



C35 - Pancreatic Cancer

Objectives

- Define what pancreatic cancer is and what the difference is between benign and malignant
- Learn the history of pancreatic cancer
- Differentiate the symptoms of pancreatic cancer and how they vary depending on the stage of the disease and location of the tumor
- Identify how MRI aides in diagnosing pancreatic cancer and how to discern on MRI images
- Learn about how other modalities aide in identifying pancreatic cancer, and how to discern on various imaging modalities
- Discuss the treatment process for pancreatic cancer

What is Pancreatic Cancer?



- Cancer starts when cell DNA is damaged, leading to uncontrolled growth. Normally, cells grow, divide, and die in a regulated manner. When this process is disrupted, cells may form a tumor
 - **Benign:** abnormal but cannot invade other parts of the body
 - **Malignant:** grow out of control and can spread to other tissues and organs
- Pancreatic cancer is rarely found in the early stages
 - pancreas is deep inside the body, so early tumors can't be seen or felt by health care providers during routine physical exams
 - Typically, no symptoms appear until the cancer has become very large or has already spread to other organs.

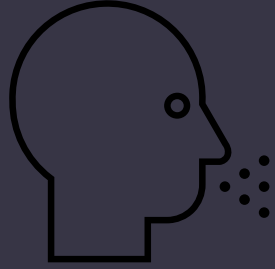


History



- **1700s** – Early descriptions that can be traced back to pancreatic cancer
- **1761** – First documented description of a pancreatic tumor found during autopsy
- **Mid 1800s** – Microscopes are used to first identify malignant pancreatic cells
- **Early 1900s** – Imaging and surgical procedures are being used to identify pancreatic cancer compared to other GI disorders
- **Mid 1900s** – ERCP and blood tests are aiding in earlier diagnosis
- **Late 1900s** – CT scans, Ultrasound, Fine Needle Aspiration (FNA)
- **Early 2000s** – Advanced MRI imaging and Early Detection Efforts
- **Current Time** – Use of AI, contrast-enhanced imaging, genetic testing for all pancreatic cancer patients

(Sakamoto, H., Attiyeh, M. A., & Gerold, J. M., 2020)



Symptoms



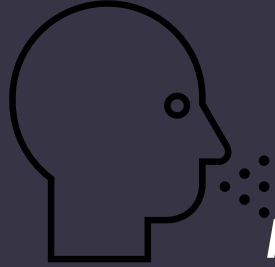
** Symptoms can vary depending on the stage of the disease **

More Common Symptoms :

- **Jaundice** - caused by blockage of the bile duct
- **Abdominal pain** - dull aching pain in upper abdomen that radiates to back, often relieved when leaning forward
- **Unexplained weight loss** - very frequent and caused by cancer-related metabolic changes and difficulty digesting food
- **Loss of appetite** - Feeling full quickly or not wanting to eat

(Mayo Clinic Staff, 2024)

Symptoms

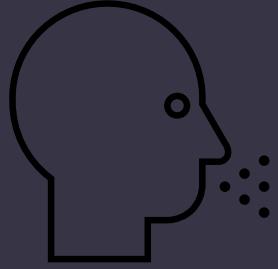


** Symptoms can vary depending on the stage of the disease **



More Common Symptoms:

- **Digestive problems** - since pancreatic tumors interfere with enzyme secretion, it can cause nausea, vomiting, and bloating
- **New onset diabetes** - tumors damage insulin producing cells. More suspicious as a pancreatic cancer symptom in people who are over the age of 50, do not have strong risk factors, and have unexplained fast weight loss
- **Fatigue** - Common in most cancers but often very significant in pancreatic cancer
- **Blood clots** - Pancreatic cancer can increase blood clot risk, sometimes appearing before other symptoms



Symptoms



** Symptoms can vary depending on the stage of the disease **

Less Common Symptoms:

- **Itching** - Due to bile buildup under the skin
- **Enlarged gallbladder/liver** - Detected on imaging or exam.
- **Upper GI bleeding** - Rare but possible if cancer invades nearby organs.

Symptoms - Per Tumor Location



** Symptoms can vary in severity depending on the location of the tumor **

Tumor located in the head of the pancreas:

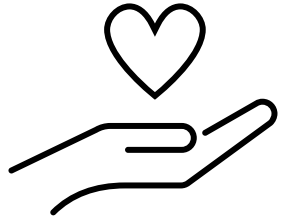
- Jaundice
- Dark urine
- Pale stools
- Itching
- Early weight loss



Tumor located in the body/tail of the pancreas:

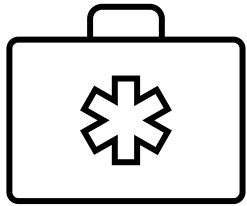
- Abdominal/back pain
- Weight loss
- New-onset diabetes





Diagnosis Related to MRI

- High-resolution imaging of the pancreas
- MRCPs
- Contrast-enhanced MRIs
- Diffusion weighted imaging (DWI)
- Detecting the spread and resectability of the cancer
 - Involvement of nearby organs
- Better detection of liver metastases
- Assessing vascular involvement



<https://cnicollege.edu/blog/mri-technology/role-of-mri-technologists-in-diagnostic-team/>

(Tummala, P., Junaidi, O., & Agarwal, B., 2011)

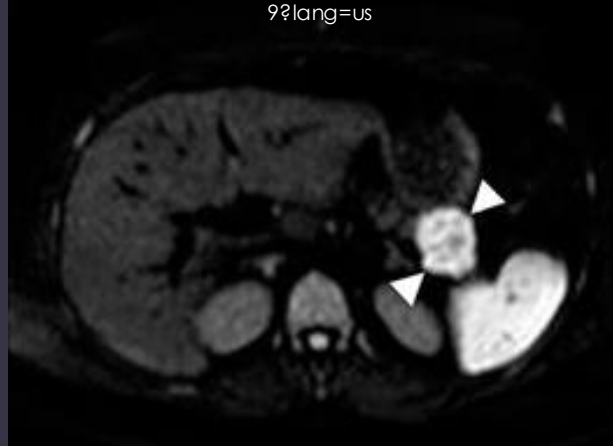
Identify on MRI Images

<https://radiopaedia.org/cases/mass-forming-autoimmune-pancreatitis?lang=us>



T1 weighted

<https://radiopaedia.org/cases/autoimmune-pancreatitis-9?lang=us>

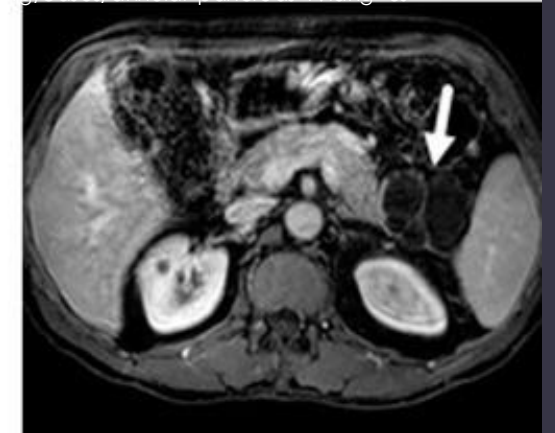


DWI

<https://radiopaedia.org/cases/annular-pancreas-1?lang=us>

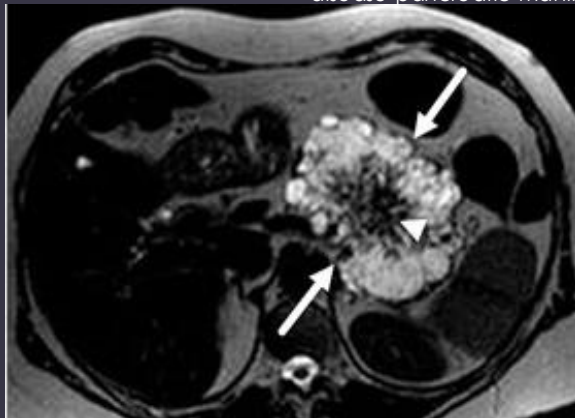


T2 weighted

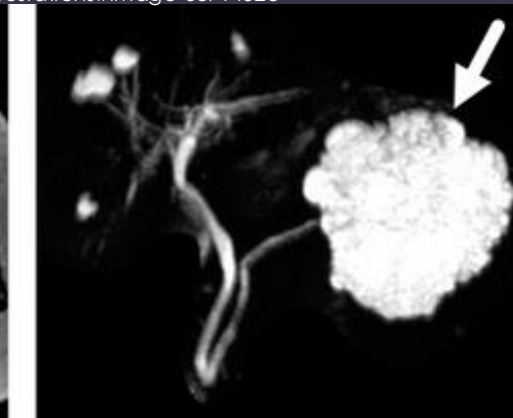


T1 weighted

<https://radiopaedia.org/cases/von-hippel-lindau-disease-pancreatic-manifestations#image-38714528>

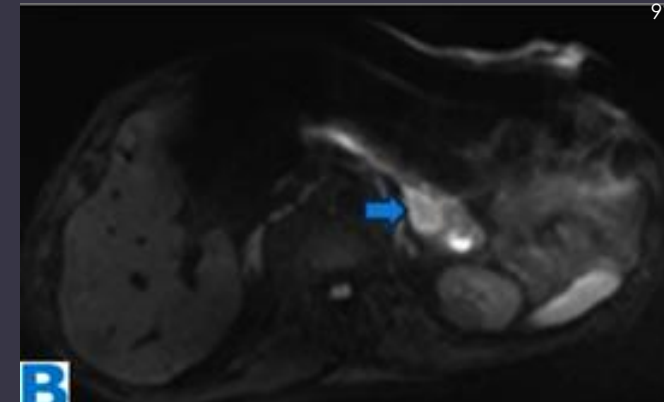


T2 weighted

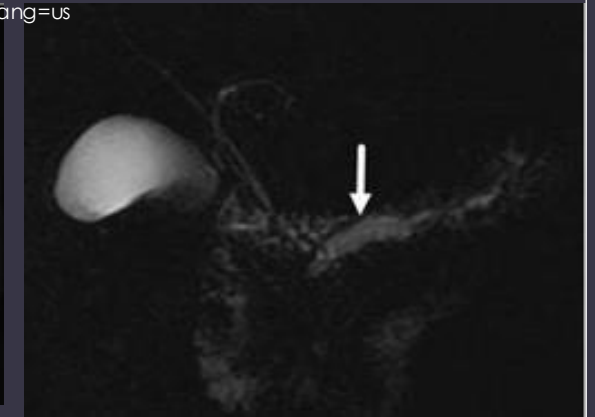


MRCP

<https://radiopaedia.org/cases/pancreatic-lipoma-9?lang=us>



DWI



MRCP

Diagnosis with Other Modalities



- CT (Pancreas protocol)
- Endoscopic Ultrasound
- PET/PET-CT
- ERCP
- Contrast-Enhanced Ultrasound
- Intraoperative Ultrasound
- Dual Energy CT and Perfusion CT



<https://www.ardms.org/how-to-become-a-sonographer/>



<https://ccitraining.edu/blog/what-is-a-limited-scope-radiologic-technologist/>

Identify on Various Imaging Modalities

https://www.researchgate.net/figure/Representative-pancreas-protocol-CT-scan-from-a-patient-with-a-PDAC-located-in-the_fig1_42390620



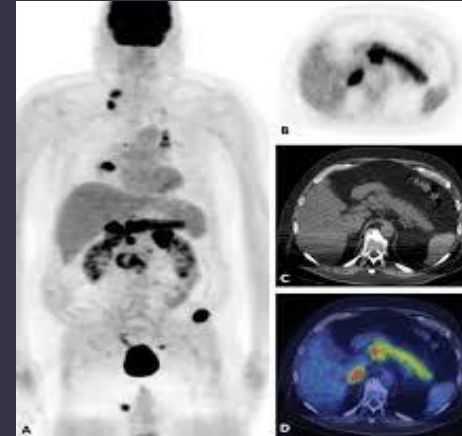
CT (Pancreas protocol)

<https://pancan.org/facing-pancreatic-cancer/diagnosis/endoscopic-ultrasound/>



Endoscopic Ultrasound

<https://ajronline.org/doi/10.2214/AJR.11.8182>



PET/PET-CT

https://www.researchgate.net/figure/ERCP-Heterogeneous-pancreatic-parenchyma-and-pseudonodular-appearance-of-the-pancreatic_fig1_330888830



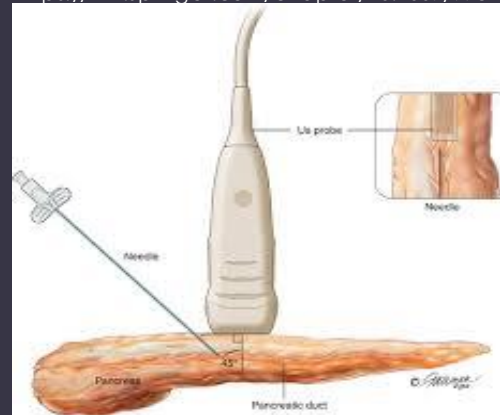
ERCP

<https://www.intechopen.com/chapters/52299>



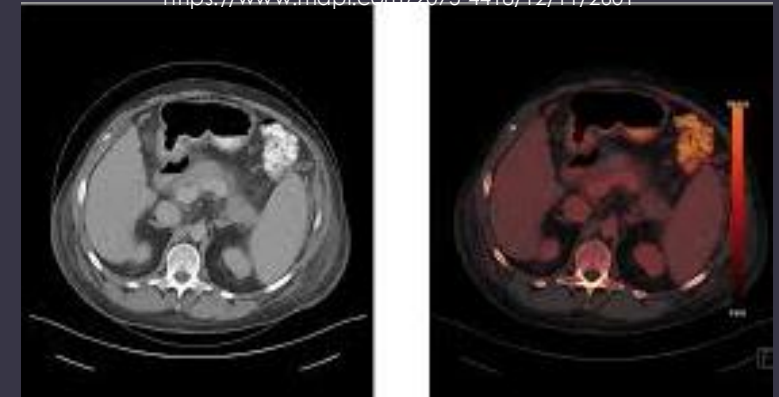
Contrast-Enhanced Ultrasound

<https://link.springer.com/chapter/10.1007/978->



Intraoperative Ultrasound

<https://www.mdpi.com/2075-4418/12/11/2601>

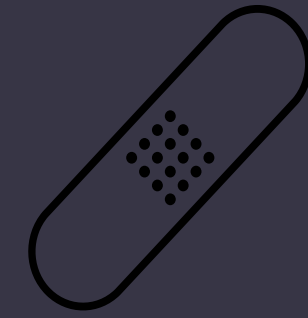


Dual Energy CT and Perfusion CT

Treatment



- Surgery (only option for cure)
 - Whipple – pancreatic-duodenectomy for tumors in the head of the pancreas
 - Distal Pancreatectomy – for tumors in the body or tail
 - Total Pancreatectomy – entire pancreas removed
- Chemotherapy (standard choice)
- Radiation Therapy (specific cases)
- Endoscopic/Interventional Procedures (symptom management)



<https://www.freepik.com/free-photos-vectors/stethoscope-nurse-clipart>



Conclusion

- Importance of early detection and genetic screening
- Importance of awareness for pancreatic cancer
- MRI is the gold standard of medical imaging for pancreatic cancer
- Various medical imaging modalities can be used to aide in the diagnosis of pancreatic cancer
- Once identified, pancreatic cancer is very difficult to cure due to the severity of the disease

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