



Pancreatic problems

Objectives:

1. surgical anatomy.
2. surgical physiology.
3. Congenital disorders of the pancreas
4. Pancreatitis
5. neoplasms of the pancreas.

Resources:

- Davidson's.
- 435 Slides.
- Surgical recall.
- Raslan's notes.
- 434 students work.

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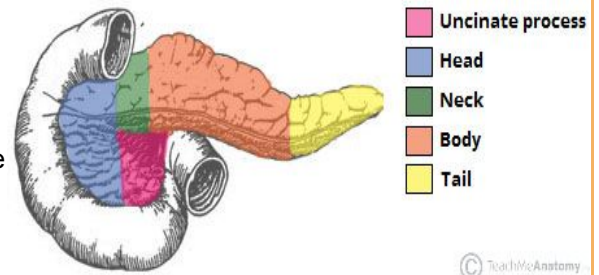
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Once you stop learning
you start dying.

Basic review:

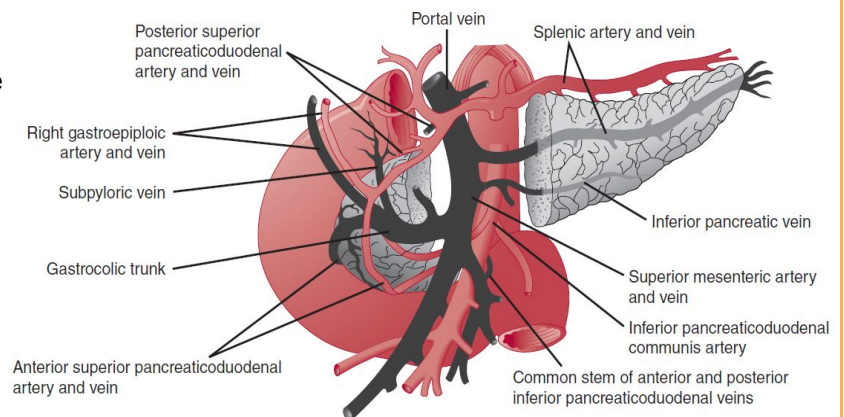
The pancreas is a **glandular organ** in the **digestive system** and **endocrine system**.

- it is located in the abdominal cavity and lies **retroperitoneally** behind the lesser sac and the stomach.
- it has four sections moving from right to left: The **head/uncinate**, **neck**, **body**, and **tail**:
 - o **The head** of the gland lies within the C-loop of the duodenum,
 - o **The neck**, lies anterior to the mesenteric vessels and portal vein.
 - o **The body** “posterior to the stomach” and **tail** “anterior to the left adrenal gland” of the pancreas lie in front of the splenic vein as far as the splenic hilum.

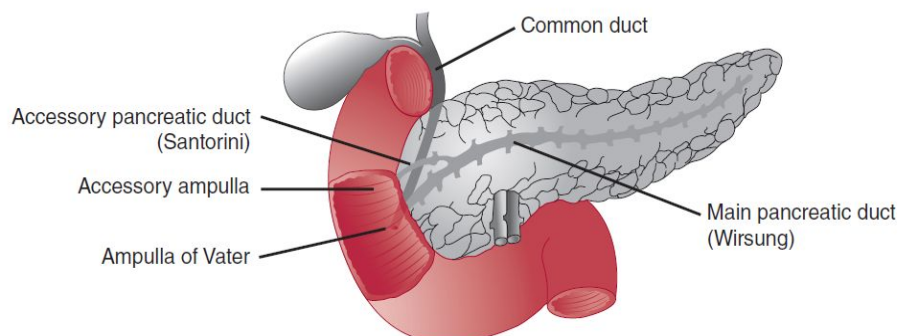


blood supply/ drainage:

- The pancreas receives its **blood supply** from both the **celiac trunk** and the **superior mesenteric artery** (SMA).
 - o The arterial supply of the pancreatic **head** is provided by the **superior pancreaticoduodenal arteries** (from the gastroduodenal artery “from celiac artery”) and the **inferior pancreaticoduodenal arteries** (from the SMA).
 - o The **distal pancreas** receives its arterial supply from branches of the **splenic artery** “from celiac artery”.
- **Venous drainage** is primarily by the **pancreaticoduodenal and splenic veins**, which drain into the portal vein.



- **The endocrine gland** produce several important hormones, including **insulin**, **glucagon**, **somatostatin**, and **pancreatic polypeptide** which circulate in the blood.
- **The exocrine gland** is a digestive organ:
 - o essential for the digestion of fat, protein and carbohydrate.
 - o it secretes 1–2 litres of alkaline (pH 7.5–8.8) enzyme-rich juice each day “neutralize acidity of chyme moving in from the stomach”
 - o it also secretes **digestive enzymes** that assist digestion and absorption of nutrients in the small intestine.
 - Pancreatic secretion is stimulated by eating. Hormonal and neural (vagal) mechanisms are involved. Food entering the duodenum (notably fat and protein digestion products) releases cholecystokinin (CCK).



[exocrine pancreas](#)
[endocrine pancreas](#)
[anatomy of pancreas](#)

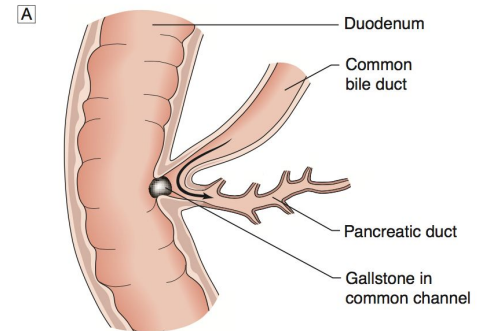


Acute Pancreatitis

A **non-bacterial inflammatory** disease caused by **activation and autodigestion** of the pancreas by its own enzymes.

Etiology: "if you suspect the patient has pancreatitis check for all of them"

- **Gallstones:**¹ (1st most common) "biliary pancreatitis" (image A)
 - Small stones can lodge in the Ampulla of Vater and block both the common bile duct (CBD) and the pancreatic duct leading to activation of pancreatic enzymes, Small stones eventually pass and can be found in stool. If it doesn't pass, it will cause **cholangitis**.



- **Alcohol:** (2nd most common)
 - Direct toxic effect on pancreatic cells
 - Transient ischemia (cutaneous vasodilation → blood diverted away from splanchnic circulation → pancreatic ischemia) البنكرياس مشكلته شوي دلوع يتحسس من ابسط الاشياء اللي ممكن الاعضاء الثانية تقدر تسيطر عليها
- **Hypercalcemia**²: Ca activates the enzyme and causes stone
 - Excessive calcium causes:
 - Deposition of Ca^{+2} in soft tissues leading to **obstruction of the pancreatic duct**.
 - With severe inflammation: **Ca^{+2} + fat** "fatty acids bind to calcium producing necrosis" → **saponification**³ (soap formation) → serum Ca^{+2} will be depleted in the process (low-normal serum Ca^{+2} levels "hypocalcemia")

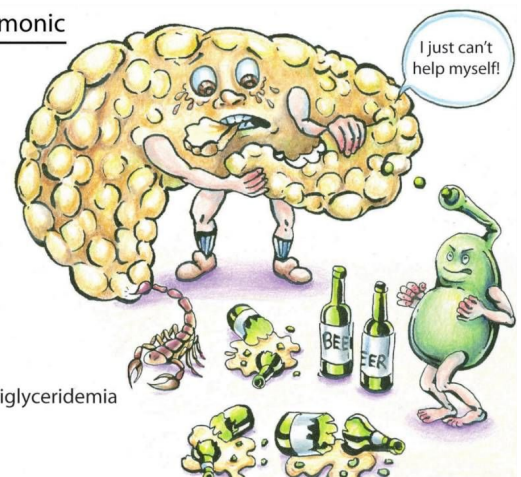
- **Hyperlipidemia especially TAG**
 - Could be a cause: Elevations greater than 1,000 mg/dL can lead to pancreatitis
 - Could be a result: TG serum levels increase with inflammatory processes, but the elevation will be moderate (<1000 mg/dL)

- Familial
- Drug induced Hormonal replacement therapy, steroids, OCP, diuretic "Thiazides"
- Obstruction Tumor
- Viral infection Coxsackie B and Mumps => lead to DM type 1 in pediatrics
- **Iatrogenic (3rd most common)**
 - **ERCP** (endoscopic retrograde cholangiopancreatography):
 - Increase Pressure with duct cannulation or contrast injection
- Trauma
- Scorpion bite
- Idiopathic

I GET SMASHED Mnemonic

Pancreatitis

Idiopathic
Gall Stones
Ethanol (Alcohol)
Trauma
Steroids
Mumps / Malignancy
Autoimmune
Scorpion Stings
Hypercalcemia / Hypertriglyceridemia
ERCP
Drugs



¹there are 2 theories in how cholecystitis can lead to pancreatitis. One is the **obstruction theory** in which small stones will lodge in the **Ampulla of Vater** (the narrowest part) and **block both the common bile duct and pancreatic duct** leading to activation of pancreatic enzymes, the other is **the reflux theory** or **the common channel theory** in which the stone will go all the way down to the Ampulla of Vater, the bile will follow it and then **reflux back to the pancreatic duct** which activates the pancreatic enzymes. Small stones eventually pass and can be found in stool.

² remember **hypercalcemia** causes pancreatitis, and pancreatitis causes hypocalcemia

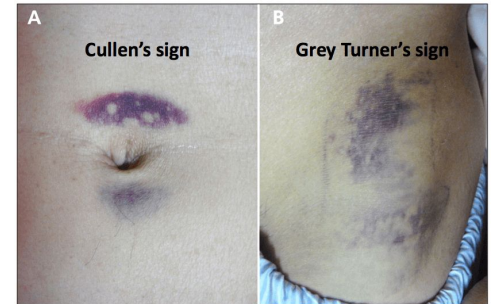
³ produced by activated lipases

History:

- **Epigastric pain (radiate to the back** because it's retroperitoneal). Patient will be **leaning forward** "less pain as pancreas moves away from the nerves"
- **Nausea and vomiting** "It is a defense mechanism; your body tells you don't eat because eating will make it worse"
- previous attacks
- underlying disease

Examination:

- ↓BP ,↑ Temperature
- **Dehydration (Rehydrate immediately by 2 liters)⁴**
- **Shock** "inflammation with big amount of fluid turns into the 3rd space leading to edema→ hypovolemia→ shock"
- Epigastric tenderness
- Grey Turner's⁵ and Cullen's signs (signs of retroperitoneal hemorrhage)
- Pleural effusion Left sided effusion. it is called sympathetic effusion "pleural effusion caused by irritation of the diaphragm". Inflammation of pancreas > irritation of the diaphragm > fluid will accumulate in left side. Right side effusion is seen with liver problems.



Investigation:

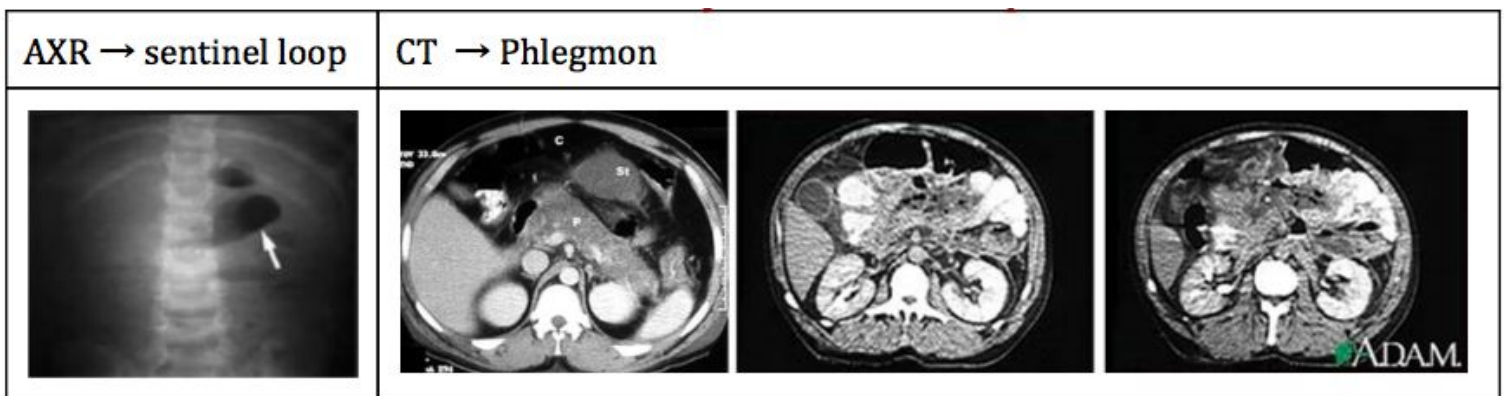
- **lab:**
 - increase WBC Leukocytosis due to inflammation not infection."remember pancreatitis is noninfectious"
 - increase serum Lipase
 - increase serum Amylase
 - Ca^{+2} & lipids⁶ مهم نشيك عليهم لأن بعض الأحيان نلقاهم نورمال فنرجع نعيد الاختبار لما يشفى البنكرياس بتلقى الكالسيوم عالي مع انه وقت الالتهاب ما كان عالي لانه كان يروح مع الليبد ويصير السيروم زي الصابون فلما اشوفهم مره مره عالين او وواحد منهم عالي بعرف انهم السبب

What is the difference between lipase and amylase?

- Amylase: **more sensitive**, if you catch the patient very early you will find Amylase very high and lipase normal.
- Lipase: **more specific**, later the lipase will be high and the amylase will be return to normal, takes time to go up and because it's only produced by the pancreas it is more specific.

Imaging:

- Plain erect chest & abdominal X-ray to see if there is perforation:



- Any patient comes with abdominal pain do an upright CXR to rule out perforations (free air) or to exclude lower lobe pneumonia which can present with abdominal pain.
- Sentinel loop: localized peritonitis lead to localized ileus.
- CT is not always unless you are not sure what is the diagnosis.
- Phlegmon: inflammatory mass. if there was gas it indicates bacterial infection.
- If you do US and find stone then if called biliary pancreatitis.

⁴ remember if u want to do something to such patient, 2 liters of fluid IV is the minimum amount.

⁵ to remember it "you need to TURN the pt to see it so it's grey TURNER".

⁶ all lipids go up with inflammation so this is NOT specific.

Management:

- Acute pancreatitis is the only acute abdominal emergency that **DOESN'T REQUIRE SURGERY**
- Most important step: **IV FLUID REPLACEMENT**

*Why patient with Acute pancreatitis die? Due to **hypovolemia**(pancreatic injury > inflammation > edema and hypovolemia “body fluids will move out of the vessels causing hypovolemia”).How you save patient life? by **IV fluids** (At least 2 L is the minimum)

Patients lose a lot of fluid (~3-4 L) to the interstitium “**3rd spacing**” = massive edema +/- retroperitoneal bleeding (due to vessel wall digestion be activated enzymes), leading to hypovolemia → replace fluid with normal saline or Ringer's lactate

Then:

- **Rest the patient:** Analgesics
- **Rest the bowel:** Nasogastric tube “If there are no vomiting no need for NG”
- **Rest the pancreas:** NPO (Nil per Os: nothing by mouth)

90% of patient will improve within 2 days after IVF and pain relieved.
-After pain relieved you can feed him.

***Do not administer antibiotics** “remember it's not infection”

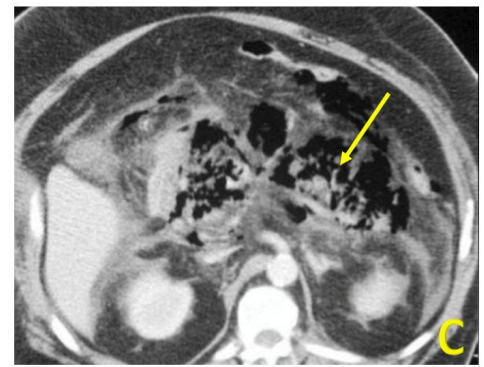
- **Cholecystectomy** in gallstone pancreatitis “In same Administration.. if the causes is stone and there are no obstructive jaundice or sever inflammation” why?⁷.
- **ERCP** only indicated in acute pancreatitis with cholangitis⁸

Complications 90% will be fine, 10% will have complication

- **Necrosis:** (pic A) if more than 30%, start antibiotic therapy (**Liquefactive necrosis**)
- **Infected necrosis** (gas formation) (pic B+C) “white color indicates live tissue that takes up the contrast and black color indicates dead tissue”

Clean all necrotic tissue “necrosectomy”

- **Abscess** (drainage and antibiotics)
- **Pseudocyst**



Ranson's Criteria “Assessing severity & prognosis” **“important MCQs”**

Most of them related to hypovolemia. we are assessing the prognosis here, management is the same.

TABLE 3-4 Ranson Criteria

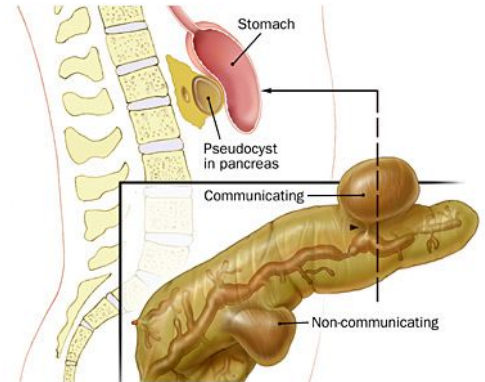
Admission Criteria (GA LAW)	Initial 48-hr Criteria (C HOBBS)	Mortality
Glucose >200 mg/dL	Calcium <8 mg/dL Decrease in Hematocrit >10%	<3 criteria—1%
Age >55 yrs	PaO ₂ <60 mm Hg	3–4 criteria—15%
LDH >350	BUN increase >8 mg/dL	5–6 criteria—40%
AST >250	Base deficit >4 mg/dL	>7 criteria—100%
WBC >16,000	Fluid sequestration >6 L	

⁷ اول كانوا يرسلونهم البيت ويقولون لهم بعد ثلاث شهور تعالو نشيل لكم المرارة لكن لاحظوا انهم يرجعون مره ثانيه بالتهاب البنكرياس خلال ذا الفتره فقررروا بعدين انهم مايطلعون المرضى الا وهم مسوين لهم ازالة المرارة نهائيا لكن مهم جدا ما نسوي العمليه وقت الالتهاب لازم يخف او يروح بعدين نسويها لو سويها وعده التهاب مصيبه بتجيه مضاعفات كثير

⁸ If the cause of Acute pancreatitis is Gallstones, most of the stones will pass on their own, if there is persistent obstruction from a stone that is the only indication to do ERCP. (If there is Obstructive Jaundice due to Cholangitis with pancreatitis) Then after obstructive removed do cholecystectomy. Otherwise, ERCP will make things worse.

Pseudocyst

- Pseudocyst⁹ occurs by a disruption of pancreatic duct structure leading to pancreatic fluid leakage typically located in the **lesser sac** “posterior to the pancreas”. Their symptoms occur when the patient goes home or during the same admission.
- Not a true cyst because it is surrounded by fibrosis not epithelium.
- its a collection of amylase-rich fluid to the lesser sac and enclosed in a wall of fibrous or granulation tissue (not epithelium) that develops following acute pancreatitis.
- due to Failure of pancreatitis to recover or recurrence of symptoms.

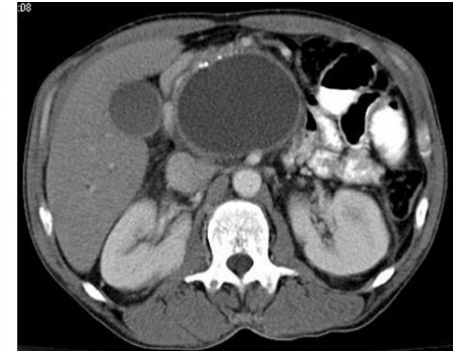


History:

- Abdominal pain **mass, tenderness**
- Pressure symptoms
 - Stomach: **nausea**
 - Bile duct: **obstructive jaundice**
- Epigastric mass

Investigation:

- ↑ Lipase or WBC **can be normal**
- Obstructive jaundice
- CT scan **(diagnostic)**



Complications:

- Infection
- Rupture
- Bleeding (**erode the vessels, esp. gastroduodenal artery or pancreatic artery**)



Treatment:

- Observe for 6-12 weeks (**60% resolve spontaneously**)
- Drainage indicated if:
 - **External**¹⁰ drainage: in case of Infection **like in abscess**
 - **internal**¹¹ drainage:
 - Symptomatic (**through the stomach** “ remember to send it to the histopathology to make sure it not a true cyst)
 - > 5 cm (internal drainage)

⁹ usually around the body of the pancreas.

¹⁰ puncture through the skin

¹¹ typically through the stomach.

Chronic Pancreatitis

Patients who drink **alcohol** and develop acute pancreatitis tend to **drink more** because they think it relieves the pain, they develop 10 attacks or more of acute pancreatitis for 5 or 6 years, then there will only be **fibrosis** in the pancreas “**no pancreatic tissue**” which means loss of both endocrine and exocrine functions (in summary repeated episodes of pancreatitis healed by fibrosis)

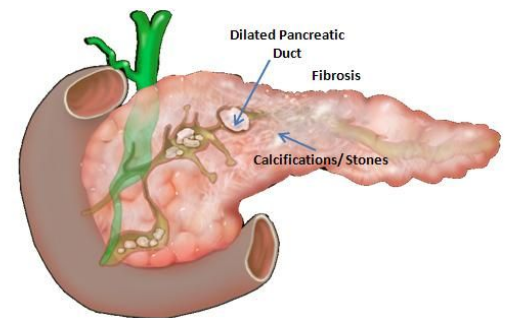
Symptoms:

- Abdominal pain
- Malabsorption
- Diabetes

sometimes develop Ca^{+2} stone due to dilated pancreatic duct.

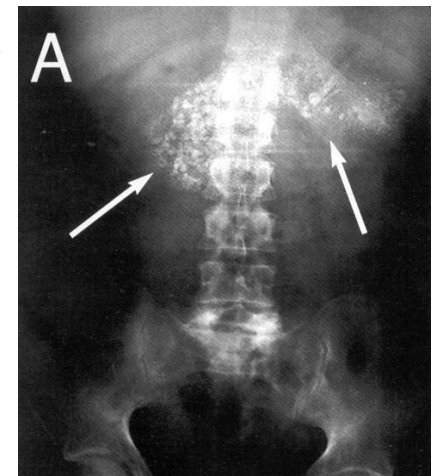
Diagnosis:

- Lipase/Amylase usually normal
- ↑ **Glucose**
- **AXR calcification** and stone “X-ray reveals calcifications that are typical for chronic pancreatitis”
- CT > Calcification, atrophy, dilated ducts “If were big dilated duct there is almost no pancreas.”



Complications:

- Biliary obstruction (due to fibrosis of the head of the pancreas)
- Pseudocyst.
- Carcinoma (due to repeated inflammation)
- Splenic vein thrombosis¹² (lies on top of pancreas)
 - left sided portal HTN¹³.
 - splenomegaly.



Treatment:

- Pancreatic enzymes for malabsorption
- Insulin for DM
- Analgesics
- Celiac block
- Surgical drainage Pancreaticojejunostomy (pancreatic duct drainage procedure to decompress the dilated pancreatic duct)— most common procedure Bypasses pancreatic duct & 70% relieves pain.
- Pancreatectomy last choice

Pain is the biggest problem, we treat it either with **analgesics** (narcotics) or **celiac block** (injection of analgesics) which does not relieve the pain in 50% of the cases, we can also relieve the pain with **surgery** which include the following types:

A. **Pancreaticojejunostomy** (Pancreatic duct drainage procedure to decompress the dilated pancreatic duct). It is the **most common procedure**. Causes **relieve of the pain in 70%** of the cases.

B. **Pancreatectomy**: “removal of all or part of the pancreas” metabolic problems “**hypoglycemia**” that may kill the patients

C. **Pancreatic resection** (last resort; will lead to “**brittle diabetes**” which is unstable diabetes with recurrent swings in **glucose levels**) it also **does not always relieve the pain**.

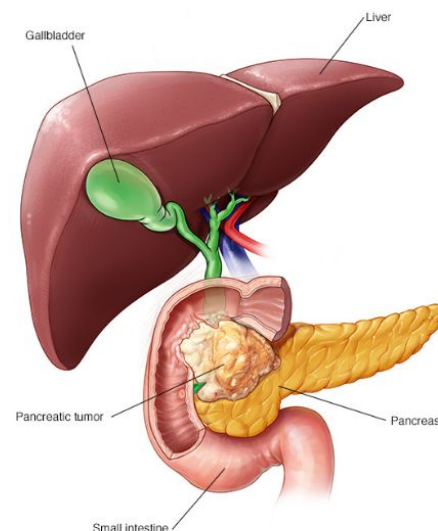
¹² (with repeated inflammation). In splenic vein thrombosis patients will not develop ascites, they might develop left sided portal hypertension, bleeding varices (around the stomach and the spleen), hematemesis. You treat this with Splenectomy.

¹³ varicose vein without ascites

Pancreatic Adenocarcinoma

- 3rd leading cause of cancer death in **men 35-55 of age**
- ↑ with **cigarette smoking (most important)**, fatty food, remote gastrectomy and in blacks
- Other risk factors: Chronic pancreatitis, polyposis syndromes, family history and cholecystectomy.
- **70% located in the head of pancreas.**

if involved the head it will cause **obstructive jaundice** “patients present to doctors early = early diagnosis”, if in body or tail “**No obstructive jaundice** = presents late with more complication and poor prognosis”



History:

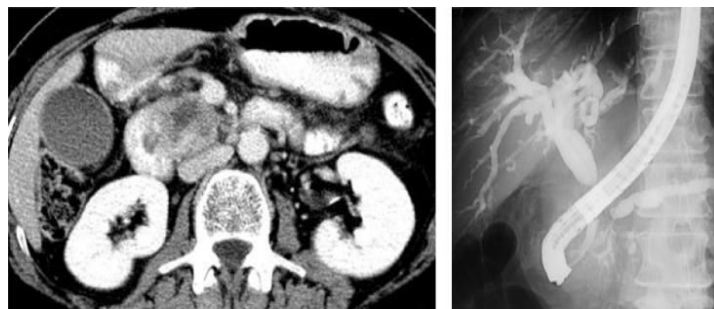
- Weight loss
- Jaundice
- Deep seated pain
- Back pain (sign of retroperitoneal invasion)
- Gastric outlet obstruction

Examination:

- **jaundice**
 - **Jaundice + fever + cholangitis**
 - **Cholangitis** is an inflammation of the biliary tree. It is a medical **emergency**. patient needs to be admitted to the OR immediately. Most patients die because of cholangitis not the cancer itself.
 - Treat with decompression using ERCP.
- Fever
- Hepatomegaly
- Palpable gallbladder
- Succussion splash

Investigation:

- **lab:**
 - Obstructive jaundice
 - ↑ WBC
 - **CA 19-9** (tumor marker) if > 100 you are dealing with cancer in 90% of cases for pancreatic adenocarcinoma or cholangiocarcinoma.
- **Imaging:**
 - **US**
 - **CT** (adenocarcinomas are hypovascular - black don't take contrast)
 - **ERCP** (double-duct sign)
 - Mass block both ducts.



Management:

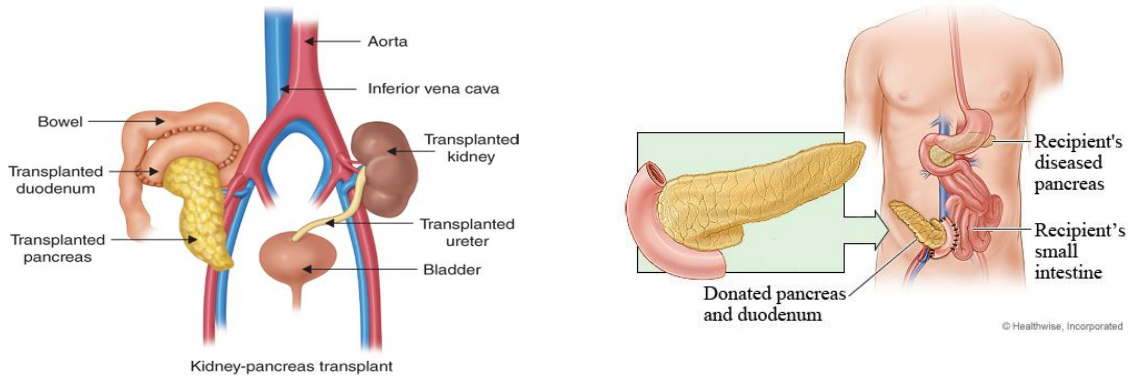
- Assess resectability (roll out local invasion and distant metastasis).
- **Whipple's resection.**¹⁴
- Palliative biliary and gastric drainage.
- Poor long term survival.

¹⁴ In a standard Whipple procedure, the surgeon removes the head of the pancreas, the gallbladder, part of the duodenum, a small portion of the stomach (pylorus), and the lymph nodes near the head of the pancreas.

Pancreas Transplant

Commonest indication : type one diabetes + hypoglycemia with unawareness.

غالبا اللي يجيهم النوع الاول من السكر يجيهم وهم صغار فهم عرضة اكثر انه يجيهم فشل كلوي فاذا جاهم فشل كلوي بنسوي زراعة للكلى و البنكرياس مع بعض



Recall:

What are the regions of pancreas ?

uncinate process, head, neck, body, tail.

What is the structure that the tail of pancreas said to tickle ?

spleen.

Name the two pancreatic duct, and which one is the main duct ?

wirsung, santorini. the main duct is wirsung (think Santorini = Small = not the main)

How is blood supplied to the head of pancreas ?

- celiac trunk - gastroduodenal - anterior superior pancreaticoduodenal artery, posterior superior pancreaticoduodenal artery.
- superior mesenteric artery - anterior inferior pancreaticoduodenal artery , posterior inferior pancreaticoduodenal artery.
- splenic artery - dorsal pancreatic artery.

What are the most common etiology for ACUTE pancreatitis in the United States ?

1. alcohol abuse 50%
2. gallstones 30%
3. idiopathic 10%

What are the symptoms of ACUTE pancreatitis?

epigastric pain that radiates to the back , nausea , vomiting

What are the signs of ACUTE pancreatitis?

epigastric tenderness, diffuse abdominal tenderness, decreased bowel sounds(adynamic ileus), fever, dehydration\shock.

What lab tests you should order?

CBC, LFT, Amylase/lipase, Type and cross, ABG, Calcium, Chemistry, Coags, Serum lipase.

What is the most common sign on AXR of ACUTE pancreatitis ?

sentinel loop(s)

What is the prognosis of ACUTE pancreatitis ?

based on Ranson's criteria.

What are the subtypes of CHRONIC pancreatitis ?

- chronic calcific pancreatitis.
- chronic obstructive pancreatitis (5%)

What are the symptoms of CHRONIC pancreatitis?

epigastric pain, back pain, weight loss, steatorrhea.

What is the surgical treatment ?

- puestow-longitudinal - pancreaticojejunostomy (pancreatic duct must be dilated).
- duval - distal pancreaticojejunostomy.
- near-total pancreatectomy.

What is the differential diagnosis of pseudocyst ?

cystadenocarcinoma, cystadenoma.

What is the treatment of the pseudocyst ?

drainage of the cyst or observation.

What is the average age of pancreatic carcinoma ?

60 yr

What is the classic presentation of pancreatic cancer in the head of pancreas ?

painless jaundice.

MCQS

1. All of the following are true about the anatomy of the pancreas, except:

- A. The head is adherent to the medial duodenum.
- B. The body is in contact posteriorly with the left crus of the diaphragm and the left adrenal gland.
- C. The common bile duct passes through a groove in the posterior aspect of the head.
- D. The uncinate process lies anterior to the superior mesenteric artery.
- E. The main pancreatic duct is also known as the duct of Wirsung.

2. Serum amylase can come from:

- A. Lung
- B. Muscle
- C. Skin
- D. Parotid gland
- E. Red blood cells

3. Acute pancreatitis:

- A. Is usually caused by acute cholecystitis
- B. Can be complicated by pancreatic abscess
- C. Causes inflammation of the pancreas that is usually not discernible by CT scan
- D. Is associated with common bile duct stones in more than 80% of patients
- E. Progresses to chronic pancreatitis in about 40% of those affected

4. Pancreatic adenocarcinoma:

- A. Is unresectable at the time of diagnosis in most people
- B. Is smaller at diagnosis, on average, for tumors in the tail of the pancreas than those in the head
- C. Can be resected by pancreaticoduodenectomy for those tumors limited to the tail
- D. Has a similar prognosis as malignant pancreatic neuroendocrine tumor
- E. Should generally be managed by operative enucleation

5. Management of insulinoma:

- A. Typically requires emergent operation
- B. Should not include preoperative imaging
- C. Should usually include resection of the primary tumor
- D. Is commonly required in the management of chronic pancreatitis
- E. Is a palliative approach to an incurable problem for most people

Answers:

1. **D.** The uncinate process lies anterior to the superior mesenteric artery
2. **D.** Parotid gland
3. **B.** Can be complicated by pancreatic abscess
4. **A.** Is unresectable at the time of diagnosis in most people
5. **C.** Should usually include resection of the primary tumor