CT of Calcified Pancreatic Masses: What are they and why?

Elliot K. Fishman MD FACR
Johns Hopkins Hospital
Calcifications in Pancreatic Masses: A Guide to Lesion Identification

- Is there calcification present in the pancreas? If yes then
  - A. where is it located?
  - B. is there a pattern to the calcification?
  - C. is the mass cystic or solid or both?
  - D. is the mass hypervascular?
Introduction

- Pancreatic calcifications are frequently related to chronic pancreatitis and is usually not a diagnostic dilemma.
- Beyond chronic pancreatitis, calcifications can be present in range of pancreatic lesions.
- Presence of calcification and appearance of the calcification can be a guide to lesion identification.
# Overview of Calcified Pancreatic Lesions

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Ductal adenocarcinoma

- Twelfth most commonest cancer, 4th leading cancer killer:
  - 48,960 new US cases (12.4:100k, 3% of all cancer cases) with 40,560 deaths (6.9%) in 2015 (SEER database)
- 85% of all pancreatic neoplasms
- Imaging:
  - Up to 70% localized to pancreatic head, 25% body/tail
  - Solid, hypovascular, locally invasive mass with duct obstruction
  - 100% sensitive for tumor >2cm
  - Best seen on arterial phase, can be isodense on venous when small
- Calcification is not a common feature
49 year old woman with pancreatic mass.

ERCP brushing revealed adenocarcinoma of pancreatic primary.
Neuroendocrine tumors

- Rare: <1:100,000 per year (US); 1-2% of all pancreatic tumors, 5-7th decade
- 50-75% “non-functional” (although still secrete substances but no hormonal syndrome). Insulinoma and gastrinoma are most common NETs to cause hormonal syndromes.

**Imaging:**
- Dual phase is critical as smaller lesions may be isodense on venous phase
- CT >80% sensitive.
- Appear as round, hypervascular masses
- Calcifications are uncommon, suggesting malignant pNET, can be peripheral or central
- Extra-pancreatic findings include vascular liver metastases, peri-portal adenopathy, and vascular invasion
Pancreatic Neuroendocrine Tumor
58 year old man with well-differentiated neuroendocrine tumor. Patient was not a surgical candidate and received chemotherapy.
Serous cystadenoma

- Frequently incidental cystic tumors found in woman in the 5th to 7th decades.
- Three morphologic types: polycystic (70%), honeycomb (20%) or oligocystic (10%)
- Imaging
  - Polycystic: cysts are <2cm; oligocystic cysts are > 2cm
  - Usually in head, 40% in tail
  - Fibrous enhancing septations
  - Central scar with coarse calcification (30%)
  - Does not communicate with duct. Can obstruct duct when large
71 year old woman with symptomatic pancreatic mass.

Central cluster of coarse calcifications are present (arrows).

Patient was a surgical candidate and underwent Whipple procedure demonstrating a serous cystadenoma without infiltrating carcinoma.
Serous Cystadenoma and Patterns of Calcification
Solid pseudopapillary epithelial neoplasm (SPEN)

- 1-2% of exocrine pancreatic tumors
- Much more common in woman (9.5:1), range 15-35 (mean 24) years
- Imaging
  - Encapsulated solid and cystic mass
  - Usually in tail
  - Peripheral enhancing solid components
  - 30% contain calcification, usually peripheral
  - Can spontaneously hemorrhage
  - Duct obstruction is rare
  - Can have hepatic metastases, >5 cm associated with increased risk
  - Capsule discontinuity has been described in malignant SPENs
30 year old woman a large pancreatic mass with rim interrupted calcifications (arrows). Mass demonstrates soft tissue and cystic components.

Mass was resected and revealed a solid pseudopapillary epithelial neoplasm.
Solid and Pseudopapillary Neoplasm

SPEN tumors very commonly demonstrate calcification, perhaps dystrophic in nature related to the frequent intralesional hemorrhage present within these lesions.
Coronal volume rendered images demonstrate a 7.4 cm complex mass with extensive peripheral calcification. 3D mapping demonstrates both solid and cystic components. No ductal dilatation was noted. Based on the age, a solid pseudopapillary neoplasm was suspected. Surgical resection was performed and pathology revealed solid pseudopapillary neoplasm.
Intraductal papillary mucinous tumor

- 1-3% of exocrine pancreatic neoplasms, 20-50% of pancreatic cystic neoplasms
- Older patients, 0.7 to 1.8 M:F, 5th to 7th decade
- Imaging (branch-duct type):
  - Usually incidentally seen
  - Usually well demarcated small simple cystic mass
  - Can be multiple
  - 60% occur in head/uncinate process
  - Up to 20% can contain calcification: punctate, coarse, or eggshell, more frequently seen in larger lesions
  - Presence of calcification is not associated with malignancy
  - > 3cm, solid component, MPD/CBD dilation, and adenopathy suggest malignancy
68 year old man with pancreatic mass.

EUS/FNA was performed demonstrating mucinous features and communication with pancreatic duct, consistent with an intraductal papillary mucinous tumor.
Colloid carcinoma arising from IPMN

- IPMNs that progress to invasive carcinoma can be either tubular (similar to ductal adenocarcinoma) or colloid type (resembles breast and skin cancer)
  - Typically main duct type more than branch duct type
- Risk of developing carcinoma varies with the histologic subtype of IPMN
- Colloid carcinoma develops in 30 to 50 percent of patients with intestinal-type IPMN
- Colloid have better prognosis than tubular
- Imaging:
  - Solid enhancing components arising in a dilated main duct (main duct type IPMN) or large peripheral cystic mass (branch duct type)
  - Coarse or fine calcifications possible
69 year old man with pancreatic mass.

Patient underwent distal pancreatectomy revealing colloid carcinoma arising from IPMN. Nodal and omental metastases were present (not shown).
Mucinous cystic neoplasm (MCN)

- Uncommon tumor. Predominately woman (>80%) with mean age 54
- Can be found incidentally on imaging (20% of cases) or present with abdominal pain, recurrent pancreatitis, gastric outlet obstruction, and/or a palpable mass.
  - Jaundice and/or weight loss are more common with malignant lesions.
- EUS-FNA can obtain fluid for cyst analysis
  - Cytology: Mucin-containing cells
  - CEA: High concentrations of CEA (no correlation with malignancy)
- Imaging
  - Round or ovoid
  - Homogenous to heterogeneous cyst contents
  - Usually septated but can be unilocular
  - Eccentric calcifications in 15% of patients
  - Malignant features: >5cm, thickened cyst wall, internal solid components
  - DDx: unilocular serous tumor, cystic neuroendocrine tumor, pseudocyst
48 year old woman with pancreatic mass.

Patient underwent EUS-FNA revealing very high CEA levels, consistent with a mucinous cystic neoplasm.
Mucinous Cystic Neoplasm

Calcification in mucinous cystic neoplasms (MCN) tend to be peripheral, thin, and curvilinear.
Lymphoepithelial Cyst

- Part of 3 types of morphologically similar “squamous” cysts
  - lymphoepithelial cysts
  - dermoid cysts (monodermal teratomas)
  - epidermoid cysts in intrapancreatic accessory spleen.

- Predominantly older men, 4:1::M:F, mean age 56 (35-74 years).

- Imaging
  - Any part of the pancreas (head, body, or tail).
  - Well-delineated cysts that may be multilocular (60%) or unilocular (40%)
  - Variable size: 1 to 17 cm
  - Peripheral calcifications may be present
66 year old man with peripancreatic mass.

Resection demonstrated lymphoepithelial cyst without evidence of carcinoma.
Pancreatic Pseudocyst

- Develop in 10% of chronic pancreatitis, after 4 weeks and without necrotic material
- Imaging
  - Small to large
  - Intra- or extra-pancreatic
  - Expansion can cause duodenal or biliary obstruction, vascular occlusion, fistula formation
  - Can get infected
  - Can cause vascular comprise by pressure erosion into adjacent vessels (splenic or gastroduodenal arteries common)
- Uncommonly pseudocysts can calcify, punctate to eggshell
42 year old woman with peripancreatic mass. (studies 7 years apart)
Current findings are consistent with a peripancreatic pseudocyst. No intervention was performed.
Chronic pancreatitis

- Chronic pancreatitis is usually related to alcohol abuse, ductal obstruction (stones, pseudocysts, tumor), systemic disease (SLE, hypertriglyceridemia), autoimmune and idiopathic pancreatitis
  - Repetitive acute pancreatitis can lead to chronic pancreatitis
- Distinguished from acute pancreatitis: not painful, progressive parenchymal fibrosis, pancreatic insufficiency, mononuclear infiltrate vs acute pancreatitis neutrophilic infiltrate
- Imaging
  - Parenchymal atrophy
  - Mild main duct dilation. Prominence of side branches ("acinar filling")
  - Parenchymal punctate calcification and intraductal stones
  - Focal inflammation can mimic ductal adenocarcinoma requiring biopsy for definitive management
64 year old man with abdominal pain.

Evidence of chronic pancreatitis seen with parenchymal atrophy, punctate parenchymal calcifications (short arrows) and 8 mm duct dilation.
Summary

- Numerous etiologies exist for calcifications within pancreatic and peri-pancreatic lesion.
- Knowledge of lesions that can calcify can help tailor a well constructed differential diagnosis.