Pancreas diseases

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1 Anatomy of the pancreas

The pancreas is an extended, accessory digestive gland that is found retroperitoneally, crossing the bodies of the L1 and L2 vertebrae on the posterior abdominal wall. The pancreas lies transversely in the upper abdomen between the duodenum (on the right) and the spleen (on the left). It is divided into the head, neck, body, and tail. The pancreas produces an exocrine secretion (pancreatic juice from the acinar cells) which then enters the duodenum through the main pancreatic duct. It also produces endocrine secretions (glucagon and insulin from the pancreatic islets of Langerhans) that enter the blood.

The majority of the pancreas (approximately 80%) is made up of exocrine pancreatic tissue. This is made of pancreatic acini (group of cells). These acinar cells contain and release digestive enzymes.

The pancreas also contains the islet of Langerhans (groups of endocrine cells). They produce hormones such as glucagon, insulin, or somatostatin.

2 Clinical Significance

Cancer

Pancreatic cancers, particularly pancreatic adenocarcinoma, are very difficult to treat and are usually diagnosed at a stage too late for surgery. Pancreatic cancer is rare in younger patients; the median age of diagnosis is 71. Risk factors include smoking, obesity, diabetes, and multiple endocrine neoplasia type 1, and hereditary nonpolyposis colon cancer.

Diabetes Mellitus

Type 1 Diabetes mellitus type 1 is an autoimmune disorder in which the immune system attacks insulin-secreting cells of the pancreas resulting in decreased insulin. Type 1 diabetes usually develops in childhood. Patients with type 1 diabetes require insulin injections for survival.

Type 2 Diabetes mellitus type 2 is the most common form of diabetes. The disease causes high blood sugar, usually due to a combination of insulin resistance and impaired insulin secretion. Treatment includes changes in diet and physical activity as well as biguanides such as metformin.

Inflammation

Pancreatic inflammation is known as **pancreatitis**. It is associated with recurrent gallstones, alcohol use, measles, mumps, medications, alpha-1 antitrypsin deficiency, and scorpion stings. Pancreatitis causes intense pain in the central abdomen that radiates to the back. It may be associated with jaundice.

3 Pancreatitis

Acute pancreatitis is an acute response to injury of the pancreas. Chronic pancreatitis can result in permanent damage to the structure and endocrine and exocrine functions of the pancreas.

The two most common causes of acute pancreatitis in developed countries are gallstones (35% to 40% of cases) and alcohol use (30% of cases). However, the causes are extensive and include the following: autoimmune pancreatitis, hypertriglyceridemia, post-endoscopic retrograde cholangiopancreatography (ERCP), and medication. Eighty percent of patients admitted with pancreatitis usually have mild disease and can be discharged within a few days. Overall mortality of acute pancreatitis is approximately 2%.

The most common cause of **chronic pancreatitis** is alcohol abuse.

3.1 Pathophysiology

The pathogenesis of acute pancreatitis can occur by **pancreatic duct and acinar injury**. In acute pancreatitis, digestive enzymes within the pancreas are not secreted properly, and this leads to **auto-digestion** and inflammation of the pancreas.

Alcohol can cause acute pancreatitis through direct toxicity and immunologic processes. Gallstones can lead to temporary obstruction of the pancreatic duct, and this is also believed to be the mechanism of ERCP-induced pancreatitis.

Chronic pancreatitis can occur by repeated acute attacks which leads to inflammatory infiltrates and fibrosis within the pancreas. Over time, this leads to pancreatic insufficiency.

Acute pancreatitis can be classified as:

- Interstitial (or edematous) pancreatitis (mild form of pancreatitis)
- Hemorrhagic-necrotizing pancreatitis (severe form of pancreatitis)

In acute pancreatitis, the pancreas can be edematous, necrotic and surrounded by fat stranding. In severe pancreatitis, there are large areas of fat necrosis, parenchymal destruction and focal hemorrhages.

Chronic pancreatitis is characterized by **fibrosis**, even calcifications present within the pancreas.

3.2 History and Physical Examination

Acute pancreatitis most commonly presents with abdominal pain, which usually occurs in the epigastric region and radiates to the back (like a belt). It is often described as severe sharp pain and is frequently associated with nausea and vomiting.

Physicians should ask the patient specifically about the previous history of gallbladder disease, history of hyperlipidemia, previous episodes of pancreatitis, and history of alcohol use.

Chronic pancreatitis can present with episodes of abdominal pain, nausea, and vomiting (that is, episodes of acute pancreatitis over a chronic pancreatitis). However, it can also be painless, and patients can present with steatorrhea (yellowish fat in the stools) and weight loss.

3.3 Diagnosis

Laboratory parameters

Laboratory work ordered on admission should include a complete metabolic panel, complete blood count, serum lipase, lactate, serum triglycerides, and C-reactive protein (CRP) levels. Amylase and lipase are pancreatic enzymes that can be found in blood. Calcium and CRP levels also indicate the severity of the inflammation. High levels of bilirubin indicate bile duct obstruction. Triglycerides indicate one of the causes of acute pancreatitis.

Abdominal imaging

Imaging (such as ultrasound, computed tomography scans and/or magnetic resonance imaging should be performed within 2 to 3 days after admission to hospital, but they are to be performed depending on the severity of the inflammation.

3.4 Treatment and Management

The most important step in the management of acute pancreatitis is aggressive fluid resuscitation, because of two reasons:

1. the patient must be with no oral feeding (to avoid the release of more lytic enzymes);
2. intravenous hydration has been shown to decrease systemic inflammation in patients with acute pancreatitis.

In regards to nutrition in acute pancreatitis, oral feedings can be started immediately if the patient can tolerate them. In severe pancreatitis, enteral feedings are preferred over parenteral feedings as there is decreased risk of infections, surgical interventions, and lower mortality. Analgesia is also an important aspect of the management of pancreatitis and can include the use of intravenous opioids.

For patients who have gallstones within the gallbladder, a cholecystectomy can be performed during the same admission.

For patients with acute pancreatitis caused by hypertriglyceridemia, current standard therapy involves placing treatment with insulin (to decrease triglycerides by activating lipoprotein lipase). Antibiotics in acute pancreatitis are indicated if presence of infectious complications.

The treatment for chronic pancreatitis involves pain control, counseling regarding alcohol cessation, and pancreatic enzyme replacement. Most importantly, patients should be encouraged to eat a low-fat diet in small meals.

4 Pancreatic cancer

Pancreatic cancer refers to the carcinoma arising from the pancreatic duct cells, pancreatic ductal carcinoma. It is the fourth leading cause of cancer deaths in the United States. The 5-year survival rate in the United States ranges from 5% to 15%. The overall survival rate is only 6%. Surgical resection is the only current option for a cure, but only 20% of pancreatic cancer is surgically resectable at the time of diagnosis.

Possible risk factors include heavy alcohol consumption, coffee consumption, physical inactivity, high red meat consumption, and two or more soft drinks per day.

More than 90% of neoplasm of the pancreas are duct cell adenocarcinomas. Tumor markers associated with pancreatic cancer include CEA and CA 19-9.

Patients with adenocarcinoma of pancreas typically present with painless jaundice (70%) usually due to obstruction of the common bile duct from the pancreatic head tumor. Weight loss occurs in about 90% of patients. Abdominal pain occurs in about 75% of patients. Weakness, pruritus from bile salts in the skin, anorexia, palpable, non-tender, distended gallbladder, acholic stools, and dark urine. Laboratory findings will include elevation in liver function tests, direct and total bilirubin levels, elevated amylase and lipase, and elevated pancreatic tumor markers (CA 19-9 and CEA.

If the pancreatic adenocarcinoma is considered locally advanced then by definition it is unresectable. Neoadjuvant treatment with chemotherapy and/or radiation is typically perferred in this situation.