KARNATAKA RADIOLOGY EDUCATION PROGRAM

Anatomy and Applied Radiology – Pancreas-2

Plain radiograph

Radiography has a limited role in imaging of the pancreas, but it can sometimes depict parenchymal calcifications, which helps in the detection of chronic pancreatitis. However, punctate calcifications near the pancreas can be confused with splenic artery calcifications. In patients with pancreatitis, several plain radiographic features have been described, including the so-called 'colon cutoff sign,' characterized by abrupt termination of colonic gas shadow at the splenic flexure

Pancreatic ultrasound

Preparation

Fast the patient to reduce interference from overlying bowel gas, which may otherwise make visualization difficult.

Scanning technique

- **3-6 MHz curvilinear ultrasound transducer**
- **pancreatic body**
  - **anterior subxiphoid approach with the left lobe of the liver as an acoustic window**
  - **adjuncts to improve visualization**
    - **deep inspiration**
    - **push abdomen out to make a "beer belly"**
- **pancreatic head**
  - **in addition to the above, a right subcostal approach with the transducer angled medially may be useful**
- **pancreatic tail**
  - **can be difficult to visualize**
  - **a water filled stomach may be used as a window [1]**

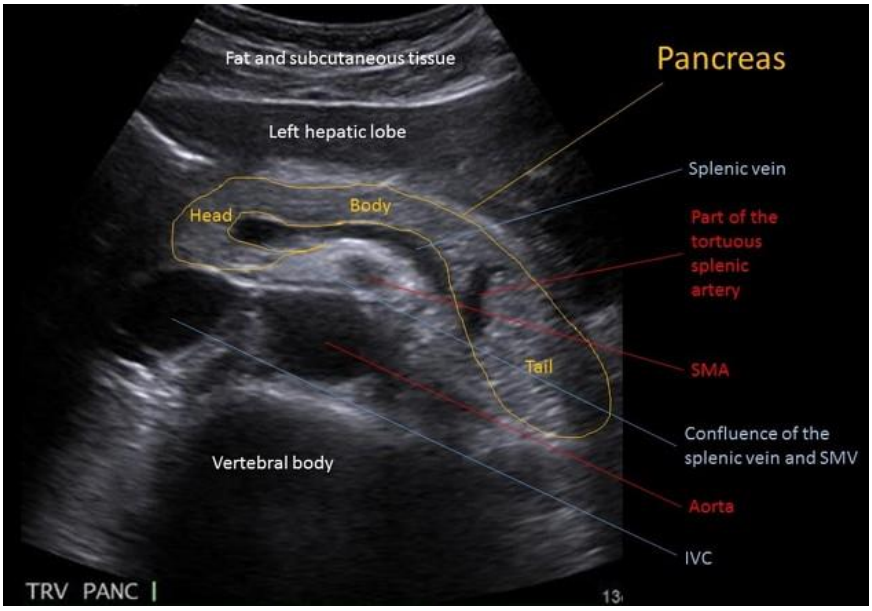
- **scan coronally in a right lateral decubitus position using the spleen as an acoustic window**

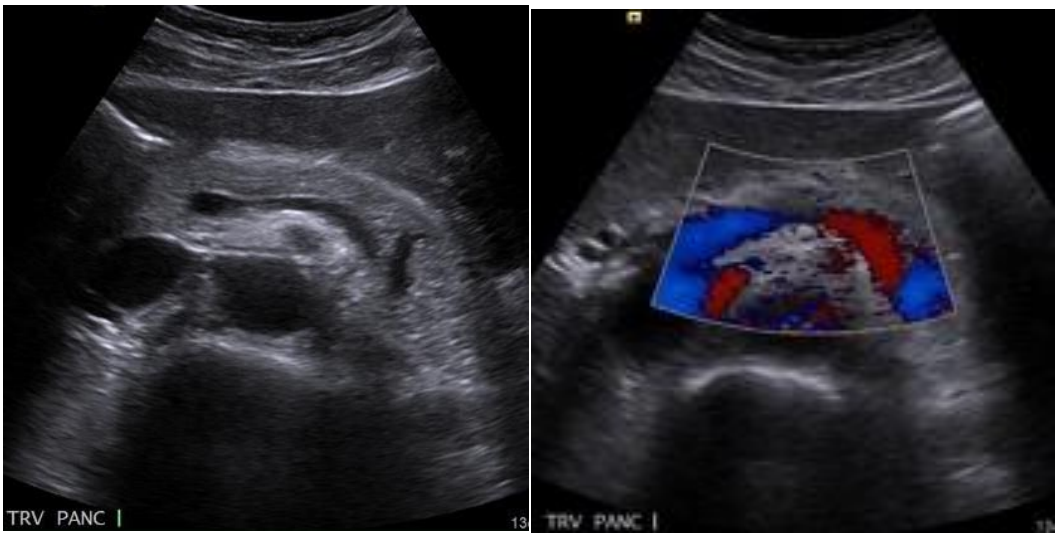
Macroscopic appearances

- **variable echogenicity**
  - **in young patients, the pancreas is generally less fatty and therefore usually hypoechoic**
  - **with age, fatty replacement of pancreas can result in echogenicity similar to surrounding mesenteric fat**
  - **fatty sparing of the uncinate process**

Measurements

- **AP diameter**
  - **head: 34 mm**
  - **body: 29 mm**
  - **tail: 32 mm**
- **length: 12-20 cm**
- **pancreatic duct: ≤3 mm**





Endoscopic ultrasound (EUS) uses a specialized endoscope with ultrasound capabilities to create detailed images of the pancreas and surrounding tissues, aiding in the diagnosis and management of pancreatic diseases.

Diagnosis: EUS can help diagnose conditions like chronic pancreatitis, pancreatic cysts, and pancreatic cancer.

Staging: EUS can help determine the extent of pancreatic cancer and assess whether it has spread to nearby tissues or lymph nodes.

Fine Needle Aspiration (FNA): EUS allows for the collection of tissue samples (biopsies) from the pancreas for further analysis.

Advantages of EUS for the pancreas:

High-resolution imaging: EUS provides detailed images of the pancreas, allowing for the detection of small or subtle changes.

Close proximity: The endoscope is inserted through the mouth and into the stomach and small intestine, bringing the ultrasound probe close to the pancreas, which improves image quality.

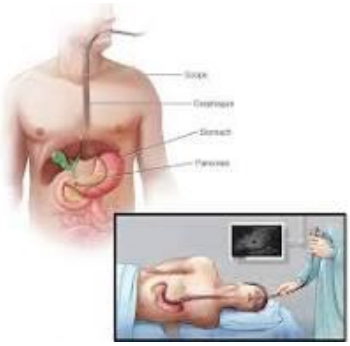
Minimally invasive: EUS is a minimally invasive procedure, meaning it doesn't require major surgery.

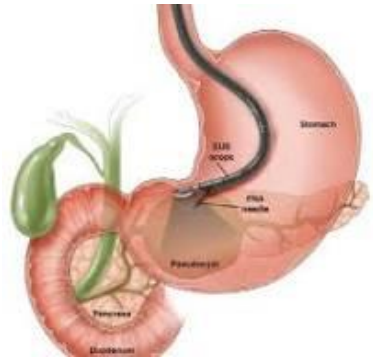
Preparation: You will likely need to fast before the procedure.

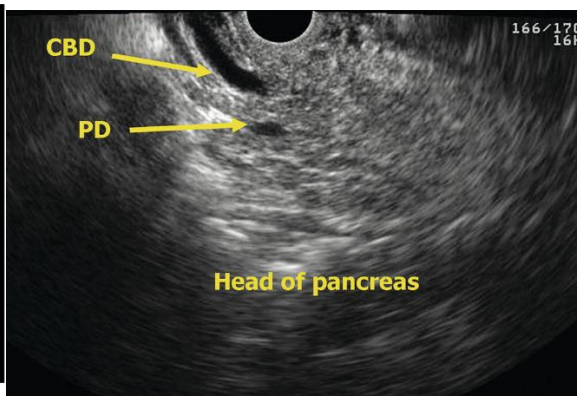
Sedation: You will likely receive medication to help you relax during the procedure.

Procedure: The endoscope is inserted through your mouth and into your stomach and small intestine.

Image acquisition: Ultrasound images of the pancreas and surrounding tissues are taken.







Computed Tomography – Pancreas

Multidetector CT

MDCT is the modality of choice for the evaluation of both inflammatory and neoplastic conditions of the pancreas.2 In inflammatory conditions, MDCT not only provides excellent visualization of the parenchymal abnormalities, but clearly depicts the extrapancreatic spread of disease. In pancreatic neoplasms, MDCT accurately depicts the tumor morphology, ductal anatomy, and its relationship to surrounding organs and vascular structures. Thin-section MDCT in combination with image-processing techniques (multiplanar reconstructions and curved reformations) can provide additional imaging details and can define the pancreatic ductal anatomy.

Technique

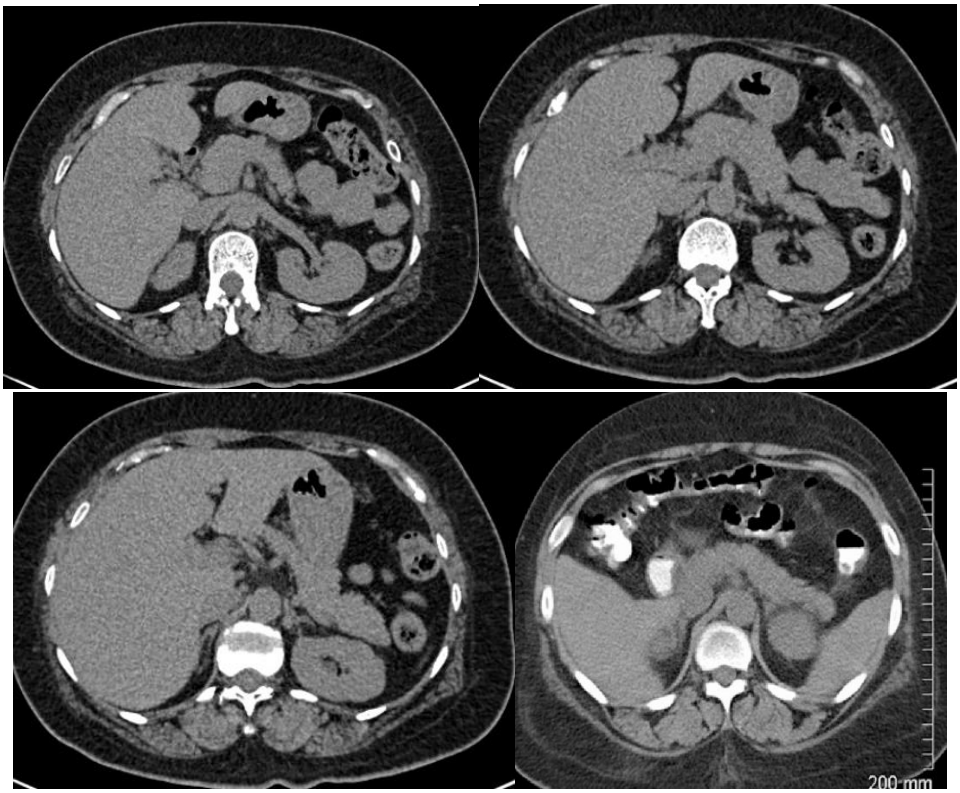
The specific MDCT imaging protocol depends on the clinical question to be answered. A typical MDCT protocol for pancreatic evaluation involves administration of oral and intravenous contrast (Table 1). For routine indications, including pancreatitis, a portal venous-phase abdominal CT with positive oral contrast medium (POCM) provides the most information. However, for a dedicated pancreatic protocol CT, neutral oral contrast media (NOCM) like water are preferred, as they allow superior image reconstruction.8 In patients with suspected pancreatic mass,a focused pancreatic protocol CT is performed, which

includes a pancreatic, portal venous, and a delayed phase through the liver to assess for hepatic metastases. An arterial phase may be performed in place of a pancreatic phase if a hypervascular pancreatic lesion like a neuroendocrine tumor is suspected. Pancreatic phase refers to the late arterial phase (typically 40-45 sec after contrast injection) during which there is maximal differentiation between the normal parenchyma and hypodense pancreatic tumors like adenocarcinoma. This phase also provides optimal arterial and mesenteric venous opacification, which allows assessment of vascular involvement, thereby permitting surgical planning by evaluating potential tumor resectability. Arterial opacification in this phase limits the need for a separate dedicated arterial phase. Accurate contrast timing for image acquisition during various phases can be achieved using the test bolus or the automatic bolus triggering technique .

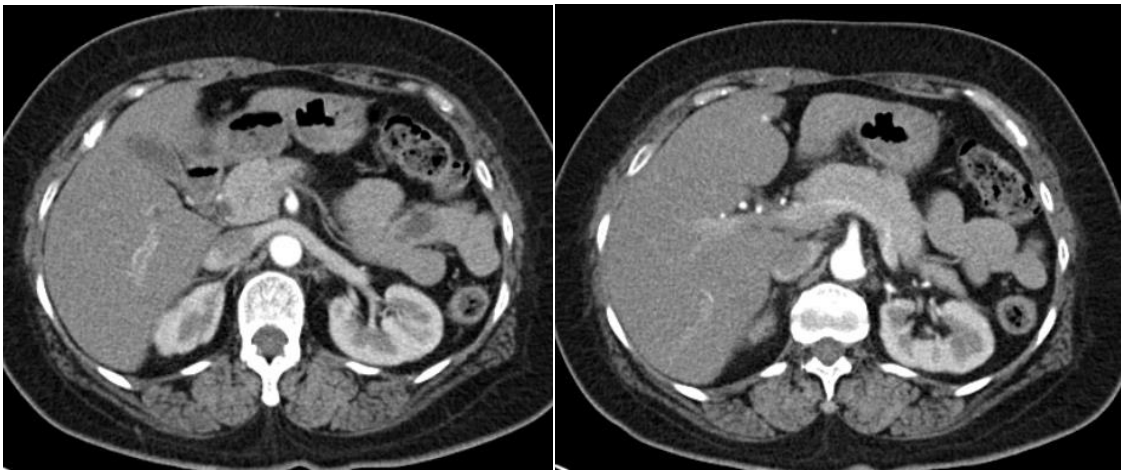
Table 1. Scanning parameters for CT using 16- and 64-slice MDCT

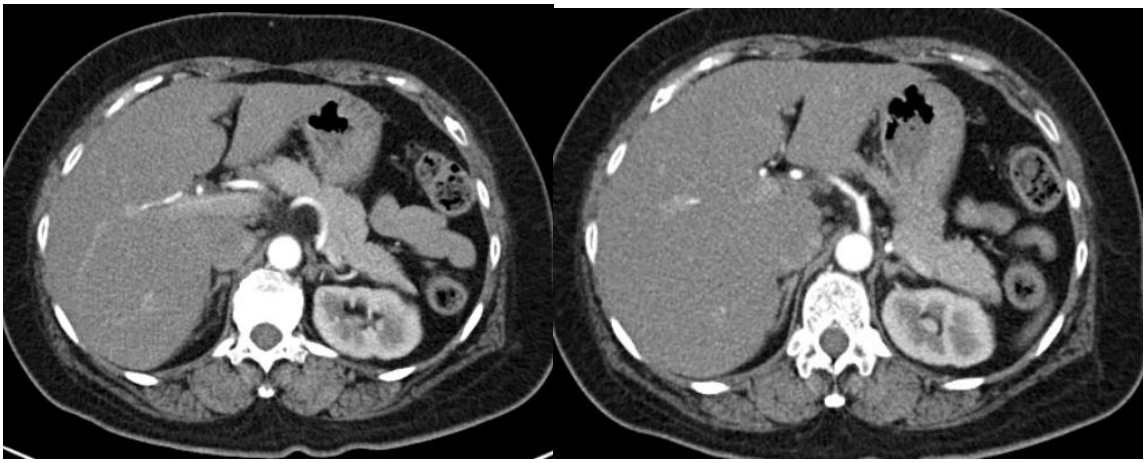
	16-MDCT	64-MDCT
Detector Configuration	16 x 1.25	64 x 0.625
Rotation time (s)	0.5	0.5
Pitch	0.9-1.375	0.9-1
Table speed (mm/rotation)	27.5	40
kVp	120-140	120-140
MA	ATCM	ATCM
Reconstruction Algorithm	Standard	Standard
Slice thickness		
1. Arterial phase	2.5	2.5
2. Pancreatic phase	2.5	2.5
3. Porto venous	5	5
IV contrast (mg/ml)	370	370
IV contrast volume	100-150	100-150
Contrast injection rate (cc/s)	4	4
Oral contrast	Neutral oral contrast	Neutral oral contrast
Scan delay (fixed)	40s (PP), 60s (PVP)	45s, 65s (PVP)
Reconstructions	1. Sagittal and coronal reformations 2. MIP reconstruction of arterial and venous phase 3. CT pancreatography for abnormal pancreas	

MIP=maximum intensity projection, ATCM=automatic tube current modulation. PP= pancreatic phase, PVP=portal venous phase

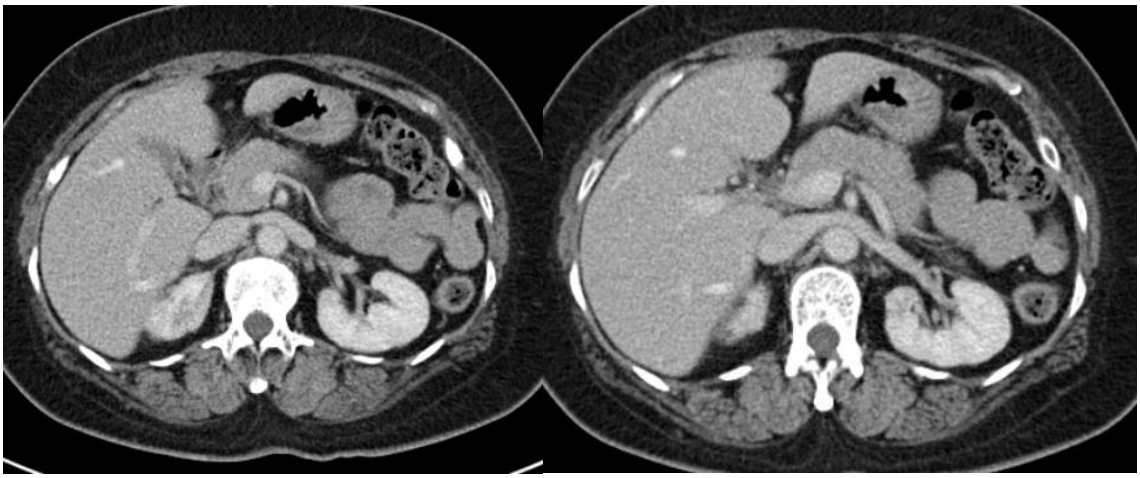


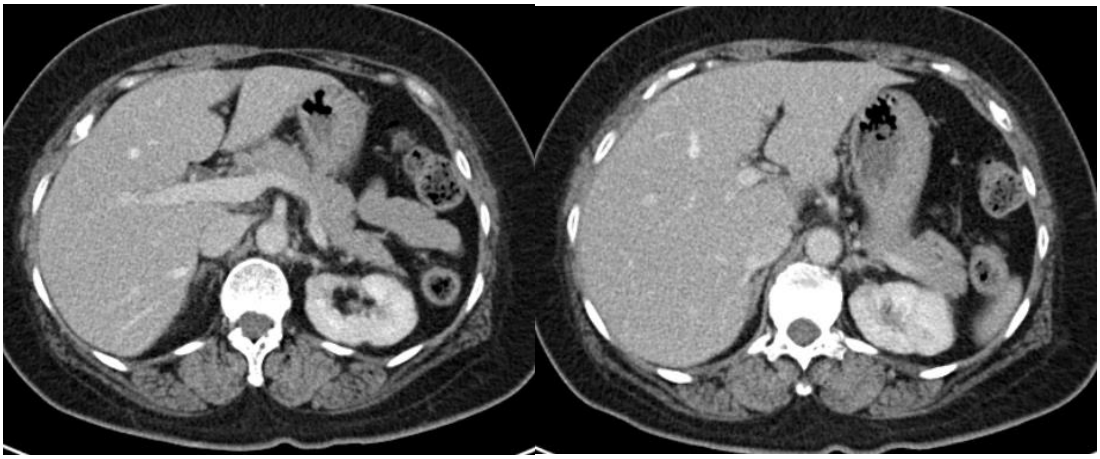
Non contrast **oral contrast**





Axial arterial phase





Axial Contrast portal venous phase

https://radiopaedia.org/articles/pancreatic-ultrasound , https://appliedradiology.com/

https://radiopaedia.org/?lang=us , **web.stanford.edu**

Normal Pancreas meaurements

Age	Head	Body	Tail
Ultrasound (Mean ± SD, cm)			
<1 month	1.0 ± 0.4	0.6 ± 0.2	1.0 ± 0.4
1 month to 1 year	1.5 ± 0.5	0.8 ± 0.3	1.2 ± 0.4
1-5 years	1.7 ± 0.3	1.0 ± 0.2	1.8 ± 0.4
5-10 years	1.6 ± 0.4	1.0 ± 0.3	1.8 ± 0.4
10-19 years	2.0 ± 0.5	1.1 ± 0.3	2.0 ± 0.4
CT (Mean ± SD, mm)			
20-30 years	28.6 ± 3.8	19.1 ± 2.1	18.0 ± 1.6
21-40 years	26.0 ± 3.4	18.2 ± 2.4	16.5 ± 1.8
41-50 years	25.2 ± 3.6	17.8 ± 2.2	15.8 ± 1.7
51-60 years	24.0 ± 3.6	16.0 ± 2.0	15.1 ± 1.9
61-70 years	23.4 ± 3.5	15.8 ± 2.4	14.7 ± 1.8
71-80 years	21.2 ± 4.3	14.4 ± 2.7	13.0 ± 2.1