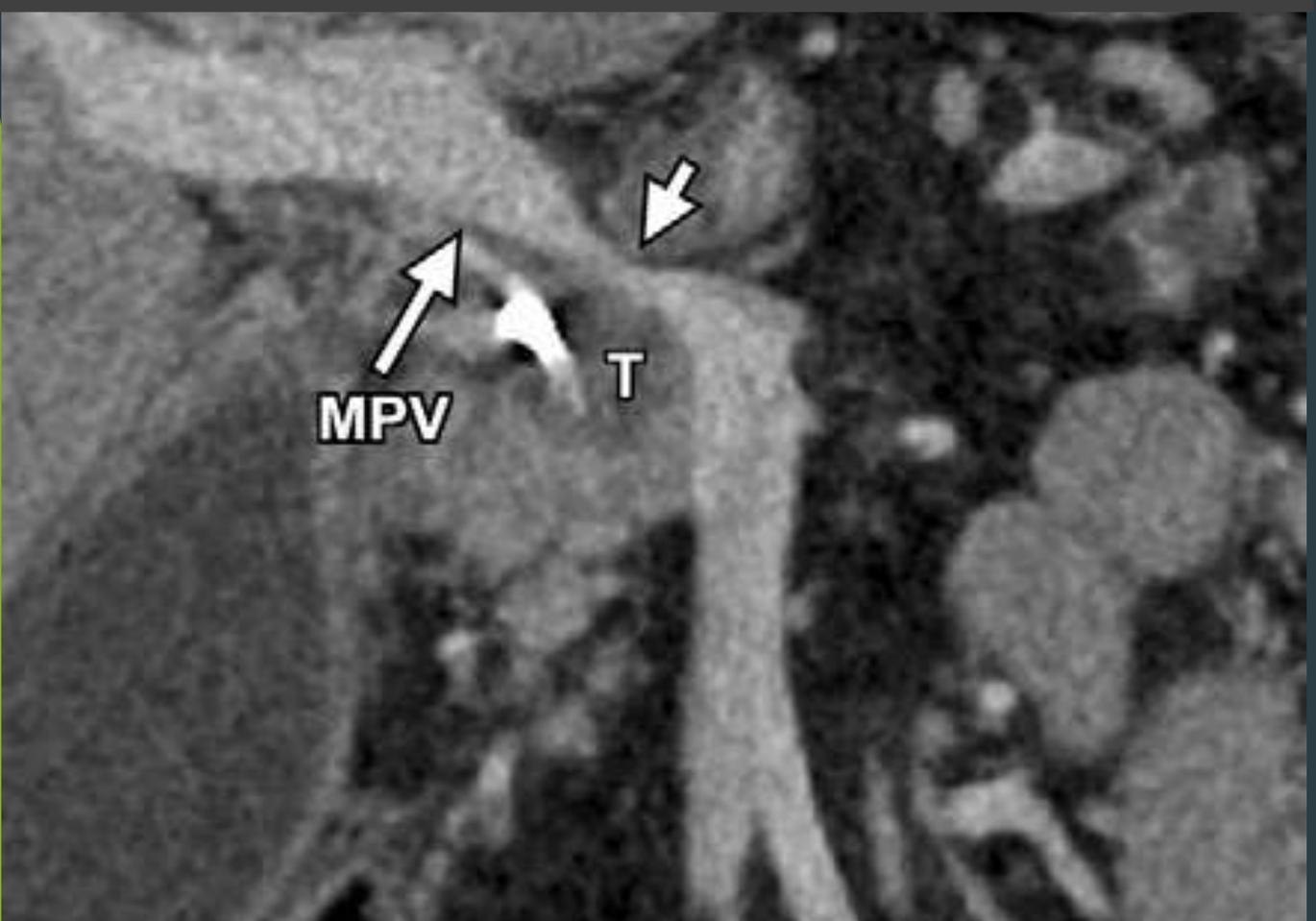






Images in a 55-year-old women with tumor with **less than 180°** of contact with the SMV. he limited tumor contact with the SMV and the identification of suitable vessel proximal and distal to the lesion, which allows safe resection and venous replacement, places the patient in the **borderline resectable** category.





Images in a 76-year-old man with tumor with **more than 180°** contact with the main portal vein (MPV). The focal vessel narrowing and length of contact is better delineated on the coronal view (short arrow). Despite the degree of tumor contact with the MPV, the presence of suitable vessel proximal and distal to the narrowing potentially allows for safe resection and venous replacement**(borderline resectable)**

Differentiating NET from Adeno CA

- It is important to differentiate NETs from other tumors of the pancreas, particularly adenocarcinoma, since the prognoses (NET patients have a better prognosis) and treatment options differ.

1. Enhancement. Adenocarcinoma is a hypovascular tumor, whereas NET is generally hypervascular.
2. Calcification. Only 2% of adenocarcinomas show calcification, compared with 20% of NETs.
3. Vascular involvement. Adenocarcinomas are associated with vascular encasement, whereas malignant NETs may show vascular infiltration with tumor thrombus.
4. Ductal involvement. Adenocarcinoma has a high propensity for ductal obstruction, but this finding is uncommon in NET.
5. Central necrosis and cystic degeneration are more common in NETs than in adenocarcinomas.

Neuroendocrine tumor with central necrosis

Patient s complain: Central abdominal pain for more than one month

CT scan of the abdomen (with IV contrast) :

- **The pancreas shows** an ill defined hypodense mass lesion infiltrating the neck, body and tail sparing the head and the uncinate process with associated peripancreatic fat stranding (measures about 9.5 x3 cm axial D.)(**Picture suggest pancreatic malignancy),**

- The mass causes distal pancreatic duct dilation(5 mm), normal caliber CBD
- **There is associated :**

- 360 degree encasement to the proximal splenic artery and proximal hepatic artery
- Intact SMA
- 360 degree encasement and narrowing of the splenic vein
- More than 180 degree encasement of the portal confluence and proximal portal vein with the remaining intact part up to the bifurcation measures about 4.5 cm
- More than 180 degree encasement of the proximal end of the SMV with distortion with the remained intact distal part down to nearest territory is about 2.5 cm

- No obvious invasion to the nearby structures (stomach and duodenum)

- **Normal size liver, of normal density , no SOL**
- **Normal size GB ,mild diffuse thickened wall , with radiodense stones inside**
- No dilated intrahepatic biliary tree
- **Normal caliber CBD despite radiodense stones seen at its distal end**
- Normal size spleen , of normal homogeneous density , no SOL.
- Both kidneys are of normal size , in normal position ,show normal parenchymal thickness , no stone , no dilated PCS , no ureteric dilatation ,a tiny simple cyst is seen at the Rt kidney
- No paraaortic LAP.
- No ascites.
- Partially filled UB , no stone

THANK YOU