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Imaging of The Pancreas

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Modern imaging modalities commonly used in pancreas include ultrasound (US), CT, and MRI. Pancreas is a retroperitoneal organ which makes it difficult to visualize by US, particularly in an obese individual. Although insensitive, US occasionally detected pancreatic mass of asymptomatic person. Therefore, US is still a useful and easily accessible technique to detect pancreatic abnormality. CT or MRI is usually needed to investigate the pancreas, and both techniques are equally sensitive and specific for pancreatic pathology. A combination of MRI and MRCP allows visualization of both pancreas and pancreatic duct. MRCP is mostly replaced ERCP for diagnostic purpose because of its high safety, high accuracy, and lacking radiation. ERCP is usually reserved for interventional purpose.

In this article, several pancreatic abnormalities will be demonstrated, using case-based approach, and emphasizing on imaging findings.

Case 1. A 64-year-old woman presenting with a pancreatic mass, incidentally detected from cardiac CTA, and further investigated by MRI.

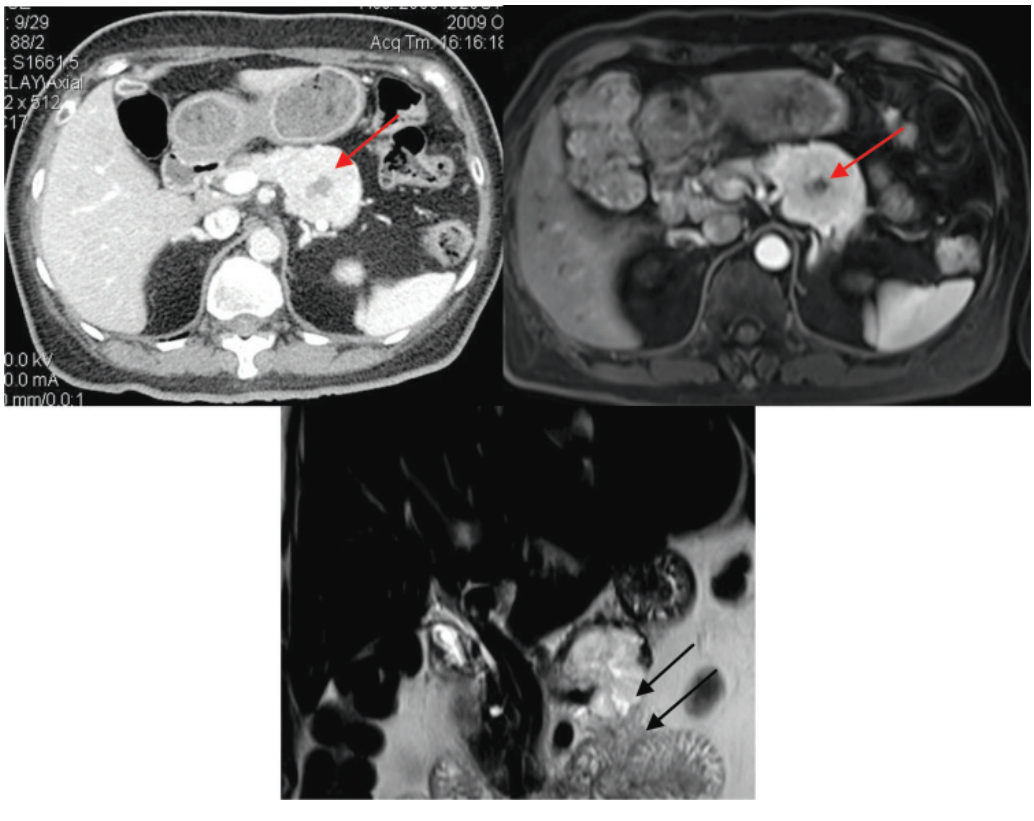

Figure 1. Case 1.

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Axial view of CT and MRI shows a well-defined, lobulated contour, hypervascular mass at the pancreatic body containing a small central scar (red arrows), and without evidence of pancreatic duct dilatation. Coronal view of T2 MRI shows subtle septation and a few small cystic spaces within the mass (black arrows). D/Dx of hypervascular pancreatic mass includes microcystic adenoma, neuroendocrine tumor, as well as solid and pseudopapillary epithelial neoplasm (SPEN). Given the incidental finding nature in the elderly woman, this hypervascular mass with central scar and small cysts is consistent with a microcystic adenoma.

Microcystic adenoma or serous cystadenoma of the pancreas is sometimes called a çgrandmother tumoré because it is often found in an elderly female of the seventh decades. Cysts in the tumor are often small (less than 2 cm) and numerous, hence the name çmicrocysticé. The content of the cyst is usually serous fluid composed of glycogen, hence the name çserous cystadenomaé. It is a multiloculated, cystic tumor that is considered benign and does not require surgery. A third of patients are diagnosed incidentally for unrelated reason. T2 MRI is the most sensitive technique to detect fluid content, and subtle small cysts and septations, which may appear solid at CT. The mass usually arises from the head of the pancreas. Central scar with calcification is typical for microcystic adenoma, but rather uncommon[1,2].

Case 2. A 37-year-old woman presenting with abdominal distension.

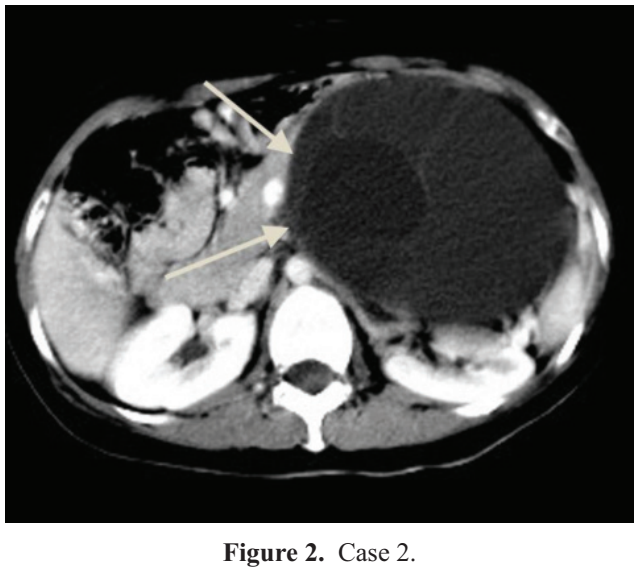

Figure 2. Case 2.

Axial view of CT shows a large multiloculated cyst with thin septation of the tail of the pancreas. D/Dx of cystic pancreatic mass includes mucinous cystadenoma, serous cystadenoma, and complicated pancreatic pseudocyst. Because of the size of each cyst within the multiloculated mass is large and number of cysts are small (less than 6), this tumor in a middle-aged female is most likely to be a mucinous cystadenoma, and surgery confirms the diagnosis.

Mucinous cystadenoma or macrocystic tumor of the pancreas is sometimes called a çdaughter-in-lawé tumor, because it usually occurs in a middle-aged female of the fourth and fifth decades. Cysts in the tumor are often small in number but large in size (more than 2 cm), hence the name "macrocystic". The content of the cyst is usually mucinous fluid, hence the name çmucinous cystadenomaé. The mass usually arises from the tail of the pancreas. Peripheral or curvilinear calcification of cyst wall is different from central calcification of microcystic adenoma. It is a premalignant tumor which will develop into mucinous cystadenocarcinoma, if left untreated[3].

Case 3. A 16-year-old woman, presenting with abdominal distension.

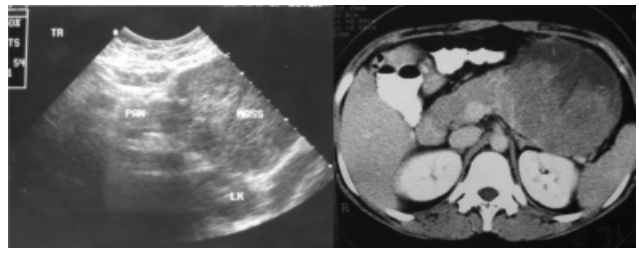

Figure 3. Case 3.

US shows a large mass at the pancreatic tail. Axial CT reveals that this large mass has mixed solid and cystic components. Based on young age of patient, differential diagnosis of this necrotic mass includes neuroendocrine tumor (NET), and SPEN. Surgery was performed and proved to be neuroendocrine tumor.

Neuroendocrine tumor could be functioning or non-functioning, depending upon its hormonal excretion. Functioning NET is usually small in size when detected. This is because patient presents early with symptoms caused by hormonal excretion. The most common functioning NET is insulinoma and the symptom is hypoglycemia. In contrast, non-functioning NET

is usually large and shows cystic and necrotic changes. Calcification, local invasion, vascular invasion, and metastatic disease are more commonly seen with larger neoplasms. All NETs are considered premalignant and should be removed, whether functioning or non-functioning[4].

Case 4. A 23-year-old woman presenting with abdominal distension.

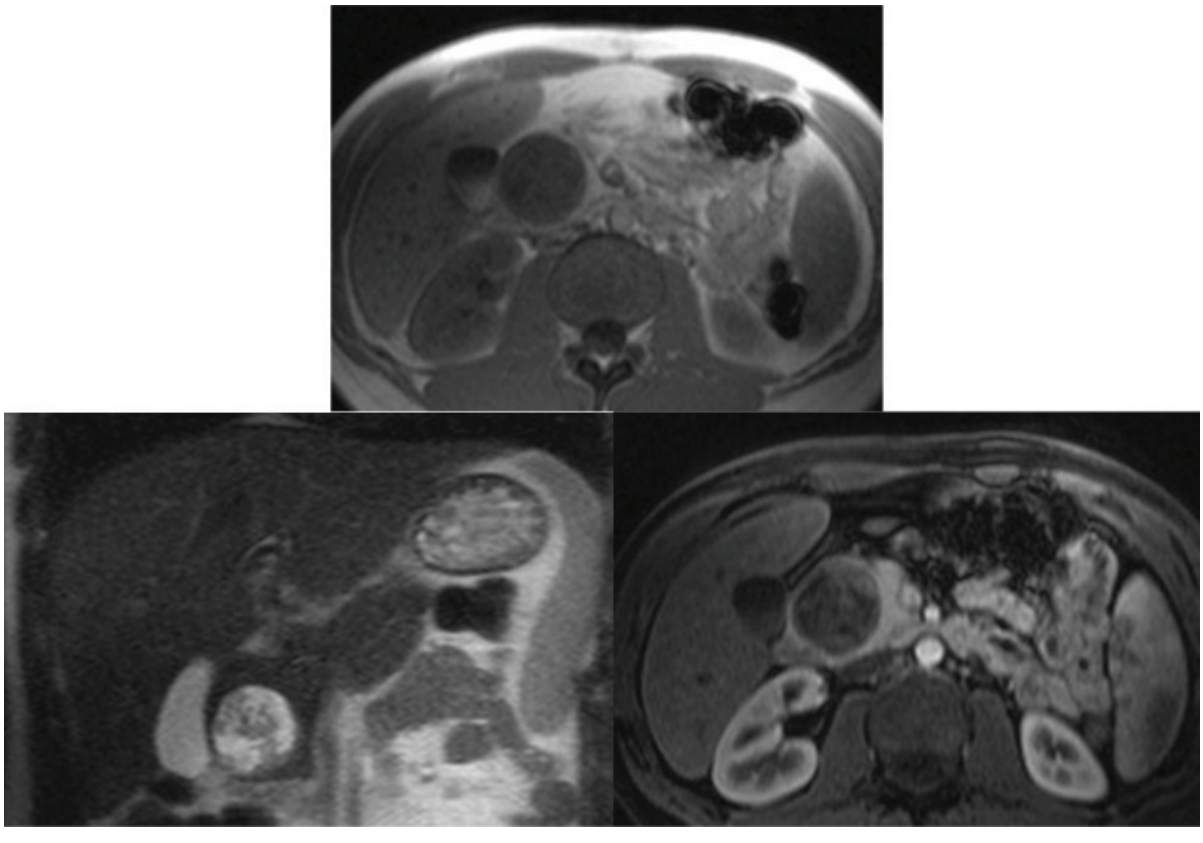

Figure 4. Case 4.

Axial T1, coronal T2, and axial post contrast T1 of MRI show a complexed solid/cystic mass of the pancreatic head without pancreatic duct dilatation. Based on young age of patient, differential diagnosis of this complexed mass includes neuroendocrine tumor (NET), and SPEN. Surgery was performed and proved to be SPEN.

SPEN is a rare and low-grade, malignant potential tumor. The tumor tends to present in young females of second and third decades. Multiloculated hemorrhagic cysts with solid component and calcification are characteristic of this neoplasm. Fluid-debris levels and vary signal intensities seen with MR imaging indicate blood products. Hemorrhage is secondary to bleeding from a solid friable portion of the tumor[5].

Case 5. A 67-year-old man presenting with abdominal pain.

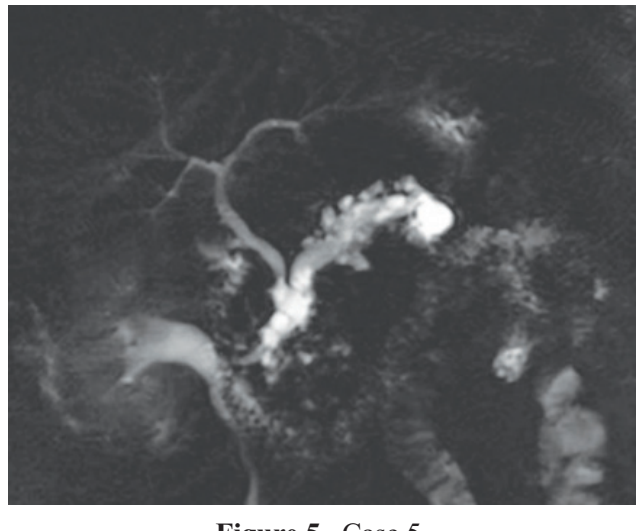

Figure 5. Case 5.

MRCP shows dilatation of pancreatic duct and its side branches without evidence of pancreatic mass. Findings are suggestive of intraductal papillary mucinous neoplasm (IPMN), mixed type.

This is a low-grade, slowly growing potentially malignant tumor with a much better prognosis than adenocarcinoma. Mucin, produced by this tumor, is secreted into pancreatic ducts causing ductal dilatation. There are three types of IPMN: main duct type, branch duct type, and combined type. ERCP is highly diagnostic if there is mucin extruded from the bulging papilla[6].

Case 6. A 54-year-old man presenting with abdominal pain and jaundice.

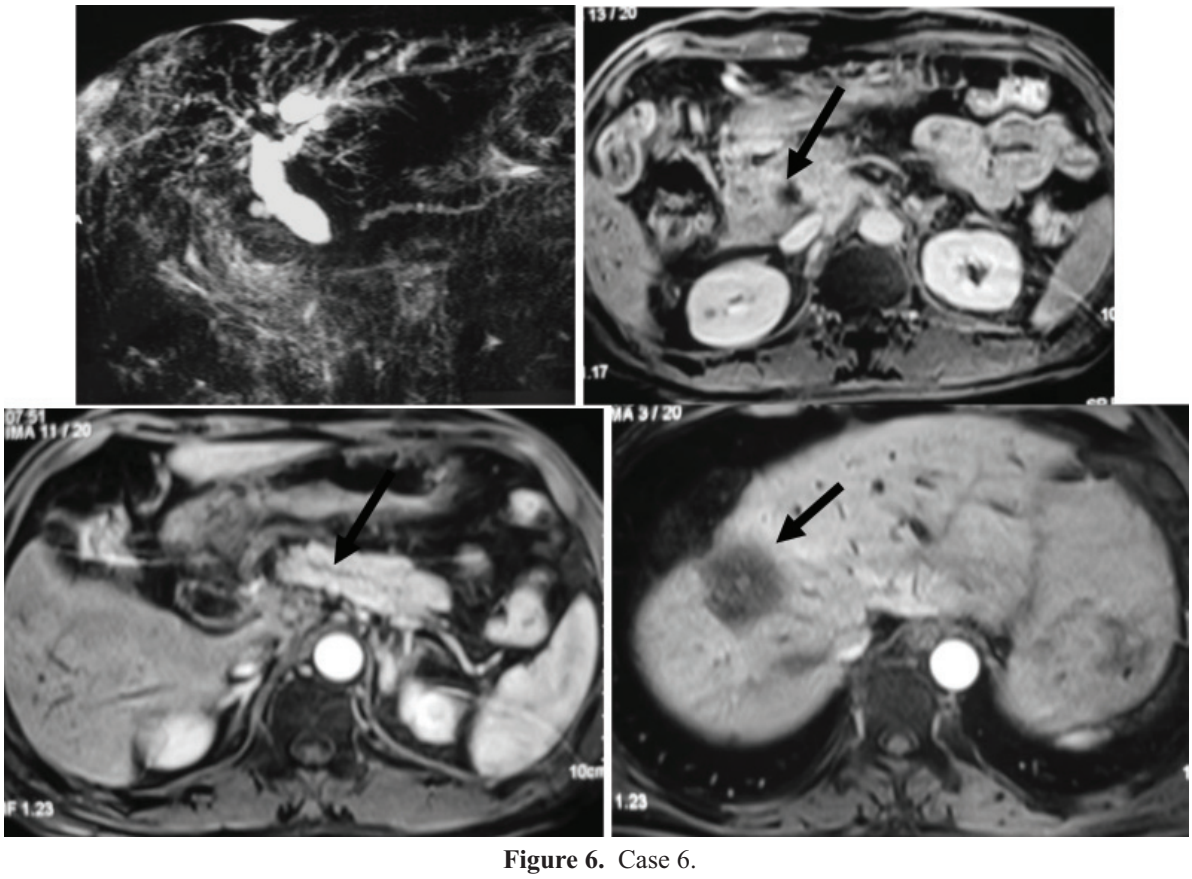

Figure 6. Case 6.

MRCP shows dilatation of both CBDs and pancreatic duct (double duct sign). Axial views of MRI show a small pancreatic head mass causing mild dilatation of the upstream pancreatic duct (arrows), suggestive of pancreatic cancer. A large liver mass (arrow) indicates liver metastasis.

Pancreatic cancer is a relative common cancer in elderly individuals of sixth and seventh decades. Complete resection of the tumor is the only curative treatment. Unfortunately, only a small number of patients are eligible for resection at the time of the diagnosis. This is secondary to advanced local tumor extension or distant metastasis.

Pancreatic cancer usually occurs in the pancreatic head. It is a hypovascular tumor that causes obstruction of the pancreatic duct and CBD. Double duct sign and atrophy of the distal pancreas are the helpful imaging signs for pancreatic cancer[7].

Case 7. A 62-year-old man presenting with abdominal mass from US.

Coronal T2, and contrast enhanced coronal and axial T1 MRI show a large, lobulated cyst-like mass at pancreatic tail with high vascularity. D/Dx includes cystic NET, and sarcoma. Surgery shows the mass is solid and pathology is proved to be myxoid liposarcoma.

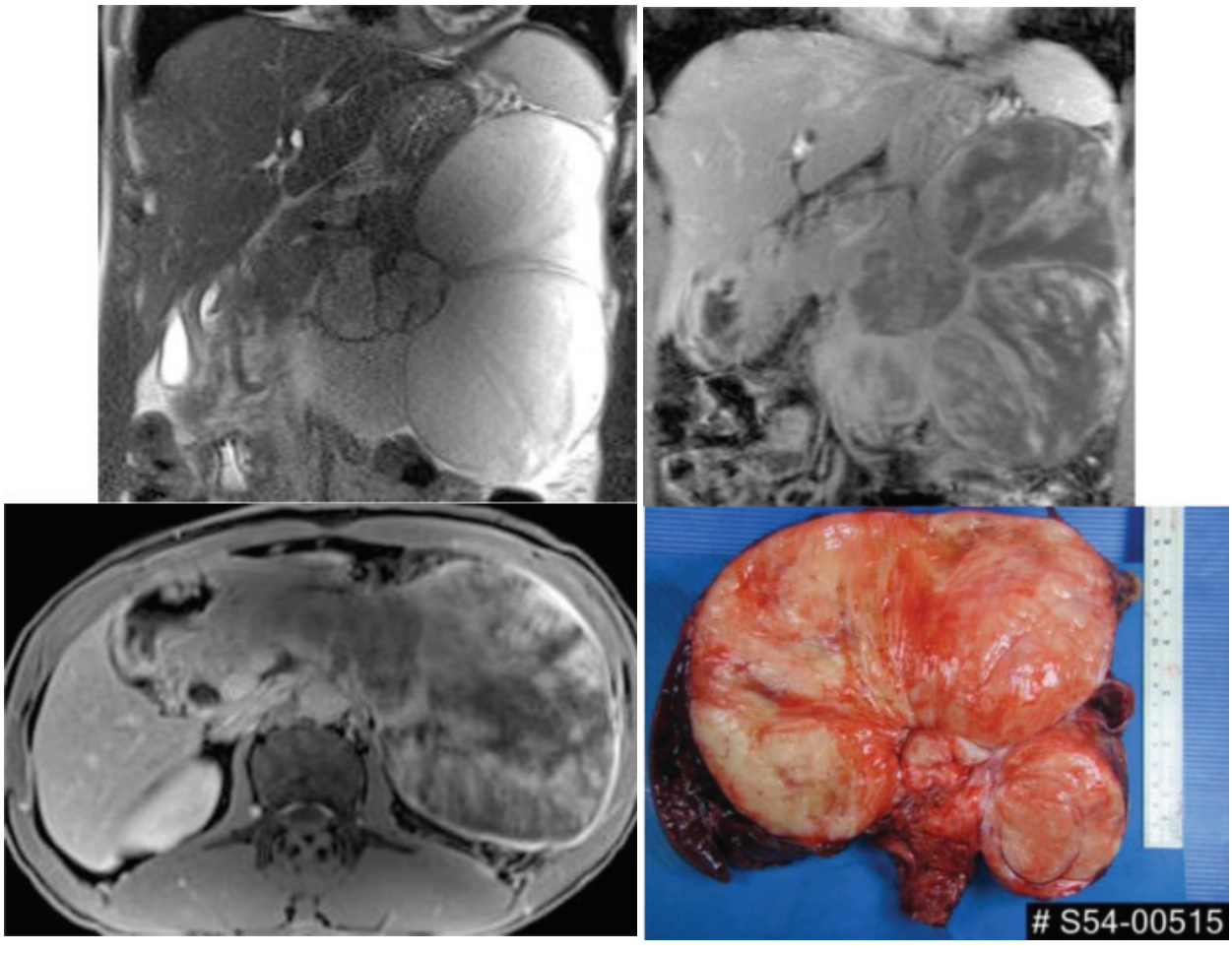

Figure7. Case 7.

Pancreatic liposarcoma is very rare, and usually reported as a single case report[8]. It is a solid tumor but a cyst mimicker, showing high SI at T2 because of high water content of the myxoid substance. Differentiation is by appearance after IV contrast. Myxoid liposarcoma shows heterogeneous intralesional enhancement, whereas cyst does not show enhancement, except for its rim.

Case 8. A 68-year-old man presenting with abdominal pain and fever.

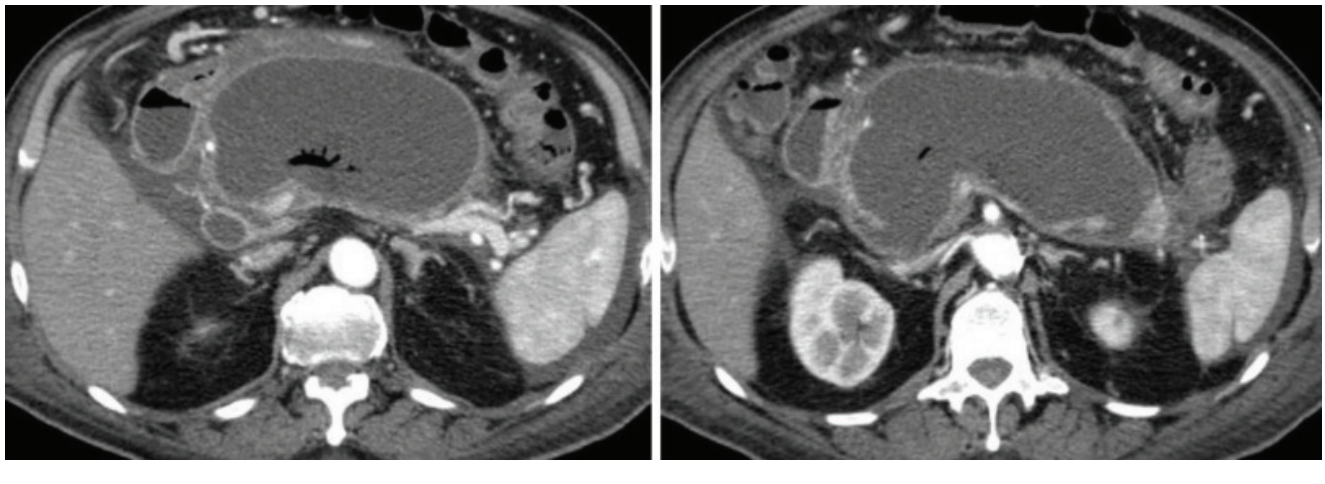

Figure 8. Case 8.

Axial views of post contrast CT show a large fluid collection containing gas of the pancreatic head and body, and minimal viable tissue of the pancreatic tail. Findings are consistent with walled-off pancreatic necrosis with superimposed infection.

Based upon 2012 revised Atlanta classification, acute pancreatitis is categorized in 2 types; acute edematous or interstitial pancreatitis and acute necrotizing pancreatitis[9]. Wall-off necrosis, as seen in the illustrated case, is a fully encapsulated collection, usually formed more than 4 weeks after acute episode of acute necrotizing pancreatitis. CT severity index does not outperform the scoring system based on clinical and biochemical parameters with regard to predicting clinical outcome. Therefore, performing CT on day of admission solely for prediction purposes is not recommended.

Case 9. A 75-year-old man presenting with abdominal pain.

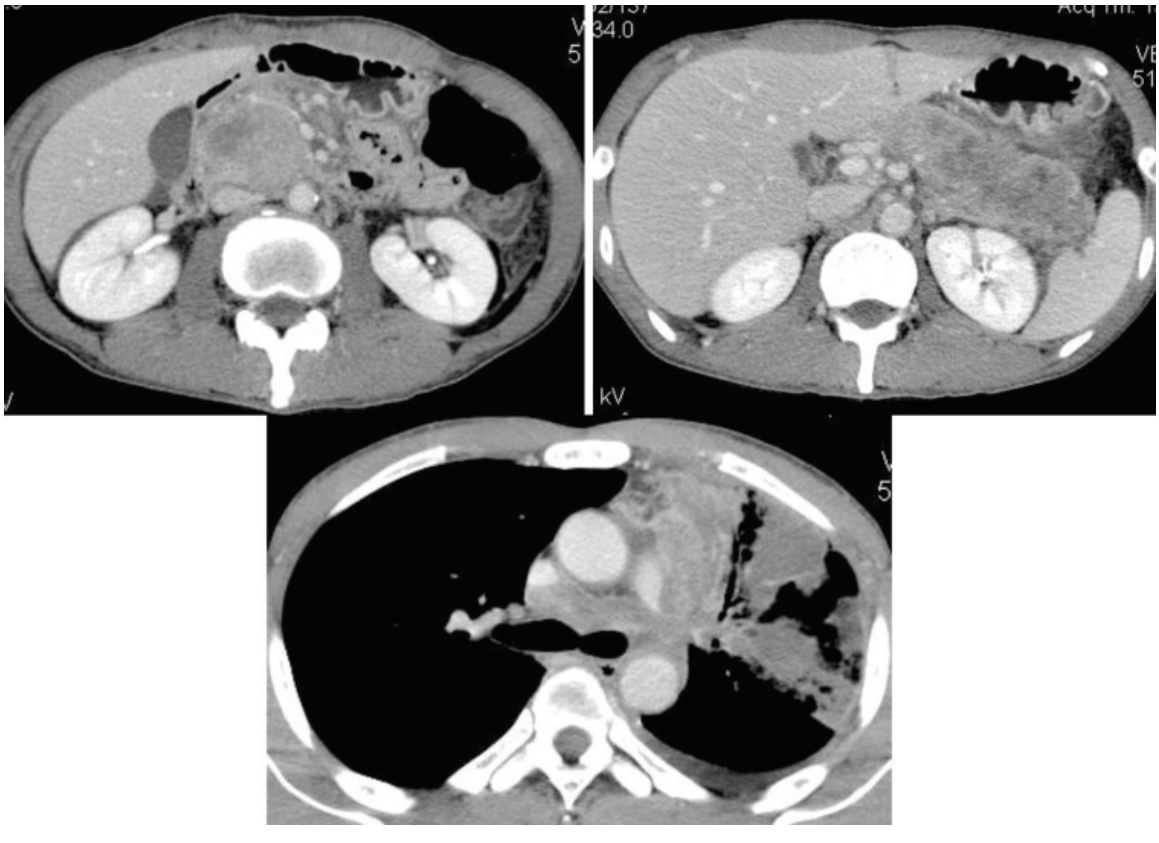

Figure 9. Case 9.

Axial views of post contrast CT show diffuse enlargement of the pancreas showing heterogeneous enhancement. D/Dx includes infiltrative lymphoma, infiltrative adenocarcinoma, and infiltrative metastasis. CT of the chest shows a large infiltrative mass of the left upper lobe, consistent with a primary lung cancer. Final diagnosis is infiltrative pancreatic metastasis.

Pancreatic metastasis is quite rare. Renal cell carcinoma is the most common primary tumor metastatic to the pancreas. Other primary tumors include malignant melanoma, breast cancer, lung cancer, gastric cancer, and colon cancer[10].

CONCLUSIONS

Nine cases of pancreatic diseases are illustrated, emphasizing on the imaging appearances. These cases are as following:

1. Neoplastic pathology:
   a. Serous cystadenoma
   b. Mucinous cystadenoma
   c. Neuroendocrine tumor
   d. Solid and pseudopapillary epithelial neoplasm
   e. Intraductal papillary mucinous neoplasm
   f. Primary pancreatic cancer

g. Myxoid liposarcoma of the pancreas
h. Pancreatic metastasis from primary CA lung

2. Infectious/inflammatory pathology:
   a. Pancreatic necrosis

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