



Pancreatic Ductal Adenocarcinoma and its Mimics: Key Imaging Features

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Introduction:

Pancreatic ductal adenocarcinoma (PDAC) is the commonest malignant neoplasm of the pancreas, comprising 85-95% of cases, and carries a meagre five-year survival rate of 5%. Diagnosing PDAC early remains a formidable challenge due to the absence of validated and specific screening tests and also because early disease is often clinically silent. Consequently, when clinical symptoms do emerge, the disease has frequently advanced significantly.

Accurate differentiation from less invasive or benign mimics is crucial before planning surgical interventions with curative intent, given that 5 to 10% of pancreatectomies for suspected PDAC yield alternative histopathological diagnoses, resulting in unnecessary major surgical procedures and associated morbidity.

Learning Objectives

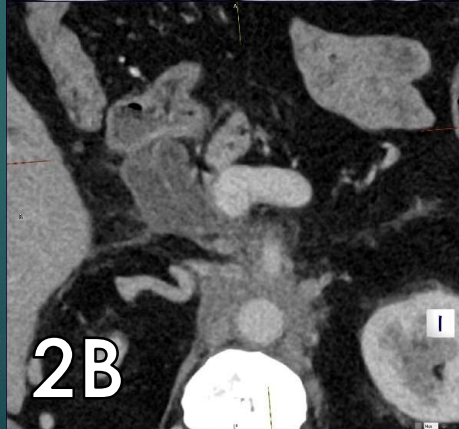
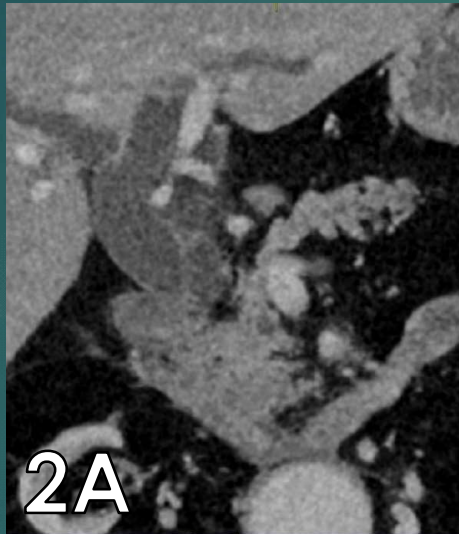
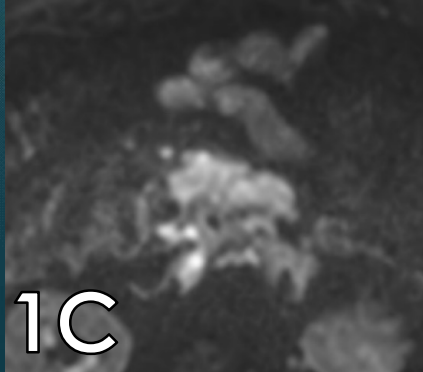
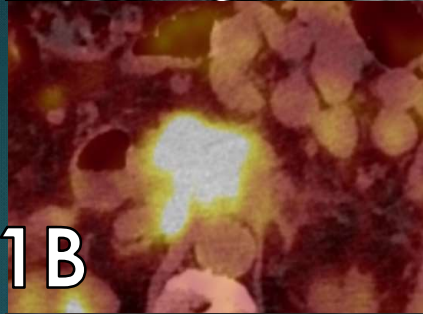
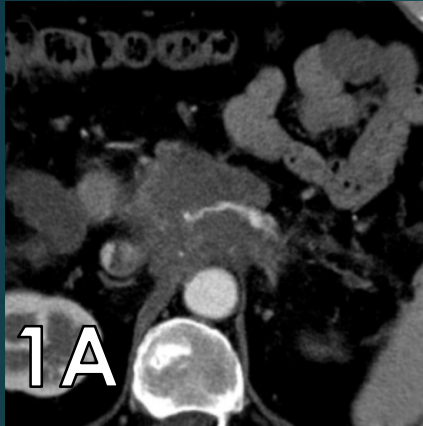
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To Illustrate the key imaging features (morphology, vascular and extrapancreatic) of PDAC

2

To Illustrate the key imaging features of mimics of PDAC and how to differentiate.

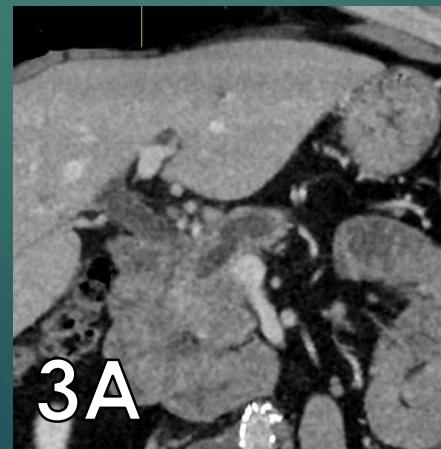
PDAC – Imaging Features



Morphology – Typically hypoattenuating (Fig 1A), 10% are iso (Fig 3A) and are difficult to diagnose unless presence of secondary signs (Focal bulge, Mass effect, Upstream duct dilatation, Abrupt duct narrowing, Double duct and Distal atrophy). Hot spot on PET (Fig 1B) and diffusion restriction (Fig 1C)

Vascular – encasement of vessels, loss of perivascular fat, vessel deformity (Fig 1A)

Peripancreatic – Peripancreatic infiltration of adjacent retroperitoneal organs (Fig 2A-B)



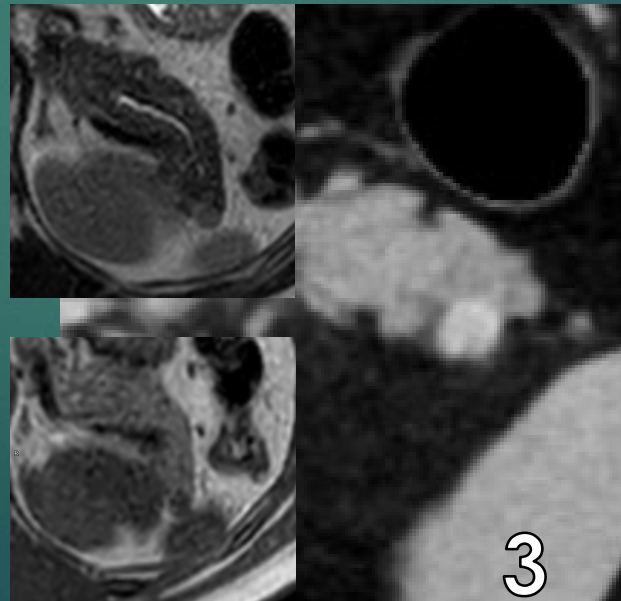
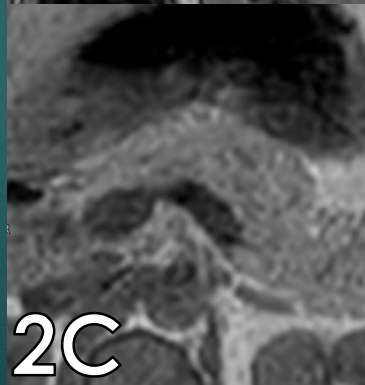
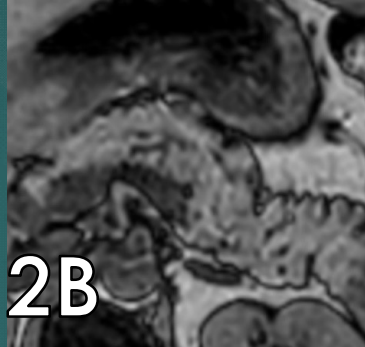
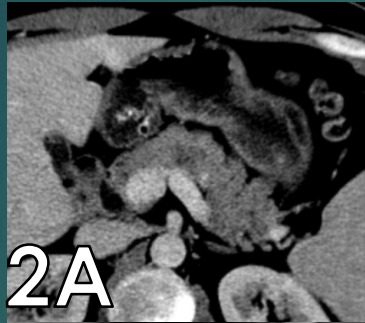
Benign lesions

Congenital variants (annular pancreas)

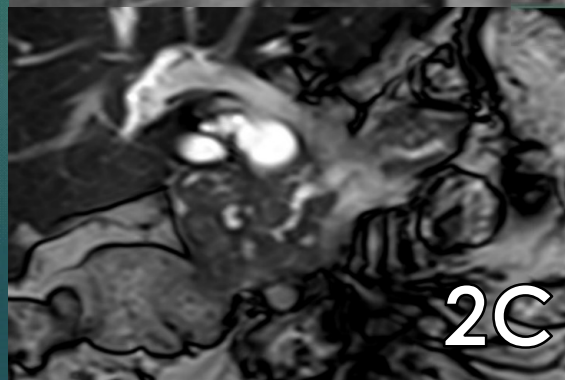
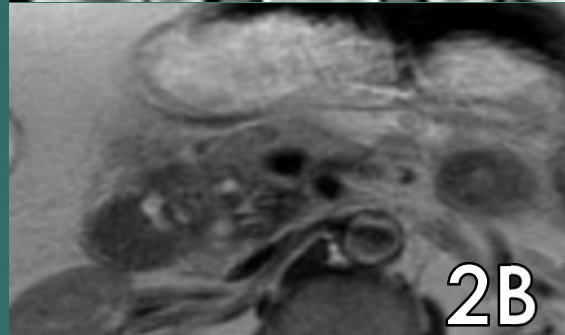
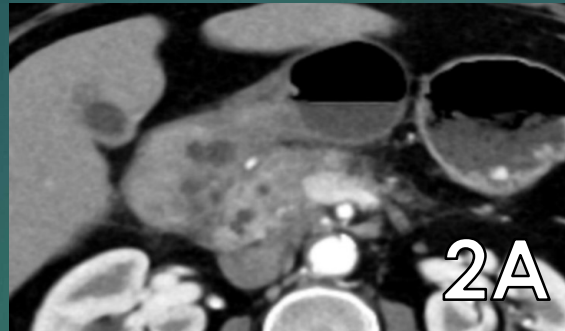
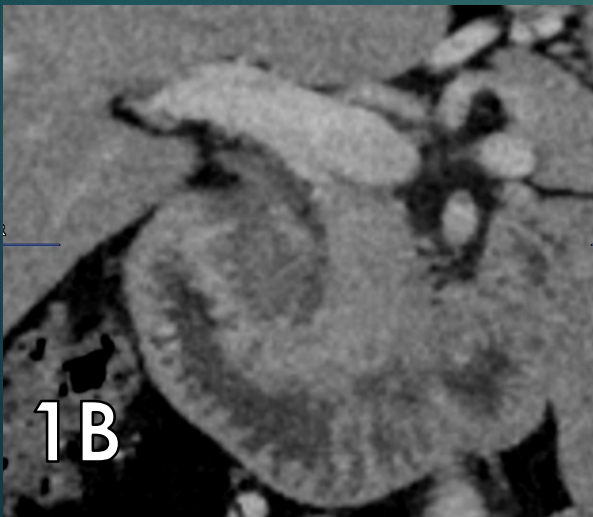
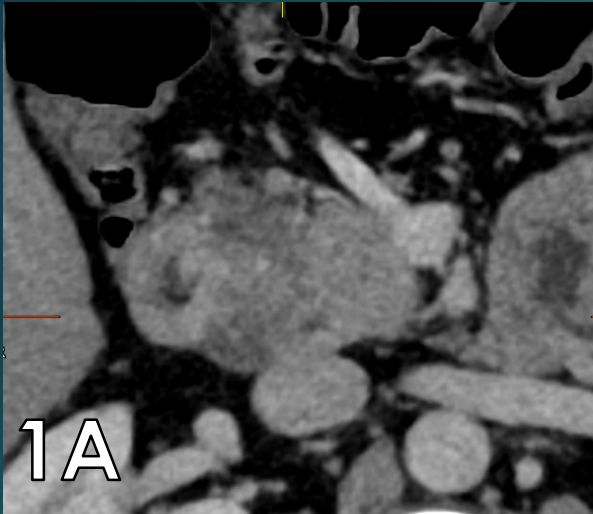
Intra-pancreatic Splenunculi – Typically small (1-3 cm), well defined and attenuation follows spleen in all phases (Fig 3).

Vascular lesions – AVM's, Aneurysms (Porto-mesentric venous aneurysm – Fig 1A and B).

Fatty infiltration – Focal lesions are hypoattenuating and mimic PDAC. MRI In / out phase helps in differentiating (Fig 2A -C)



Groove Pancreatitis



Rare variant of focal pancreatitis, typical location- Groove between duodenum and CBD

Hypodense mass – similar to PDAC (1A,B)

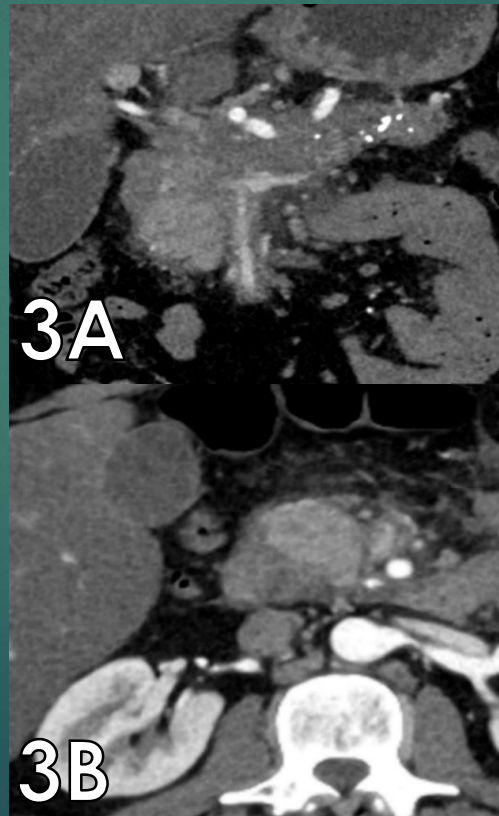
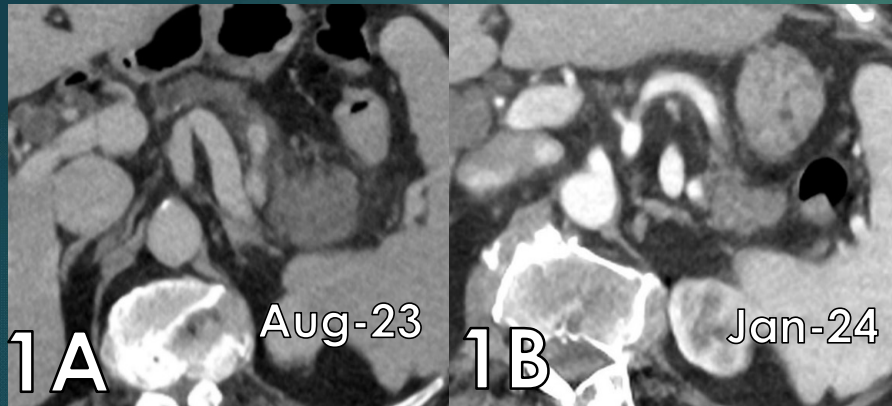
Fibrosis usually prominent so may cause duodenal stenosis, dilated ducts (2C).

💡 Thickened duodenal wall and cysts within the wall of duodenum (2A-C) and widening of groove

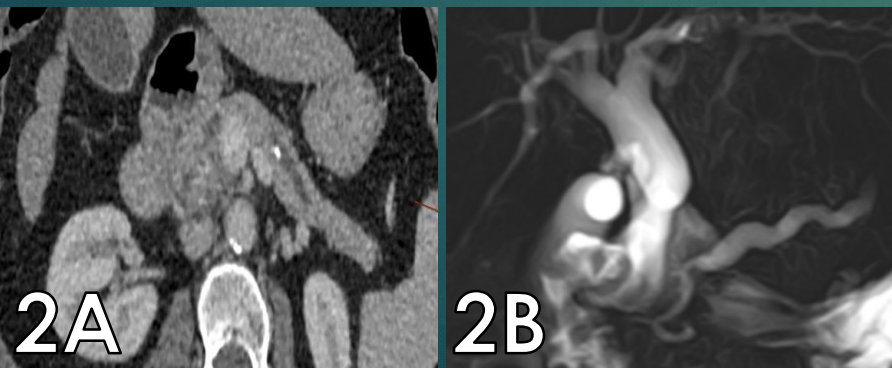
Mass forming Chronic Pancreatitis (CP)

Increased risk of pancreatic Ca in CP and risk diminishes with long term follow up. Risk of ca -16X in first 2 Yrs Vs 3.5X in 9 yrs follow up.

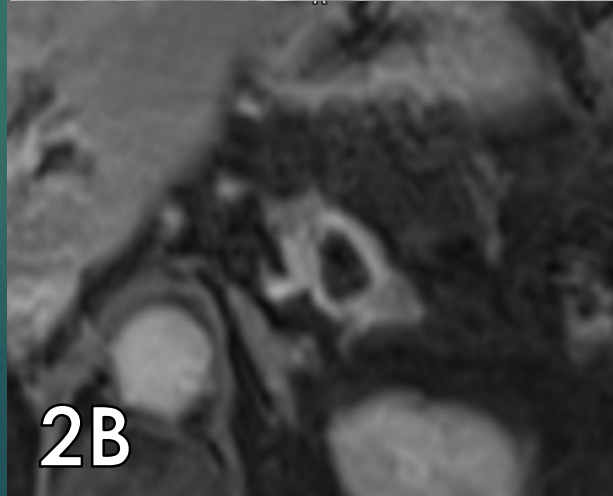
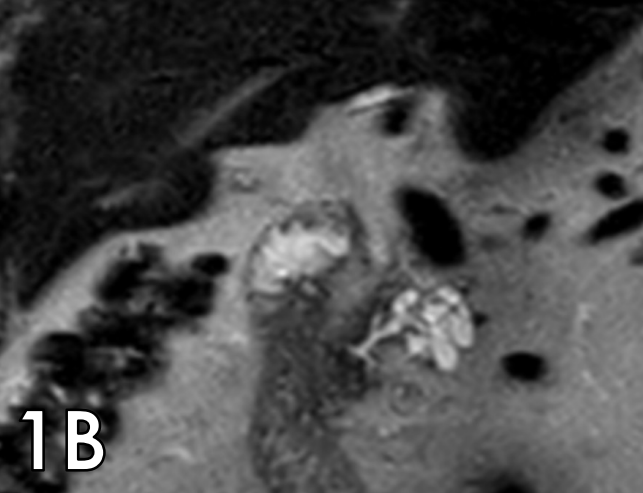
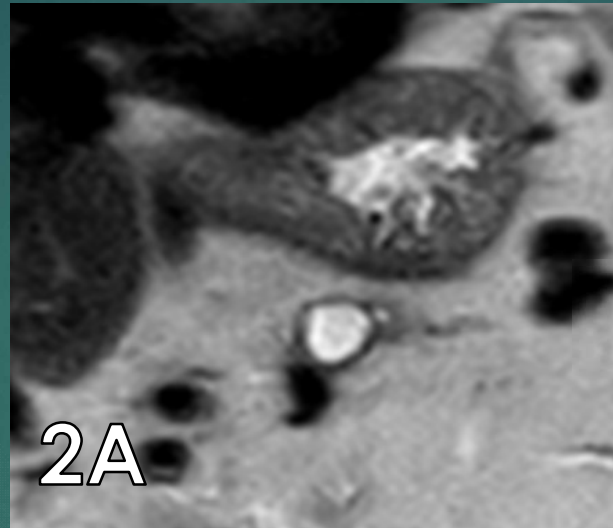
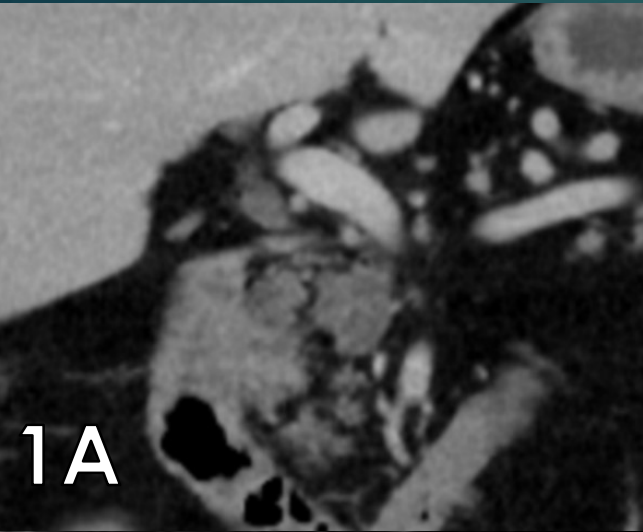
One of the trickiest and difficult mimicker to diagnose correctly, sensitivity of EUS guided biopsy also drops significantly to only 50-70%



- Usually hypo attenuating (Fig 1A-B) but can show variable enhancement (Fig 3) (Chronic Vs Acute on chronic)
- Parenchyma calcification in 60% (Fig 3A)
- **Duct calcification and duct penetrating sign – (Fig 2A-B)**
- Improvement in interval scans (Fig 1A-B)

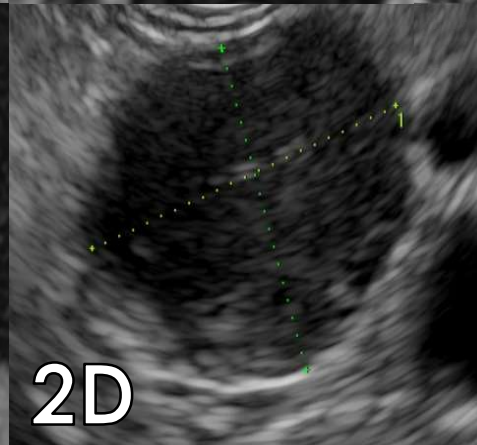
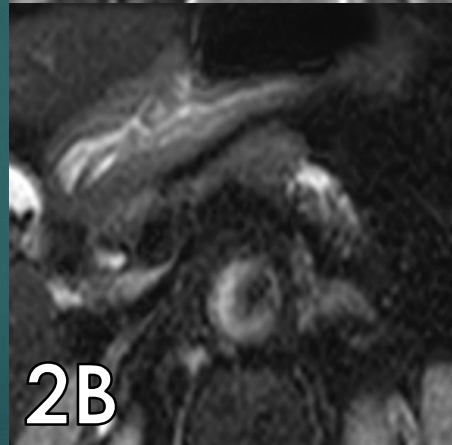
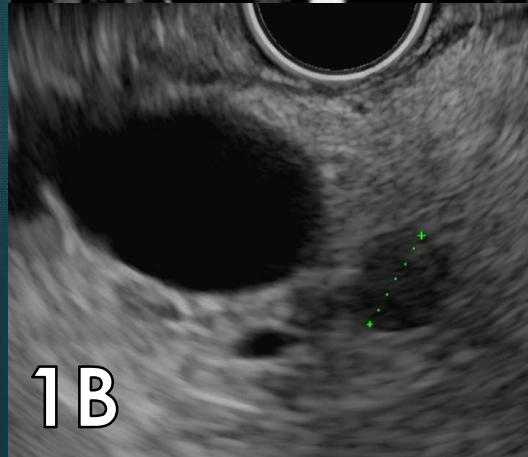
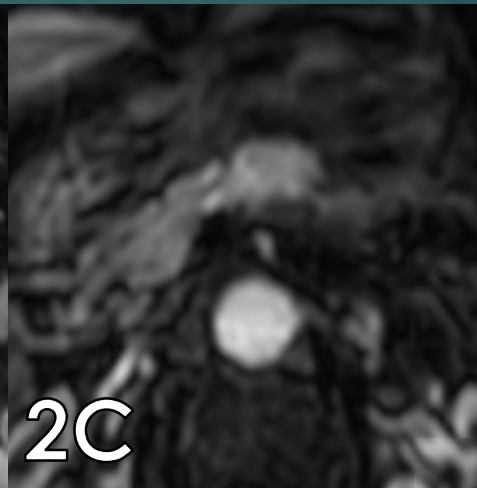
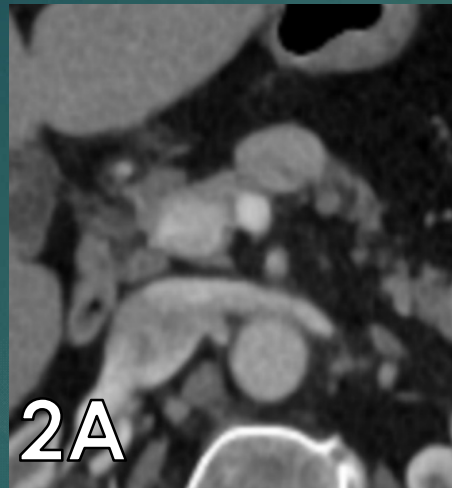
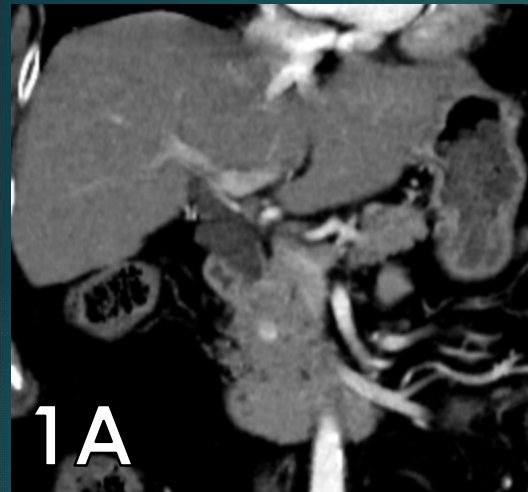


Intraductal Papillary Mucinous Neoplasm



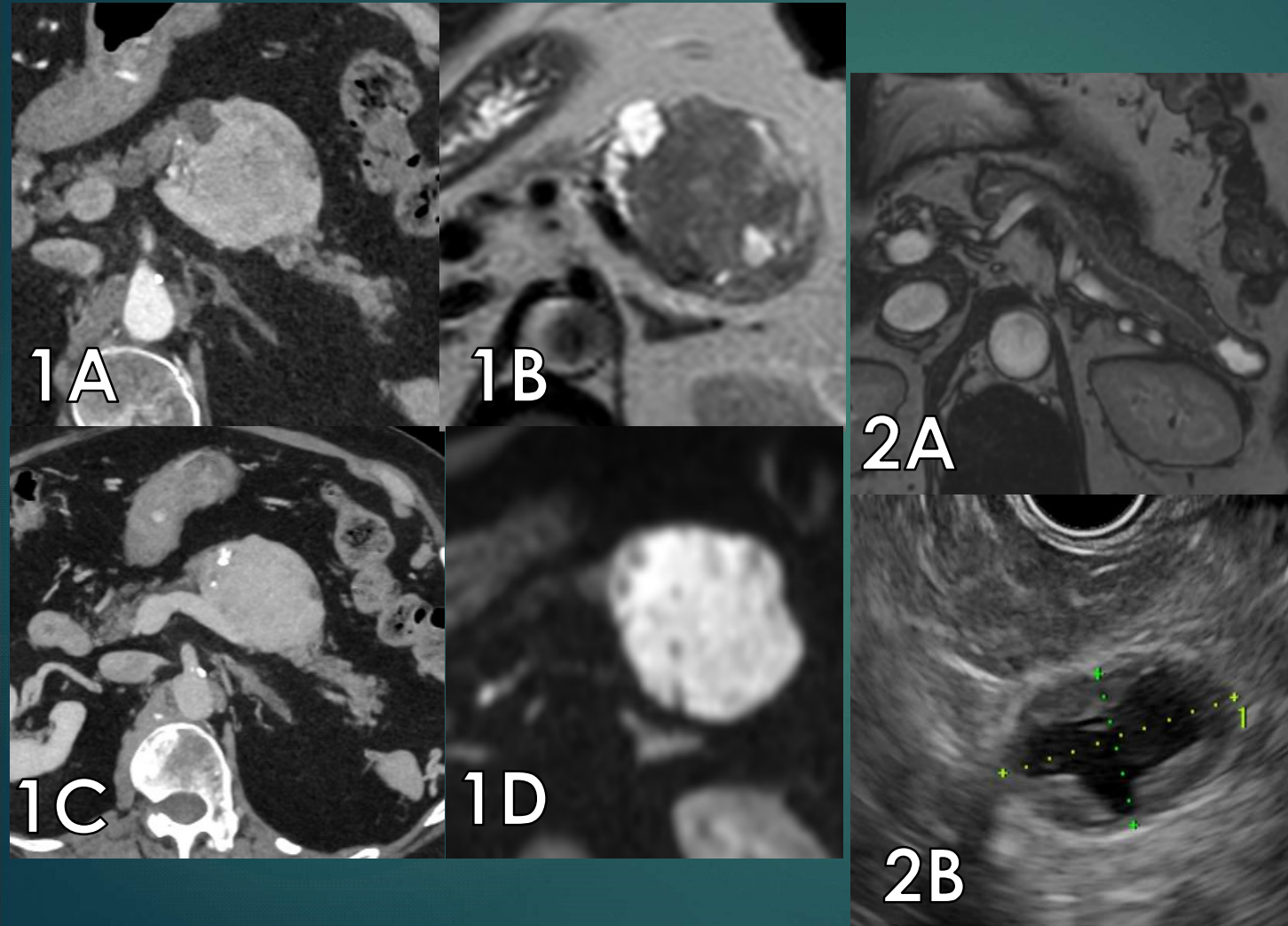
- Mucin producing tumor in main pancreatic duct or branch-duct.
- Pancreatic head > tail and body.
- **Must have communication with pancreatic duct, best seen on MRCP (Fig 1B).**
- Main-duct IPMN may present as significantly dilated pancreatic duct.
- Branch-duct type can look like other cystic neoplasms (Fig 1A-B)

Pancreatic Neuroendocrine Tumors (pNET)



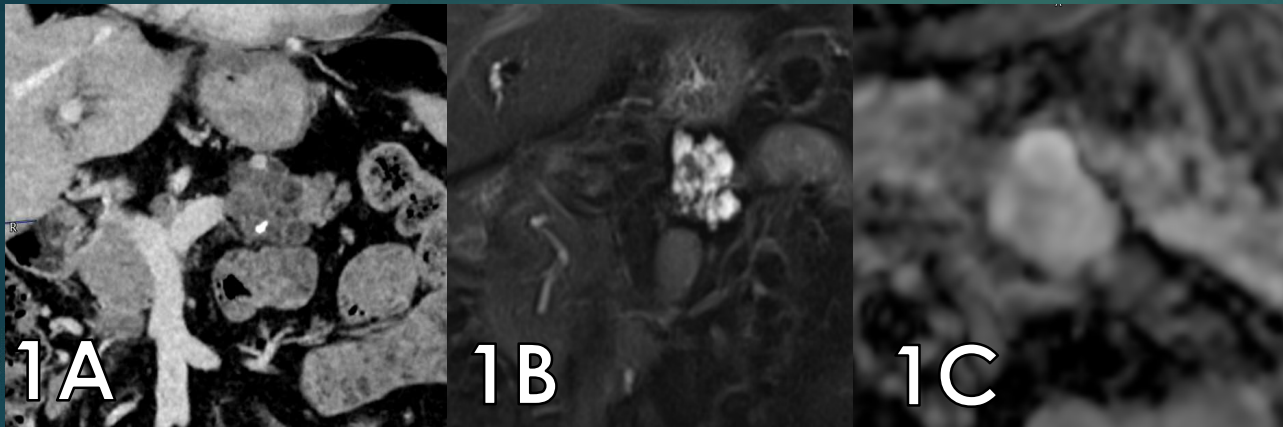
- Heterogeneous, potentially malignant.
- Upto 2 % of all pancreatic ca, of all 30% are functional.
- 💡 Well differentiated (Grade I and II) are typical small (<3cm), solid and hyper vascular (Fig 1 and 2).
- 💡 Small tumors are not typically associated with duct obstruction. However, when present is usually a feature of serotonin-producing tumors causing fibrotic stricture (Fig 2A and B)

Pancreatic Neuroendocrine Tumors (pNET)



- Well differentiated grade 3 pNET are large (>3 cm) with irregular margins and show variable enhancement. They are heterogeneous due to necrotic / cystic changes and may show calcification (Fig 1 A-D)
 - Cystic pNET were classically considered very rare; however, recent published studies suggest 10-20% of all pNET.
- 💡 Peripheral rim of tissue is key feature of cystic pNET and may show more enhancement than normal parenchyma (Fig 2A-B)


Common Cystic Neoplasms

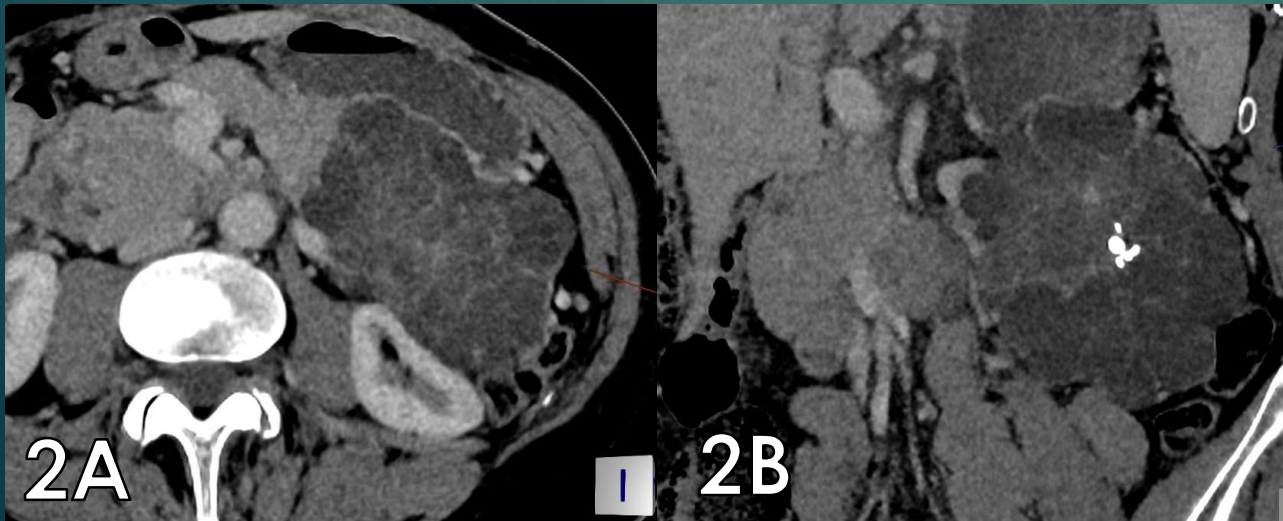


Serous cystadenoma



Mucinous

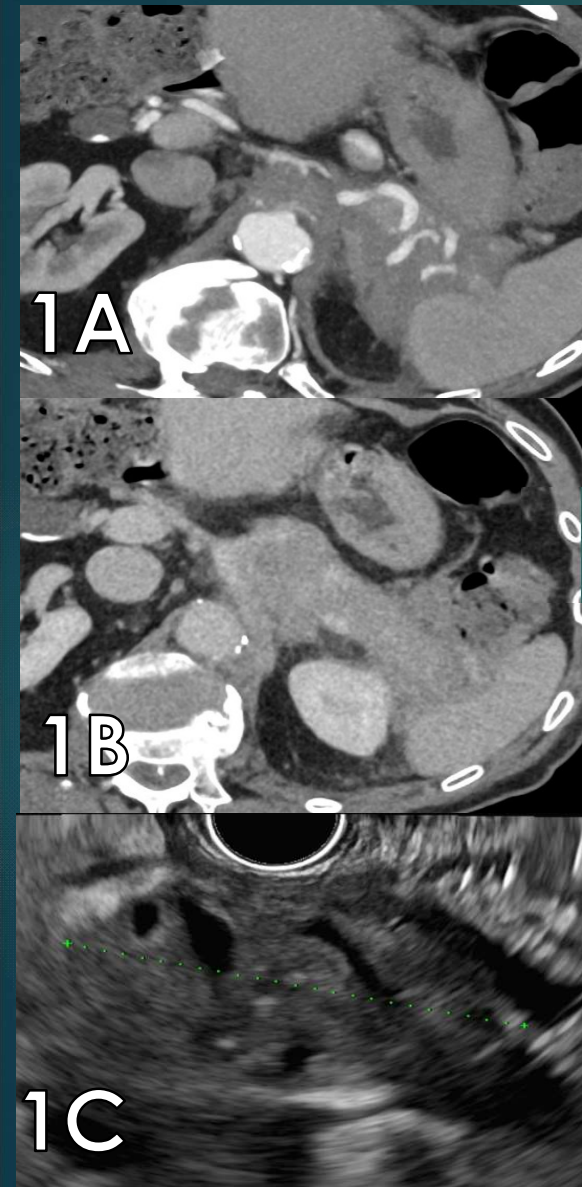
- Mucinous cystic neoplasm - usually a unilocular cyst filled with mucin, may show wall, exclusively in 40 – 60 year old women.
- Serous cystic neoplasm - Lobulated, microcystic (45%, cysts < 2 cm) macrocystic (32%).
-  A characteristic feature of a serous cystic neoplasm is a central scar, sometimes with calcifications (Fig 1 and 2).
- MRI is useful to see if cysts communicate with the pancreatic duct D/d IPMN



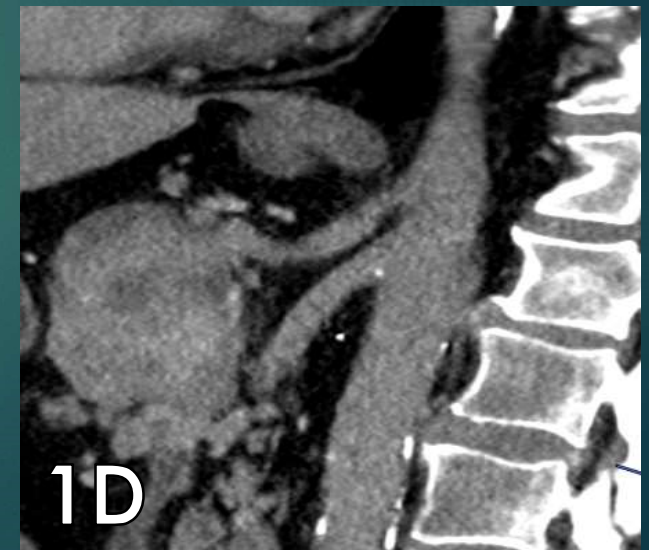
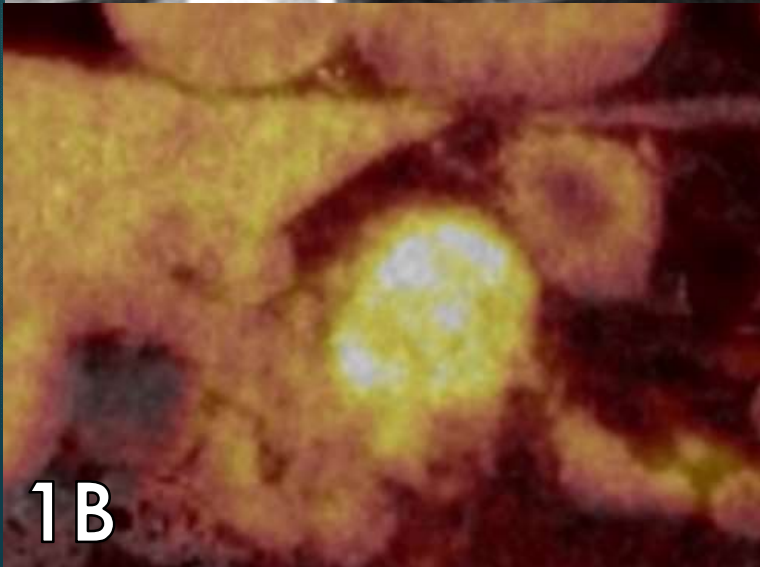
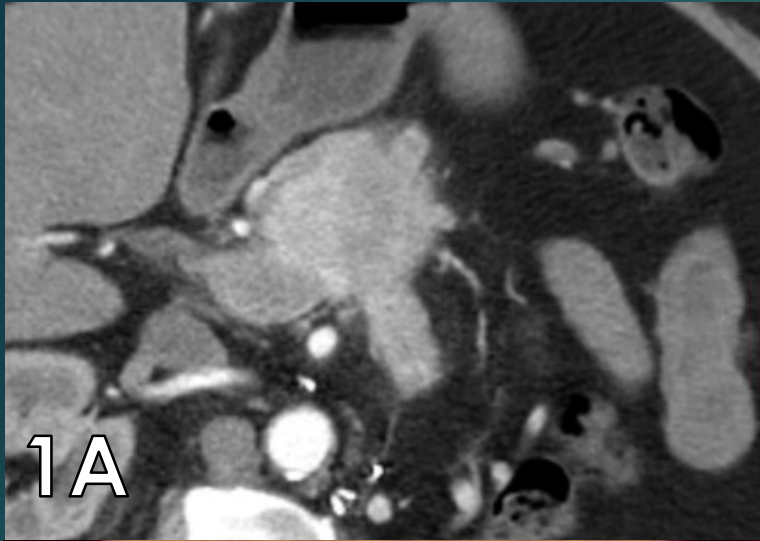
Pancreatic Lymphoma

- <5% of all pancreatic masses, potentially curable disease.
- Often bulky, hypovascular and tend to infiltrate adjacent structures (Fig 1 A-C), may show splenomegaly and /or bulky L nodes (Fig 2 A-C).

💡 Pancreatic duct mostly non dilated and encases vascular structures without obstruction or occlusion.



Pancreatic Metastasis



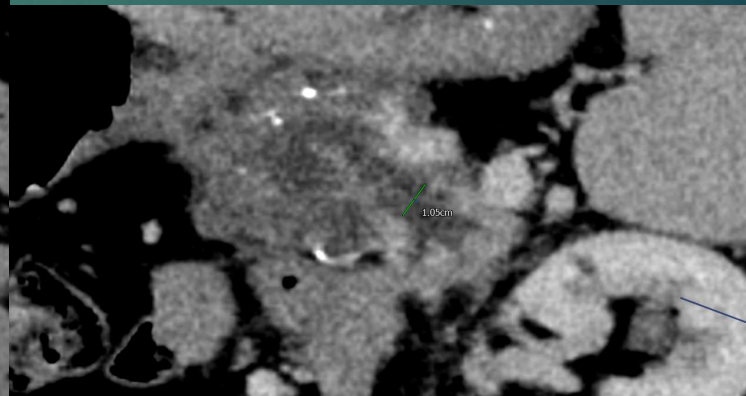
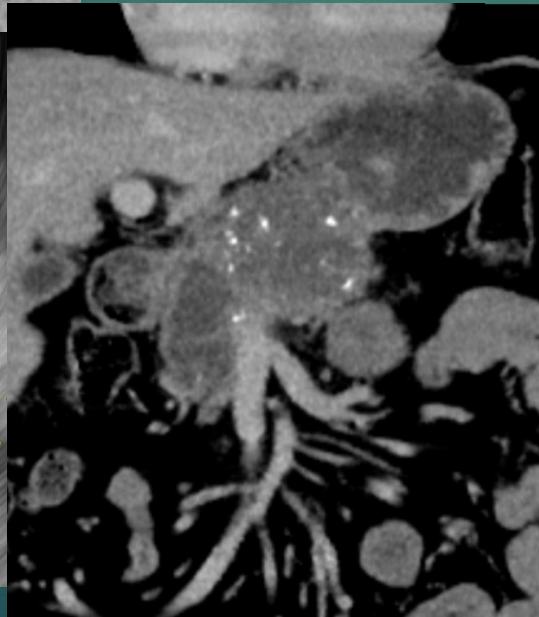
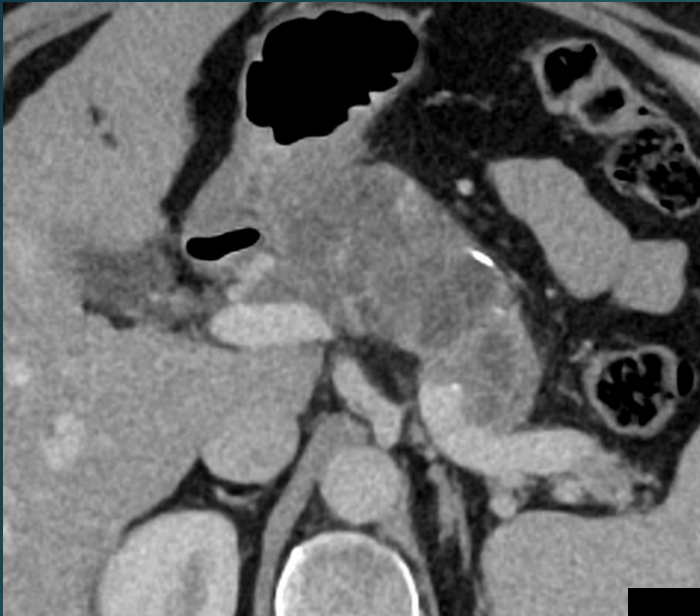
- Uncommon; RCC (30%) and Lung cancer (23%). Imaging appearance varies and reflects primary lesion. Hyper vascular in RCC (Fig 1 A-D) and hypo in lung primary.
- 💡 In presence of another primary and pancreatic mass without duct dilatation and or vascular invasion think of metastasis before PDAC

PDAC In IPMN

Adenocarcinoma arising in the setting of IPMN may not strictly constitute an “imaging mimic” of de novo adenocarcinoma, because both represent primary epithelial malignancy, but this variant has a 5-year survival rate of 34%, compared with 9% for standard adenocarcinoma.

Natural history and frequency are not well established

💡 Large intracystic solid nodule in tortuous, dilated main pancreatic duct, consistent with malignancy arising in main duct IPMN (Fig 1 A-D)



Pancreatic Neuroendocrine Carcinoma (pNEC)



- These are typically large tumors with ill defined margins and heterogeneous enhancement, commonly show necrosis and calcification.
- Poorly differentiated and frequently show nodal and hepatic metastasis.
- Rim like enhancement on arterial phase is common and also seen in its hepatic metastasis (Fig 1 A-B).

💡 Vascular invasion into vein is more commonly seen than PDAC

Conclusion:

- Several anatomic variants, benign inflammatory processes and neoplastic lesions mimic PDAC on imaging. A thorough knowledge of these conditions allows many of them to be accurately diagnosed and those who remain indeterminate may need follow up or EUS guided interventions.
- Key imaging findings that favors diagnosis other than PDAC are – incidental detection with large size, hypervascularity, absence of significant duct dilatation or abrupt narrowing, presence of vascular encasement without distortion / stenosis, venous invasion or thrombus and intralesional ducts and presence of cysts.

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