Pancreas

Effective February 2007
6%-14%

Anatomy

Head
- The head is located to the right of the SMV.
- The right lateral border is the second portion of the duodenum.
- The IVC is posterior.
- The GDA is the anterior lateral border.
- The CBD is posterior and lateral to the GDA.
- The PV is cranial to the head.
- The uncinate process is directly posterior to the SMV.
- The head measurements are: AP—2.1 to 2.5 cm; longitudinal AP—2.0 to 2.4 cm.

Anatomy

Neck
- found directly anterior to the portal-splenic confluence or SMV.
- PV is formed posterior to the neck  
  - by the junction of superior mesenteric vein and splenic vein.
- Measurements over the SMV are as follows: longitudinal—1.0 to 1.3 cm; AP—0.95 to 1.1 cm.
Anatomy

Body
• The body is the largest section of the pancreas.
• It is anterior to the SMA.
• It rests anteriorly to:*
  – aorta, the origin of the SMA, the left renal vessels, the left adrenal glands, left kidney.
• The SV courses posteromedial surface of the pancreas to join the main portal vein.

Anatomy

Tail
• lies anterior to the left kidney, close to the spleen and left colic flexure.
• The SV courses along the posterior surface of the body and tail.
• splenic artery forms the anterior border,
• splenic vein forms the posterior border,
• stomach forms the superoanterior border.
Anatomy

Ducts

• Duct of Wirsung – main pancreatic duct
• Duct of Santorini – accessory pancreatic duct – usually disappears
• Ampulla of Vater – major papilla in second portion of duodenum where pancreatic duct and CBD enter
• Sphincter of Oddi – muscle that controls flow of pancreatic juices or bile into duodenum
• Minor papilla – orifice in duodenum, superior to Ampulla of Vater, where duct of Santorini enters

Vascular

Arterial
• splenic artery
• pancreaticoduodenal arteries.

Venous drainage
• tributaries of the splenic (SV)
• superior mesenteric veins (SMV).

Lymph Drainage

• Celiac nodes
  – → Cysterna Chyli (origin of thoracic duct) →
• Thoracic duct (main lymph duct)
  – → Left subclavian vein.
• secondary connections with mediastinal and cervical nodes
  – appearance of mets in the “Supraventricular” (Virchow’s) nodes.
Technique

• NPO for 8 to 12 hours before the examination
• Water or fluid technique may be used to fill the stomach for better visualization of the pancreatic area.
• Fasting promotes dilation of the gallbladder and ducts and ensures an empty stomach.
• Fasting causes less bowel gas.
• Real-time allows visualization of the peristalsis, duodenum, and stomach.
• adults, use a 3- to 5-MHz transducer with a mid-focal zone.
• pediatric patients, use a 5- to 7.5-MHz transducer.

Windows for Visualization

• Left lobe of liver
• Stomach
• Colon
• Water technique
• Lt kidney

Lab Values

Amylase
  – elevates within first 24 hours, but declines after 3 days
Lipase
  – elevates 48 – 72 hours, but stays elevated up to 14 days
  – better indicator of acute pancreatitis
  – excreted in urine
Trypsin
  – elevates with pancreatic cancer
Leukocytes
  – elevated WBC → infection, inflammation, abscess
Direct Bilirubin
  – biliary obstruction
Serum Glucose
  – test for diabetes
  – detects disorder of glucose metabolism
Lab Values

- **Amylase**: digestive enzyme for carbohydrates. A serum amylase level twice that of normal usually indicates acute pancreatitis.
- **Lipase**: an enzyme excreted specifically by the pancreas. Lipase elevates in pancreatic disease and may persist for a longer period than amylase.
- **Glucose**: controls the blood-sugar level in the body. An increase in blood glucose level is found in severe diabetes, chronic liver disease, and overactivity of the endocrine glands. There may be a decrease in blood-sugar level in tumors of the islets of Langerhans.

Physiology

- **Exocrine gland** → **Acinar glands**
  - Aid in digestion
- **Endocrine gland** → **Islets of Langerhans**
  - Storage of sugars → **INSULIN**
  - Alpha cells 15 – 20%
    - Produces glucagon
    - Affects fat and protein metabolism
  - Beta cells 60 – 70%
    - Produces insulin
    - Assists in reducing blood glucose levels

Insulin

- **Required for life**
- Secreted in response to
  - Increased levels of blood sugar
  - Presence of simple sugars in stomach
- High levels of sugar over long periods of time
  - Stress normal insulin production
  - Cause dysfunction
Diabetes Mellitus

- decreased insulin production
- failure of uptake of sugar by tissues
- affects fat, carbohydrate, protein, mineral, and water metabolism
- patient presents with polyuria,
  - increased thirst, increased appetite, weight loss in face, hyperglycemia

Hypoglycemia

- increased insulin production
- low blood sugar
- increased sugar uptake and storage
- light-head, faint

Indications

including clinical symptoms, clinical correlation and associated complications
Normal texture

• As dense or more dense than liver
• Internal echoes consist of regularly and closely spaced elements of uniform intensity, with uniformly distributed variation throughout the gland.
• Texture depends on amount of fat between the lobules or interlobular fibrous tissue.

Pancreatitis

• related to biliary tract disease and alcoholism.
• Gallstones present in 40% to 60% of patients.

Acute Pancreatitis

• Initial symptom in 5% of patients with gallstones
• Other causes
  – trauma
  – inflammation from PUD
  – abdominal infection
  – vascular thrombosis and embolism
  – drugs.
Acute Pancreatitis

Clinical signs
• Persistent abdominal pain
• Fever
• Leukocytosis beyond the 5 days of the usual attack of acute pancreatitis
• Risk for abscess and hemorrhage

Clinical course
• Severe pain after a large meal or alcoholic binge.
• Pain is constant and intense.
• Serum amylase level increases within 24 hours.
• Serum lipase level increases within 72 to 94 hours.
Approximately 5% of patients die from the acute effects of peripheral vascular collapse and shock during the first week of the clinical course.

Complications
• Pseudocyst formation (10%)
• Phlegmon (18%)
• Abscess (1%–9%)
• Hemorrhage (5%)
• Duodenal obstruction
Sonographic findings

- Normal pancreas (29%)
- Increase in size (52%)
- Loss of normal texture (28%)
- Hypoechoic to anechoic and less echogenic than liver
- Borders indistinct but smooth
- Loss of distinction of splenic vein

Advanced inflammation

- Hemorrhagic Pancreatitis
- Phlegmonous Pancreatitis
- Liquefactive Necrosis
- Chronic Pancreatitis

Parenchymal Disease
Focal and Diffuse abnormalities
Inflammatory and Infectious Lesions

• Pancreatic Pseudocysts
  – associated with pancreatitis
  – collection of fluid arising from inflammatory processes, necrosis, or hemorrhage

• Cystic Lesions of the Pancreas
  – Autosomal dominant polycystic disease
  – Von Hippel-Lindau disease
  – Solitary pancreatic cysts

Parenchymal Disease
Acute and Chronic processes

Masses
Benign
Malignant Masses

Clinical course
- Weight loss
- Abdominal pain
- Back pain
- Anorexia
- Nausea and vomiting
- Generalized malaise and weakness
- Patients are more often men >50 years old
- Painless jaundice

Exocrine Pancreatic Lesions

Adenocarcinoma
- fatal tumors
- 95% of all malignant pancreatic tumors
- More common in men 60 to 80 year olds.

Mucinous Adenocarcinoma (Colloid Carcinoma)
- produces a large volume of mucin

Cystadenoma

Microcystic Adenoma
- tiny cysts
- benign
- 60% body and tail
- 30% head

Macrocystic Adenoma
- uncommon
- cysts with or without septations
**Endocrine Pancreatic Neoplasms**

- *Islet Cell Tumors*
  - most common functioning islet cell tumor is insulinoma (60%)
  - mostly in the body and tail

**Exocrine Pancreatic Lesions**

**Malignant Masses**

- Metastatic Disease
  - lymphomas
  - Multiple nodes are seen
  - appear hypoechoic
- *Parapancreatic Neoplasms*
  - Lymphoma most frequent

**Cysts**

Simple