Jaundice

Objectives

The student is expected to describe and explain the pathogenesis, etiology, clinical features and complications of each of the following conditions:

a. Prehepatic

- Hemolysis
- Transfusion reaction

b. Hepatic

- Infectious Hepatitis
- Cirrhosis
- Drugs
- Alcohol

c. Posthepatic

- Intraluminal
  - Stones
  - Polyps
- Intramural
  - Benign biliary stricture (ischemic, Mirizzi's syndrome, iatrogenic, inflammatory, sclerosing cholangitis)
  - Primary cancer (cholangiocarcinoma)
- Extramural
  - Secondary carcinoma (porta hepatic LN metastasis)
  - Carcinoma in the head of pancreas
  - Chronic pancreatitis

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Summary File

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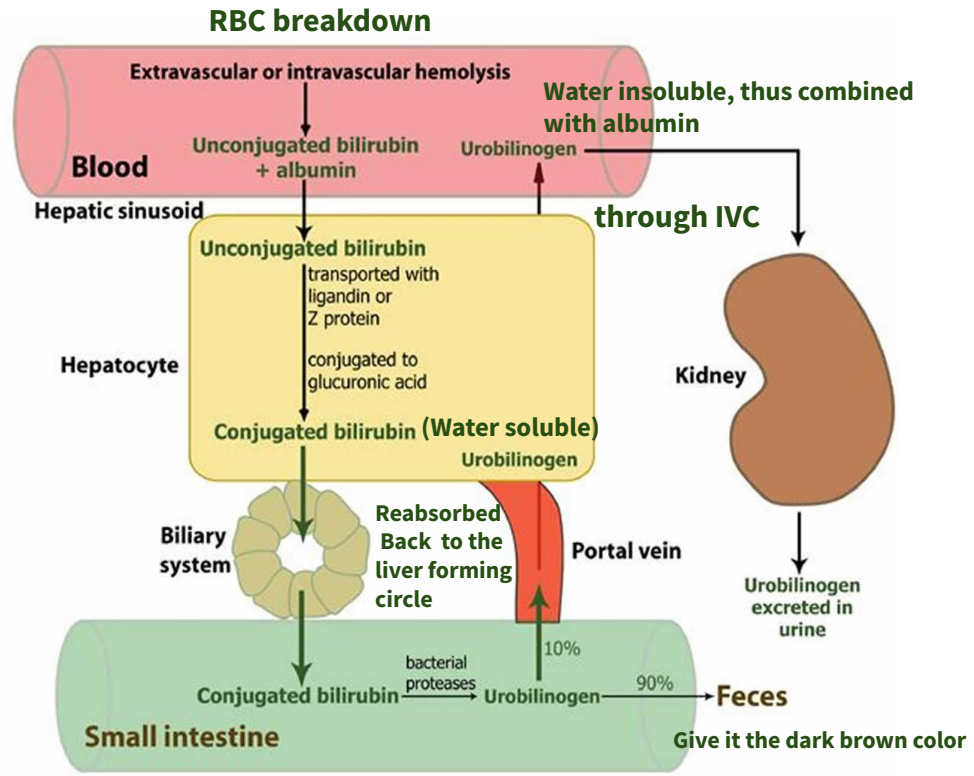
Jaundice

Definition:

- It is the Yellowish discoloration of skin, mucous membranes, sclera first to be seen in the sclera, because it's white thus any change can be seen early and body fluids due to hyperbilirubinemia (deposition of bilirubin). In advance cases yellow discoloration is seen in the saliva, urine, sweat and even fat.
- Clinical diagnosis made by inspection
- Usually clinically apparent when serum level of bilirubin **> 40-50 mmol/l (2.5-3 mg/dl)**
- Could be: based on the pathology site
    A. Pre-Hepatic
    B. Hepatic
    C. Post-Hepatic

- **Charcot's triad** means ascending cholangitis; consists of right upper quadrant pain, fever, and jaundice. Highly sensitive symptoms that could even diagnose w/o imaging (start treatment right away).
- Charcot's triad + leukocytosis = Surgical emergency that need ERCP.
- Charcot's triad + hypotension and confusion = End organ damage (failure), the sepsis is getting worse **(Reynolds pentad)**
- 500-1000 ml of bile is produced daily

Excretion of bilirubin:



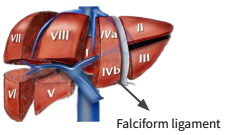
Bilirubin comes out in the form of unconjugated bilirubin, and it's not water soluble so it binds to albumin to be able to get transported to the blood gets picked up by the liver and gets conjugated via glucuronic acid and becomes water soluble. Once it gets secreted to the GI tract it helps with the digestion of fatty food, it turns into urobilinogen (by bacterial proteases) which most of it 90% gets excreted in the feces. Some of it 10% gets reabsorbed in the portal venous circulation, goes back to the liver, then gets excreted by the urine

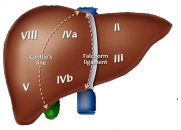
-Problems at any level leads to hyperbilirubinemia-

Jaundice

Surgical anatomy of the biliary system:

- Gallbladder lies beneath segments IV and V of the liver.
- Normal sizes (diameter):
  - Common bile duct (CBD) < 8 mm (< 10 mm after cholecystectomy)
  - Gallbladder wall < 4 mm,
  - Pancreatic duct < 4 mm.

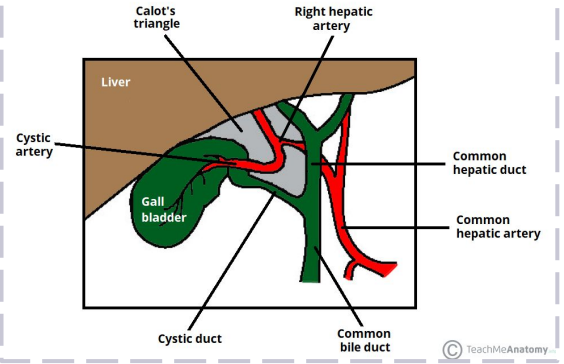




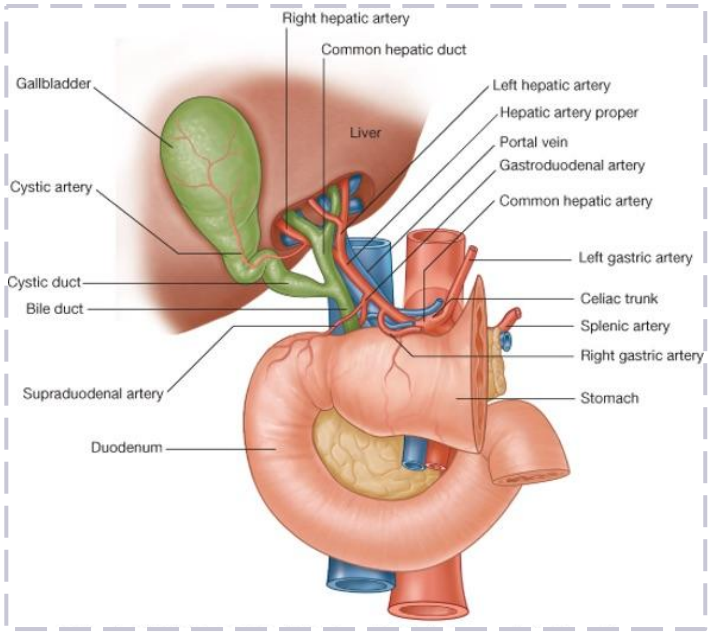
- Right hepatic (lateral) and retroduodenal branches of the gastroduodenal artery (medial) supply the hepatic and common bile duct (9- and 3-o'clock positions when performing endoscopic retrograde cholangiopancreatography [ERCP]); considered longitudinal blood supply
- Cystic veins drain into the right branch of the portal vein.

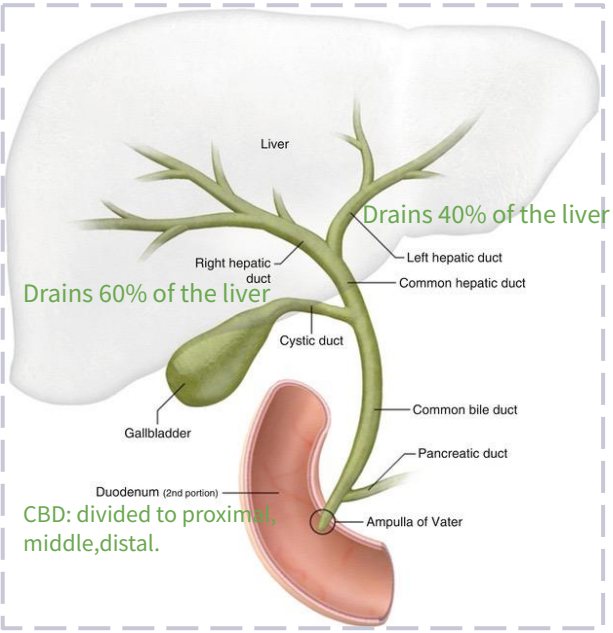
- Cystic artery branches of right hepatic artery (Is found in the triangle of Calot)
- ★ Triangle of Calot (hepatobiliary triangle) boundaries:
  - Cystic duct [lateral]
  - Common hepatic duct [medial]
  - Liver [superior]

- Lymphatics are on the right side of the common bile duct.
- Parasympathetic fibers come from left (anterior) trunk of the vagus.
- Sympathetic fibers from T7–10 (splanchnic and celiac ganglions).



Intrahepatic Biliary ducts are: Left lateral, Left medial, Right Ant, Right Post.
They converge and make right hepatic and left hepatic (outside the liver i.e. **extrahepatic**).
Right + left hepatic duct = **common hepatic duct**, + cystic duct = **CBD** (Common Bile Duct)
Lower ⅓ of CBD is **intrapancreatic**.





Jaundice

Classification:

Very helpful to the point that you don't even need to look at this page until the exam:)

Pre-hepatic jaundice:

- The liver conjugation is NOT compromised
- The liver excretion is not affected
- The capacity of the liver is overwhelmed The liver has a limited number of receptors when they are all occupied the rest will circulate freely
- Total bilirubin increased and UNCONJUGATED (Indirect) (Fat soluble)
  - also increased in:
    - Hemolytic Anemia E.g. sickle cell anemia, G6PD deficiency, thalassemia, hemophilia, spherocytosis, malaria, drugs (Rifampin) , sepsis
    - Transfusion reaction. specifically Hemolytic reaction
    - Hematoma secondary to trauma or surgery.
- Total bilirubin (>50%unconjugated) → prehepatic cause

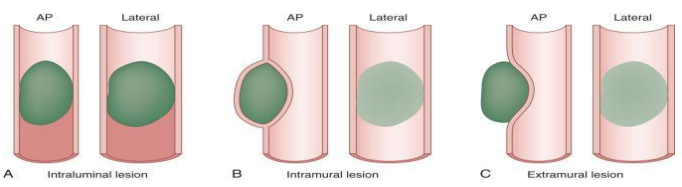
Hepatic jaundice:

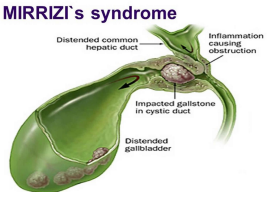
- Liver dysfunctional metabolism leads to increased bilirubin level and failure to remove bilirubin, may be due to storage problems, intrahepatic obstruction, or extrinsic insults.
- Results in Mixture of conjugated and unconjugated bilirubin.
  - **Infectious hepatitis**
    - Viral hepatitis (A-B-C) or parasitic increase unconjugated mostly
  - **Cirrhosis:** the most common cause of hepatic jaundice.
    - End stage liver disease that cause intrahepatic biliary duct obstruction e.g. PBC (affects bile ducts in the liver with stricture & fibrosis not hepatocytes). Not considered extrahepatic as it's still inside the liver. Anything beyond this area is extrahepatic. causing conjugated hyperbilirubinemia
    - Decompensated ones regardless of etiology
  - **Alcohol**
  - **Drugs:** paracetamol toxicity
  - Other causes: shock, liver cysts, Crigler-Najjar syndrome (Absent UDP-glucuronosyltransferase) and Gilbert syndrome (Low UDP- glucuronosyltransferase activity) (Mostly Unconjugated) and liver abscess.

Post-hepatic jaundice:

Obstructive jaundice gives dark urine and pale stools

- The two most common causes of obstructive jaundice are gallstones and cancer of the head of the pancreas.
- It is due to obstruction of the bile duct (extrahepatic ducts) after liver secretion. **Direct** hyperbilirubinemia. (Water soluble).
- Depending on the location of the duct obstruction can be classified into:
  - **Intraluminal (Intrinsic):** inside the **lumen** of the duct (most commonly gallstones) Caused by bilirubin stones or sludge (pre-stones stage, more friable) and polyps (Gallbladder polyps – if > 1 cm, need to worry about malignancy).Polyps in patients > 60 years more likely malignant. Tx: cholecystectomy.
  - **Intramural:** Inside the **wall** of the duct, Mass (cholangiocarcinoma, Ampullary carcinoma), Fibrosis, Benign Biliary Strictures (Congenital, Traumatic, Ischemic, Inflammatory e.g.Primary sclerosing cholangitis and infection of schistosoma)and choledcocal cyst (intramural and intraluminal)
  - **Extramural:** Outside the duct (extrinsic). Caused by lymph node metastasis, gastric, duodenal, hepatic, and pancreatic cancer and pancreatitis. Investigated by MRI and CT
  - Painless jaundice is cancer until proven otherwise.
  - Mirizzi syndrome: is defined as common hepatic duct obstruction caused by extrinsic compression from an impacted stone in the cystic duct. The bile duct is normal won't be dilated distally.





Jaundice

Difference between types of jaundice:

	Hemolytic (Prehepatic)	Hepatic	Obstructive (Posthepatic)
Age	Young	Young /middle age	Older age group
Abdominal pain (RUQ)	No	+/-	+
Color of urine	Normal	Yellow	Dark yellow
Color of stool	Normal	Normal	Clay (pale) colour Very specific
Pruritus [1]	--	--	+ Characteristic
Icterus	Lemon yellow	Yellow	Greenish / dark yellow
Liver	--	+	+
Gallbladder	--	--	+
Serum bilirubin	4-5 mg/dl (indirect)	Up to 10-12 mg/dl (indirect/direct)	15-20 mg/dl (direct)
SGOT (AST)/SGPT (ALT)	Elevated	Markedly elevated	Normal / elevated
Alkaline phosphatase	Normal	Normal / elevated	Elevated Very specific
Serum proteins	Normal	Decrease	Normal

- ALT-AST-ALP-GGT are not actually functional so it's a misnomer, the only functional part is **bilirubin, coagulation factors, and albumin.**
  - Partial obstruction: (might) result in mild elevation of LFTs with normal bilirubin
  - Complete obstruction: rise in both LFTs and bilirubin
  - Bile duct injury(cholestasis): rise in ALP and GGT
  - Hepatocytes injury: rise in ALT and AST

- Surgical Jaundice (obstructive jaundice). must meet the following:
  - Elevated ALP
  - Elevated GGT
  - Elevated Total bilirubin (direct)

- Intermittent RUQ abdominal pain with fluctuant jaundice suggests gallstone- related obstructive jaundice.
- History of progressive relentless jaundice with weight loss suggests neoplasm.

1-due to the accumulation and precipitation of the bile salts in the skin .

Jaundice

Investigations [1]:

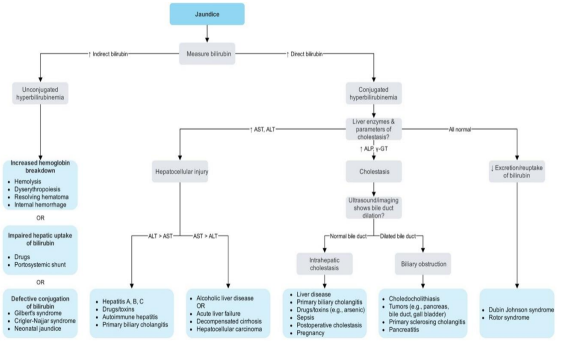
All patients

Predominant elevation of **indirect** bilirubin elevation:

- Obtain a hemolysis workup
- Consider specialized testing for hereditary conditions in select cases

Predominant elevation of **direct** bilirubin elevation:

- Distinguish between hepatocellular injury and cholestasis.
- Obtain additional laboratory studies and imaging based on the suspected etiology, e.g., RUQ ultrasound for cholestasis.



Laboratory tests

- CBC, LFTs, coagulation profile, INR, hepatitis panel, serum protein and creatinine.
- **Prehepatic** Jaundice: High **un**conjugated bilirubin, normal liver enzymes and pale urine and dark stool.
- **Intrahepatic** jaundice: High liver enzymes and mainly high conjugated bilirubin , prolonged coagulation profile.
- **Obstructive** jaundice: High serum conjugated up to 50% bilirubin hence dark urine, and intestine doesn't contain urobilinogen therefore a pale stool is present. **High alkaline phosphatase** (very specific) and maybe high liver enzymes and serum lactic dehydrogenase. Other haematological findings include: prolonged coagulation profile, prolonged prothrombin time.

Liver Biopsy

- Liver biopsy is indicated in patients with unexplained jaundice, If the obstruction lesion has been ruled out by imaging
- biopsy of the liver lesion can be performed under ultrasound or CT guidance
- coagulation profile (platelets count) must always be determined, and any clotting abnormalities Must be corrected before the procedure of liver biopsy

Laparoscopy

- Laparoscopic Examination under general anesthesia can be used to assess the liver disease
- it is used also in the staging of the malignancy of the liver, biliary tree, and pancreas in selected patients
- It can detect hepatic, peritoneal and omental metastases .
- When disseminated malignancy is discovered during laparoscopy,it safe that patient unnecessary laparotomy

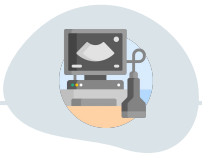
1-Consuming large quantities of lycopene, or carotenes, or receiving drugs such as rifampicin or quinacrine, can give the false appearance of jaundice.

Jaundice

Investigations:

Laparotomy

- Intraoperative ultrasound may be used to assess the liver and pancreatic tumours, Vascular invasion by tumours, metastases n the lymph nodes.
- It commonly used in the liver surgery to evaluate the relation of the tumors to the vascular structures and to help in planning and performing a safe and curative liver resection intraoperative cholangiography may be used to assess any clear biliary anatomy to assess for any iatrogenic biliary injury, and to assess for any intraductal stones or lesions.
- Intraoperative choledochoscopy is used to inspect the biliary tree for any pathology, biopsy taken, and to extract any intraductal stones.



Ultrasonography

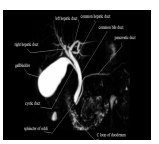
- The **best initial** imaging test when evaluating any jaundiced patient.
- It can show:
  1) Gallstones and intraductal stones.
  2) Gallbladder distension due to obstruction.
  3) Dilation of intrahepatic and extrahepatic biliary tree.
  4) Space-occupying lesion in the liver or the pancreas.
  5) Metastatic lesions in the liver due to malignant obstructive jaundice
- Pt came with RUQ and jaundice. How will you investigate? **US**.
  Unfortunately, most of the area is covered by the stomach so it isn't clear on imagining, but you will be able to see secondary bile duct dilation proximally inside the liver, NOT the bile duct itself.

Computed Tomography CT

- if US didn't show anything, we should do a CT scan.
- Contrast enhanced CT is used Most commonly when malignant obstructive jaundice is suspected .
- It can show you hepatic , bile duct and pancreatic tumors.
- It demonstrates the biliary tree (bile ducts, hepatic ducts, and intraductal) dilatation to the level of the obstruction.
- It also identifies vascular abnormality or invasion and any metastases to adjacent lymph nodes or to the liver
- Although CT specificity is low so we prefer MRCP.

MRCP

- MRCP (Magnetic Resonance Cholangiopancreatography).
- Not therapeutic, only diagnostic.
- Non invasive, no radiation, sensitive but time consuming, hard for eldery/pediatrics/claustrophobic and might need general anesthesia.
- Most accurate investigation.

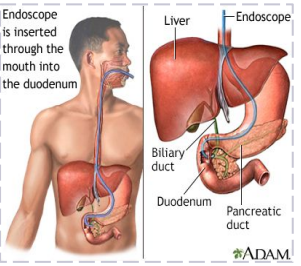


Jaundice

Investigations:

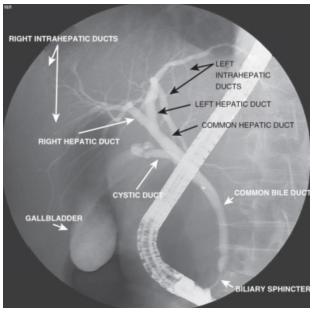
ERCP

- ERCP (endoscopic retrograde cholangiopancreatography): gastroscope with side camera (to see the ampulla of vater), it's retrograde because it goes against the flow of the bile and X-ray is involved too where contrast is injected showing us filling defect (most likely stones).
- It's diagnostic and therapeutic.
- ERCP can be used to insert stent when there is thickening , brushing for cytology (**FOR CANCER)** , biopsy is not possible because walls are thin, balloon dilation and to extract or destroy the stone.

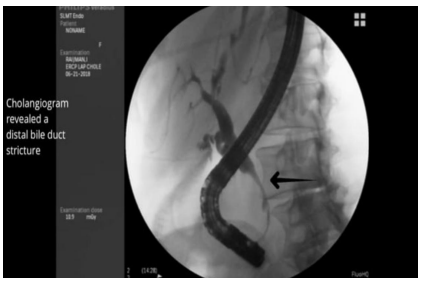


- **Stent:**
  - **Plastic**: Removable 6-10 weeks & High risk of obstruction. used in benign cases, strictures, or stones but high risk of cholangitis because it has a small caliber.
  - **Metal**: Better patency, Once placed can't be removed used in severe fibrosis or renal cancer.
- **ERCP complications:**
  - **Bleeding:** while inserting the catheter inside the ampulla of vater sometime the sphincter won't open thus the preform sphincterotomy to get access in addition to easily remove the stone out.
  - ★ **Pancreatitis**: (most common) either because of entering the wrong duct or manipulation.
  - **Perforation:** cannula is a sharp object the can perforate the duodenum or the bile duct.
  - **Infection:** Introduction of infections into an obstructive biliary system or pancreatic duct.
  - **Inflammation:** Acute cholangitis, acute cholecystitis and rarely gallstones.
  - Stricture, radiation, or even cholangitis due to bacterial flora that goes up bile duct when injecting contrast.

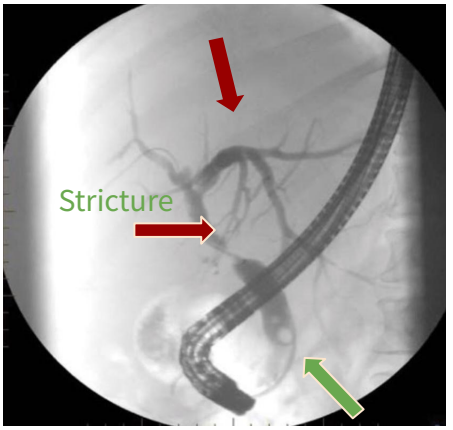
When you see a **stricture** you can't diagnose the exact type, therefore you do brushing or MRI to check for other signs. Such as, multiple lymph nodes and swelling around cancer, Or other obstruction in case of iatrogenic injury



Contrast fill the duct in a uniform way, smooth, no abrupt change in diameter, no filling defect (normal)



Arrow: narrowing (distal bile duct stricture)



- Proximal to the obstruction if it was dilated it indicate chronic condition ,Not dilated here
- Obstruction (**filling defect**) most likely a sludge, Sometimes they go beyond it, inflate a balloon and extract it.

Obstructive Jaundice

Intraluminal cause:

Gallstones (Cholelithiasis):

Definition	• Cholelithiasis: A stone in the gallbladder. • Presented as RUQ pain radiating to right shoulder. • Stones found in the gallbladder never causes obstructive jaundice unless ★ Stones pass through the common bile duct, At the level of the ampulla of vater → pancreatitis along with obstructive jaundice. ○ 80% of pancreatitis is caused by biliary stone ○ Gallstones is the most common cause of acute pancreatitis
Risk factors	• Age is important. 4 F's (all increase the risk of gallstones) ○ 40'S ○ Female ○ Fat (diet) ○ Fertile Meanwhile if the patient is 75 with obstructive jaundice then most likely it's cancer
Diagnosis	• **Laboratory tests:** CBC and LFTs are normal, elevated serum conjugated bilirubin. • **Ultrasound:** reveals gallstones with acoustic shadowing.
Treatment	Only in high risk group patient otherwise no need • Analgesia during acute attacks to relieve pain. • Cholecystectomy is indicated to prevent recurrent attack and gallstones complications. • Ursodeoxycholic acid (ursodiol) must be supplied after removal of gallbladder.

Acute calculous cholecystitis:

Definition	Acute calculous cholecystitis: acute inflammation of the gallbladder, which is typically due to cystic duct obstruction by a gallstone. Presents with **+ve Murphy's sign** and signs of inflammation (**Fever** and **leukocytosis**) and **RUQ pain.**
Diagnosis	• **Laboratory tests:** CBC shows leukocytosis,↑CRP, normal level of bilirubin (no jaundice because biliary tract still intact). there might be mild elevation of serum amylase and moderate elevation of LFTs. • **Ultrasound:** shows distended gallbladder with thickened wall and pericholecystic fluid. While CT scan can be used when the diagnosis is in doubt. HIDA scan may help in atypical cases.
Treatment	• Patient must be admitted to the hospital as soon as possible, and must be NPO and given adequate analgesic and IV fluids. • Broad-spectrum antibiotics are effective against gram -ve aerobes (Cefazolin or Cefuroxime) and anaerobes (Metronidazole). • Emergent cholecystectomy is indicated if the patient presents within 7 days from the onset of abdominal pain, while delayed presentation mandate conservative treatment and interval cholecystectomy in 8-12 weeks.

Obstructive Jaundice

Choledocholithiasis

Definition	• Choledochlithiasis : A stone in the common bile duct • Manifested as **RUQ** pain and **+ve Murphy's sign**, signs of obstructive **jaundice**, **pruritus** and **fever**.
Diagnosis	• **Laboratory tests:** shows elevated WBCs count, elevated Liver enzymes particularly ALP and GGT, and direct bilirubin will be more than 50% of total bilirubin. • **Ultrasound:** it's the initial imaging for jaundiced patients and it shows gallstones, dilated intrahepatic and extrahepatic bile ducts. But less sensitive for common bile duct stones especially in the distal part of CBD. • **Endoscopic US:** the most sensitive test, and shows dilated biliary tree. • **CT:** not commonly used but it shows dilated biliary tree and intraductal stones.
Treatment	• ERCP with extraction of biliary tree follows by cholecystectomy to prevent recurrent passing of stones from gallbladder into biliary tree. • Temporary biliary stenting is indicated when it's difficult to remove the stones, followed by endoscopic extraction of stones after few days. when it fails the surgical exploration of CBD is indicated.

Obstructive jaundice

Stone

- Acute, sudden, healthy young patient, Painful (severe symptoms but not for long time , and on/off pain after meals)
- most common cause of post-hepatic jaundice is gallstones but if the patient is elderly we should consider malignancy
- obstructive jaundice caused by stone → shrink gallbladder

Mass

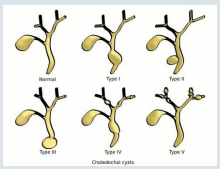
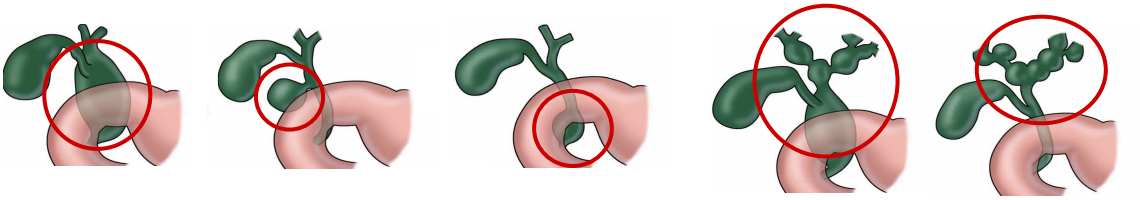
- Chronic, gradual, most common in elderly, loss of weight and appetite, night sweat, Painless so the patient presents late
- E.g. pancreatic head and ampullary masses and cholangiocarcinoma
- Obstructive jaundice caused by malignancy → distended gallbladder (palpable)

Obstructive Jaundice

Causes of obstruction:

Intramural causes:

Fibrosis	
Definition	Fibrosis in the wall that causes obstruction and can transform to cholangiocarcinoma.
Etiology	• Can happen due to extrinsic compression, stones, previous infection/multiple cholangitis, iatrogenic, multiple ERCP, or primary biliary cholangitis (PBC) and primary sclerosing cholangitis (PSC) • Reaction to chronic pancreatitis that can cause obstruction in 2 forms: 1- Extrinsic 2- Secondary to reactive wall scarring and fibrosis
Investigation	• MRCP, ERCP, and Choledocalscopes to inspect the mucosa. • In any intramural thickening we assume it's cancer until proven otherwise as well as painless jaundice (esp. elderly)

Choledocal cyst	
Definition	• A Rare Congenital cystic disease of biliary tree, may involve intrahepatic or extrahepatic tree or both and it has a potential of malignant transformation into cholangiocarcinoma. • More common in women than men. • Clinical features: RUQ pain and mass, jaundice , recurrent cholangitis and recurrent acute pancreatitis • Congenital malformation with abnormal bile duct wall leading to accumulation of bile, obstruction, and jaundice. In choledochal cysts the common bile duct is dilated like the gallbladder → stasis → stones • Types 1-4: can present with extra hepatic jaundice. • Type 5: Intrahepatic cystic dilation, don't cause extra hepatic jaundice
Types 	 **Type I**: complete fusiform dilation of the bile duct ;Remove all the bile duct, connect hepatic duct to jejunum **Type II:** cystic dilation ;secondary gallbladder that can be removed without bile duct. **Type III:** intrapancreatic portion dilation ;ERCP and open it. **Type IVA:** both bile duct and hepatic ducts dilated Type IVB: limited to extrahepatic duct. **Type V:** intrahepatic only
Management	• **Type 1,2 and 4B:** via excision of the cysts and cholecystectomy with Roux en-y hepaticojejunostomy. • **Type 4B:** initially via conservative treatment and liver transplantation when surgery is required. • **Type 3:** treated by endoscopic sphincterotomy when symptomatic. • **Type 5:** requires liver resection when cyst is limited to one lobe and liver transplantation when the disease is diffuse. • **Type 4A and 5:** Need transplant due to intrahepatic biliary duct dilation.

Obstructive Jaundice

Causes of obstruction:

Intramural cause:

Benign biliary strictures	
Etiology	• 90% of cases caused by damage during cholecystectomy. • Devascularization of bile duct during cholecystectomy. • Damage during distal gastrectomy or pancreatic surgery and erosion of duodenal ulcer in distal common bile duct. • Abdominal trauma. • Mirizzi's syndrome. • Primary and secondary sclerosing cholangitis.
Clinical features	• Signs of obstructive jaundice: Dark urine and pale stool and Right hypochondriac pain. • Fever indicates development of cholangitis. • Prolonged obstruction may cause signs of liver cirrhosis.
Complication	• Recurrent cholangitis. • Liver abscess and Liver failure. • Secondary biliary cirrhosis with sign of portal HTN.
Diagnosis	• Laboratory tests may show leukocytosis and positive blood culture in case of cholangitis, also shows elevated liver enzymes and raised CA 19-9 marker. • Trans-abdominal ultrasound shows dilated proximal biliary tree, while MRCP/ERCP shows the site and extent of the stricture.
Treatment	• Definitive treatment is done by reconstructive surgery (bilioenteric anastomosis). • Temporary treatment is done by either: endoscopic or percutaneous dilation with high recurrence rate, or via endoscopic stenting or percutaneous catheter especially in the presence of cholangitis and it improves LFTs.

Extramural cause
• Metastasis to lymph nodes of porta hepatis, gastric cancer, duodenal cancer, pancreatic cancer, chronic pancreatitis • External compression caused by a mass in any of the adjacent organs (duodenal cancer, pancreatic cancer..etc) • Obstruction by impinging bile duct while in situ (in gallbladder not bile duct) May form extramural fistula, heals in pouch and obstructs bile duct. • Mirizzi syndrome: CBD Obstruction and jaundice due to stone in gallbladder. • Confirmed by CT or MRI

Obstructive Jaundice

Complication of obstruction:

- Stone causes stasis and inflammation → cholangitis.
- Bile is destructive to the liver (primary biliary cirrhosis).
- Choledocholithiasis can cause pancreatitis by obstructing the pancreatic duct.
- No bile → not fat absorption → no absorption of fat soluble vitamins (ADEK) → decrease in vitamin K → coagulopathy

Gallstones ileus	
Definition	Mechanical bowel obstruction due to obstructive gallstones (rare complication of gallstone)
Pathophysiol -ogy	Gallbladder perforation or Mirizzi syndrome → biliary-enteric fistula formation (most commonly cholecystoenteric fistula) between the inflamed gallbladder and bowel → gallstones passing down into bowel lumen **Sites of obstruction :** Terminal ileum
Clinical features	Features of mechanical bowel obstruction (abdominal pain and distention, nausea, vomiting) with history of gallstone

Acute pancreatitis	
Definition	Inflammatory condition of the pancreas most commonly caused by gallstones and alcohol use
Clinical features	Yypical manifestation includes sudden, severe epigastric pain that radiates to the back, fever, jaundice (rare)
Investigation	Elevation of serum lipase or amylase 3 higher than normal
Treatment	This condition should be managed as a medical emergency as it is a potentially fatal condition. Initiate fluid resuscitation as soon as this diagnosis is suspected

Obstructive Jaundice

Chronic pancreatitis

Etiology	• Alcohol (The most common cause) • Obstruction of pancreatic duct by tumor or stricture or stones. • others: Hereditary, Tropical and autoimmune pancreatitis and smoking.
Clinical features	• Abdominal pain, nausea and vomiting and weight loss. Signs of obstructive jaundice. • Exocrine insufficiency: steatorrhea turning stool into pale and bulky. • Endocrine insufficiency: leads to diabetes mellitus several years later.
Complication	• Pancreatic abscess, pancreatic pseudocyst. • Portal and splenic vein thrombosis. • Common bile duct obstruction.
Diagnosis	• Labs shows elevated serum amylase in early disease and later shows minimally or normal level. • Plain x-ray shows diffuse pancreatic calcification. • CT shows speckled pancreatic parenchymal calcification, ductal dilation, masses and pseudocyst. • MRCP can show any associated biliary dilation. • ERCP is the most accurate test, it shows details of pancreatic duct, dilation, stones and strictures. It helps in choosing the appropriate operation when surgery is indicated.

Treatment	• Conservative management includes NSAIDs for pain relief, Abstinence of alcohol, treating DM, pancreatic enzymes supplements and nutritional support.
	• Surgical management Indications:
	  ○ Intractable pain.
	  ○ Symptoms of obstruction of CBD, duodenum, portal or splenic veins.
	  ○ pseudocyst when endoscopic therapy fails.
	  ○ Abscess when percutaneous drainage fails or is impossible.
	  ○ When Cancer can't be excluded.
	• Two types of procedures:
	  ○ Drainage procedures: when pancreatic duct is dilated (>8 cm) and it includes: puestow procedure, Hamburg modification of puestow procedure, Frey procedure, Beger procedure and Bern procedure.
	  ○ Reactive procedures: when pancreatic duct is not dilated and includes:
	  ■ Whipple's procedure: when focus of the disease or a mass located in pancreatic head.
	  ■ Distal pancreatectomy:when the disease is focused the body and the tail.
	  ■ Total pancreatectomy: when the disease is diffuse to involve the whole pancreas.it's associated with high morbidity and even mortality.

Obstructive Jaundice

Carcinoma of the head of pancreas:

Association	• Associated with: Smoking, chronic pancreatitis, BRCA2, Lynch syndrome, Peutz-Jeghers syndrome, Diabetes mellitus, Race(more common in black race)
Clinical features	• **PAINLESS** jaundice (CBD obstruction): Dark urine and pale stool. • Constitutional symptoms. • Vague epigastric pain or discomfort. • Itching. • Trousseau's sign and hypercoagulable states. ★ Distended, palpable, non-tender gallbladder (Courvoisier's law) Courvoisier's law states that 'a palpable non-tender gallbladder in the presence of jaundice is unlikely to be due to gallstones'. It usually indicates a neoplastic stricture obstructing the distal common bile duct. A palpable gallbladder due to stones is usually tender i.e. due to acute cholecystitis. • Enlarged supraclavicular lymph nodes (Virchow nodes) (Troisier sign).
Diagnosis	• Labs show elevated liver enzymes, elevated CA 19-9 (but it lacks specificity and sensitivity but helpful for following-up) • Imaging:: • US may reveal the pancreatic mass or liver metastasis. • CT shows the tumor and gives evidence of irresistibility in case of encasement of major arteries (superior mesenteric, hepatic and celiac). • MRI/MRCP: gives similar information as CT, but it gives more accurate picture of biliopancreatic ducts changes. • ERCP/PTC: ERCP is indicated in case of acute cholangitis, doubtful diagnosis, sky high liver function tests, deep jaundice. PTC is one when ERCP fails. Early drainage should be avoided due to risk of introduction of infection. • Endoscopic ultrasound: gives information about the site and staging which can't be demonstrated by CT. • Diagnostic laparoscopy:it's the initial step in the procedure of pancreatic tumor resection.it reveals small peritoneal and liver metastasis that couldn't be seen by preoperative ultrasound. And can be combined with laparoscopic US for more accurate results.
Treatment	• Surgical resection is the only potential cure. • Pancreatoduodenectomy (Whipple's procedure) is the standard procedure. • Other procedure is Pylorus preserving pancreatoduodenectomy which is reserved when the tumor doesn't involve the stomach or duodenum and no indication for complete duodenal resection.

Obstructive Jaundice

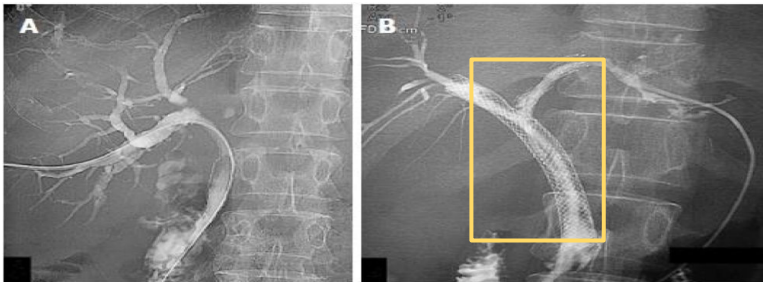
Cholangitis (surgical management):

Clinical features	★ **Charcot triad (Fever, jaundice and RUQ pain)** seen in less than 50% of the patients. (must give prophylaxis antibiotics) ● Reynolds Pentad (Fever, jaundice, RUQ pain, Hypotension and Altered mental status) seen in toxic cholangitis with septic shock.
Diagnosis	● Diagnosed based on systemic signs of inflammation (fever, leukocytosis, ↑ CRP) in combination with signs of cholestasis (jaundice, ↑GGT, ↑ALP) and/or characteristic imaging (RUQ Ultrasound) findings such as dilated CBD
Management	● Cholangitis is an acute surgical emergency managed with ERCP to remove the stone.

What if the patient had previous bariatric surgery? I.e. Roux-en-Y gastric bypass where they divide the stomach, cut the small bowel and connect it to the pouch in the bypass so 1.5 + 1 meter = 2.5 before you can reach the ampulla **or a total gastrectomy and they developed cholangitis?**

- The last option is bile duct exploration (**laparoscopic surgery**)
- Less two invasive solutions:
    a. The least invasive: Through the **liver**, by
        - antegrade percutaneous transhepatic cholangiogram (**PTC**) where they find bile duct and put a cannula to do some treatment such as dilation, push stone, or put a stent.
        - **Rendezvous procedure** where we go through PTC and push cannula through bile duct all the way and then ERCP can go from below and meet.
    b. **laparoscopic with gastroscope**, The route has to be surgical so use a classical laparoscopy where you make a small opening at the stomach and use a laparoscope, there it's a combined operation where the advantage is that the stomach is more forgiving than bile duct and its not being used (due to bypass) you can open and close it easily. The original route is still there. Why? You are away from the inflammation are, and it's a big caliber less likely to leak and low pressure.

Rendezvous procedure combining PTC and ERCP, if can't be reached due to structure There's a cancer somewhere in the GI tract involving the bile duct



Once you drained the bile outside the body through PTC, it will stop the jaundice and the harmful effect of bilirubin and bile. However, your draining around 1-2L of bile thus dehydration, electrolyte imbalance, unable to absorb fat soluble vitamins. Yellow box : metal stent

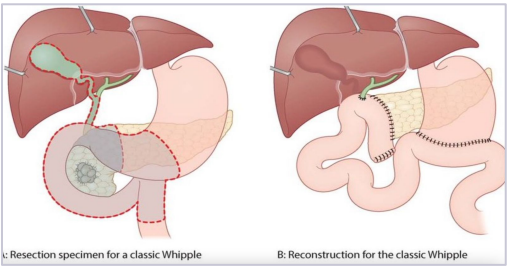
Obstructive Jaundice

Cholangiocarcinoma (surgical management):

- Adenocarcinoma of biliary tree , & can be either intrahepatic or extrahepatic.
- ★ **Risk factors include:** Primary sclerosing cholangitis, Hepatitis C, Parasitic biliary infestation, and choledocal cyst.
- ★ **Clinical features:** Abdominal pain, Anorexia, weight loss, Jaundice ,dark urine and pale stool, pruritus, and in patients with distal mass it presents with palpable gallbladder (Courvoisier's law)
- Associated with elevated tumor marker CA 19-9.
- Cholangiocarcinoma don't respond to chemo and have poor prognosis the only option is surgery.

Middle to Distal bile duct cancer: → Whipple procedure

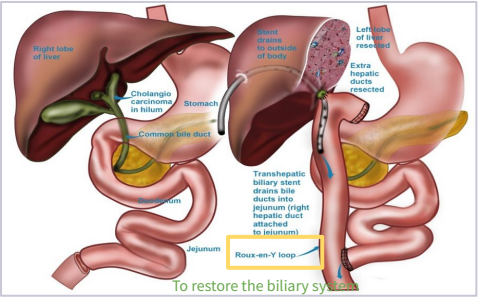
- Distal bile duct cancer (intrapancreatic portion) may be indistinguishable clinically and radiologically from pancreatic head cancer. It's associated with better prognosis due to the early obstruction with the early development of jaundice.
- **Whipple procedure** is removal of distal stomach, all of duodenum, proximal jejunum, head of pancreas, gallbladder and bile duct. And perform anastomosis pancreas to jejunum (pancreaticojejunostomy), hepatic duct to jejunum (hepaticojejunostomy), and stomach to jejunum (gastrojejunostomy)



- **Why remove all of this?**
  - they share the same blood supply
  - they share the same lymph nodes
  - close proximity to each other, so there's a risk of direct invasion
  - Risk of ischemia to pancreas and duodenum.
- And generally speaking: any abdominal cancer the cancer spread fast through the lymph node thus perform lymphadenectomy.
- **Complications of Whipple procedure?**
  - Leakage from pancreas, Leakage from stomach, Leakage from bile duct

Middle - proximal bile duct cancer

- Middle - proximal bile duct cancer will spread to the liver either to the left or right side thus hepatectomy of the side of the involved duct, and bile duct, gallbladder removal.
- During the operation we cut the bile duct and sew it, if we have suspicion we send for frozen specimens. Then we close it up and go up and remove the whole bile duct. Leaving just a few millimeter If we don't have data e.g. previous MRI, we send both R&L frozen specimens. If we know left is positive for cancer we do left hepatectomy, bile duct resection, cystectomy and then roux-en-Y hepaticojejunostomy "forget about this step :)"



- Treated with radical resection of the extrahepatic biliary tree along with the tumor with bilio-enteric anastomosis.

Jaundice

History taking of a jaundiced patient:

- Abdominal pain, fever, nausea and vomiting.
- Dark urine, pale stool.
    - Urine color differentiates between mechanical obstruction (dark in color) and non mechanical obstruction (Normal)
    - clay color stool is a very specific sign for obstructive jaundice
- Itching. very characteristic
- Weight loss or Loss of appetite.
- Blood transfusion, travelling abroad, Alcohol, IV drugs injection, and Tattooing.
- Diarrhoea, steatorrhea.
- Pre-Hepatic → travel, fever, blood transfusions
- Hepatic → previous infection of hepatitis B or C, fatigue, autoimmune hepatitis
- Post-hepatic → jaundice, pain RUQ

History taking of Gallstones

- **Mild goldstone** → Asymptomatic
- **Biliary colic** → constant, dull RUQ pain lasting < 6 hours

Especially postprandial , cholecystokinin release following a fatty meal → gallbladder contraction → attempts to force the stone into the cystic duct
May radiate to the epigastrium, right shoulder , with no fever (no inflammation or infection)
most commonly patients will come through clinic

- **Acute cholecystitis** → RUQ persistent pain prolonged (> 6 hours) than in biliary colic, a positive Murphy sign, and fever are the characteristic clinical features , Guarding malaise, anorexia Nausea and vomiting most commonly patients will come through ET

Physical examination may show:

- Yellow skin, sclera and mucosa under the tongue.
- Scratch marks
- Abdominal tenderness, Abdominal mass.
- Palpable gallbladder.
- Palpable liver.
- Signs of Chronic Liver Disease and Cirrhosis:
    - Altered mental status
    - Asterixis
    - Palmar erythema
    - Caput medusae
    - Spider angiomata
    - Ascites
    - Testicular atrophy
    - Gynecomastia
    - Fetor hepaticus

General management:

- IV fluids, Oxygen mask and immediate IV Broad-Spectrum antibiotics.
- Emergent ERCP or PTC to decompress biliary tree for patients didn't respond to medical therapy.

Summary

Doctor's Qs

- When will jaundice appear? X3 normal (at least again it depends on the race)
- What is the best test for stones in the gallbladder ? US
    - What about CBD? Distal CBD will pass behind the duodenum and cant be seen on US

Recall

Q1: Which artery is susceptible to injury during cholecystectomy?
Right hepatic artery, because of its proximity to the cystic artery and Calot's triangle

Q2: At what level of serum total bilirubin does one start to get jaundiced?
2.5

Q3: What are the signs and symptoms of obstructive jaundice?
Jaundice-Dark urine-Clay-colored stools (acholic stools)-Pruritus (itching)-Loss of appetite-Nausea

Q4: What causes the itching in obstructive jaundice?
Bile salts in the dermis (not bilirubin!)

Q5: What is the histology of Cholangiocarcinoma?
Almost all are adenocarcinomas

Q6: What is the differential diagnosis of proximal bile duct obstruction?
Cholangiocarcinoma-Lymphadenopathy-Metastatic tumor-Gallbladder carcinoma-Sclerosing cholangitis-Gallstones-Tumor embolus-Parasites-Postsurgical stricture-Hepatoma-Benign bile duct tumor

Q7: What is the differential diagnosis of distal bile duct obstruction?
Choledocholithiasis (gallstones)-Pancreatic carcinoma-Pancreatitis-Ampullary carcinoma-Lymphadenopathy-Pseudocyst-Post Surgical stricture-Ampulla of Vater dysfunction/stricture-Lymphoma-Benign bile duct tumor-Parasites

Q8: What is the initial study of choice for obstructive jaundice?
Ultrasound

Q9: What lab results are associated with obstructive jaundice?
Elevated alkaline phosphatase, elevated bilirubin with or without elevated LFTs

Q10: What are the "Big 4" risk factors of cholelithiasis?
"Four Fs": Female-Fat-Forty-Fertile (multiparity)

Q11: What are the causes of black-pigmented stones?
Cirrhosis, hemolysis

Q12: What are the five major complications of gallstones?
Acute cholecystitis-Choledocholithiasis-Gallstone pancreatitis-Gallstone ileus-Cholangitis

Q13: What are the indications for cholecystectomy in the asymptomatic patient?
Sickle-cell disease-Calcified gallbladder (porcelain gallbladder)-Patient is a child

Q14: What is the major feared complication of ERCP?
Pancreatitis

Q15 :What are the complications of acute cholecystitis?
Abscess-Perforation-Choledocholithiasis-Cholecystenteric fistula formation-Gallstone ileus

Q16: What lab results are associated with acute cholecystitis?
Increased WBC; may have: Slight elevation in alkaline phosphatase, LFTs-Slight elevation in amylase, total bilirubin

Q17: What is Cholangiocarcinoma?
Malignancy of the extrahepatic or intrahepatic ducts—primary bile duct cancer

439 Quiz

Q1: A 29-year-old patient presents with a short history of right upper quadrant pain. She is jaundiced with dark urine and pale stool. She has a fever of 38.9 °C. Abdominal examination gives no suggestion of a palpable gallbladder. The diagnosis is

A) Ascending cholangitis
B) Acute cholecystitis
C) Biliary colic with duct obstruction
D) Pancreatitis
E) Mirizzi's syndrome

Q2: A 62-year-old patient is admitted with jaundice. His stool is pale and urine dark red. On examination he has a palpable gallbladder. The most likely cause is

A) Ascending cholangitis
B) Impacted stone in the common bile duct (choledocholithiasis)
C) Tumour of the head of pancreas
D) Impacted stone in the neck of gallbladder
E) Cholangiocarcinoma

Q3: An alcoholic man has been suffering excruciating pain from chronic pancreatitis recalcitrant to analgesics and splanchnic block. A surgeon recommends total pancreatectomy. A patient who has a total pancreatectomy might be expected to develop which of the following complications?

A) Diabetes mellitus with steatorrhea
B) Diabetes mellitus with constipation
C) Hypoglycemia
D) Hypoglycemia and steatorrhea
E) Hypoglycemia and constipation

Q4: A 63-year-old patient is admitted with intermittent, colicky right upper quadrant pain and jaundice. Abdominal ultrasound shows a thickened gallbladder, but no identifiable stones. He is treated for biliary colic with fluids and analgesia but fails to improve. His serum bilirubin continues to rise and after 24 hours his C-reactive protein level and white cell count become elevated. Two days after initial presentation he develops a pyrexia of 39.2 °C and his pain is now constant. The next step in management is

A) Cholecystectomy
B) ERCP
C) Open stone removal with T-tube drainage
D) MRCP
E) Lithotripsy

Answers

Q1	A	Q4	B
Q2	C	Q5	
Q3	A	Q6	

Extra Questions

439's Quiz

Explanations

Q1 Explanation: The high pyrexia is not typical of biliary colic, pancreatitis or Mirizzi's syndrome without supervening infection. Most candidates should therefore quickly narrow down the options to a choice between ascending cholangitis and acute cholecystitis. Acute cholecystitis is inflammation within the gallbladder most commonly due to long standing presence of gallstones. It presents with right upper quadrant pain and signs of sepsis. Jaundice may complicate cholecystitis if a gallstone migrates into the common bile duct; however, it is more usual for cholecystitis to present without jaundice. In addition, the fact the patient does not have Murphy's sign makes acute cholecystitis less likely, although it is not a reliable sign and therefore cholecystitis is a possible answer.
However, this patient is jaundiced with high fever and right upper quadrant pain – these three symptoms constitute Charcot's triad, the classic description of the presentation of ascending cholangitis. Therefore A is the single best answer, although in reality, both A and B would be on your differential list.

Q2 Explanation: Dark urine and pale stool is the classic presentation of obstructive jaundice; one would also expect this patient to be complaining of pruritus as itching is a common symptom of conjugated hyperbilirubinaemia. The causes of obstructive jaundice are multiple and may be divided into obstructions within the lumen (stones, parasites) or within the wall (stricture, inflammation, tumour) or external pressure (lesions of the head of the pancreas, vascular aneurysms, local lymph nodes, Mirizzi's syndrome).

The key to answering this question is recognizing that a palpable gallbladder makes stone-related disease unlikely. Courvoisier's law states that 'in obstructive jaundice, the presence of a palpable gallbladder precludes the diagnosis of stones'. This is because the presence of gallstones irritates the gallbladder, resulting in wall fibrosis and thickening, a feature used when ultrasound scanning to confirm the presence of stones and a feature which prevents gallbladder distension in the presence of obstruction. Therefore answers A, B and D may all be discounted. The answer therefore relies on the candidate knowing the relative incidence of pancreatic cancer and cholangiocarcinoma, the former being the more common of the two.

Q3 Explanation: Patients who undergo total pancreatectomy will have brittle diabetes and severe steatorrhea. Total or near total pancreatectomy is usually reserved for patients with chronic pancreatitis who have failed drainage procedures or who have small ducts and have already undergone distal pancreatectomy.

439's Quiz

Explanations

Q4 Explanation: This patient has obstructive jaundice. The likely culprit is gallstones, as his gallbladder is thickened on ultrasound. On admission there were no clear signs of cholecystitis as his pain was intermittent and colicky. The majority of biliary colic may be successfully managed with fluids and analgesia in the absence of superseding infection or pancreatitis. All patients should subsequently be offered cholecystectomy 6–12 weeks following recovery to avoid recurrence.

Escalation of acute management is required when jaundice fails to resolve or when acute cholecystitis or ascending cholangitis supervenes, as has occurred in this case. The immediate priority is to treat the sepsis with intravenous antibiotics and fluids. However, this is not an option in this question. The next step in the management of such patients is the decompression of the biliary tree and the release of the stagnating bile.

MRCP is not an appropriate option, and nor is lithotripsy which is reserved for renal calculi lying within the renal pelvis; ERCP is the single best procedure as it is minimally invasive, and allows confirmation of diagnosis and therapeutic intervention. In young patients, or in patients where ERCP fails, open stone removal with T-tube placement is a viable alternative to ERCP, however percutaneous cholecystostomy is more frequently used as it is a lower risk procedure.

Cholecystectomy risks leaving the obstructing stone in place and is best avoided in patients with an obstructed biliary tree. Cholecystectomy is commonly deferred and performed as an elective day case procedure following resolution of the life-threatening sepsis.

438 Quiz

Q1: 10 days after a motor vehicle collision, a 28M develops jaundiced skin. Upon initial presentation for his injuries, the patient was taken for an emergency laparotomy, which revealed significant internal hemorrhage from blunt abdominal trauma to the spleen. He required rapid transfusion with a total of 7 units of packed red blood cells. He has recovered well from the procedure until this morning, when he began to develop jaundiced skin and sclerae. He does not have pruritus. He has had no prior surgeries and takes no other medications. He is sexually active with one female partner. Prior to the accident, he drank 4 beers per day. His vital signs are within normal limits. Abdominal examination is limited due to pain. There are no palpable abdominal masses. There is a midline surgical scar with no erythema, purulence, or drainage. He has healing abrasions on the upper left side of his face and bruises over the anterior abdomen. CT scans show a resolving hematoma in the peritoneal cavity. Laboratory studies show:
Hemoglobin 9.7 g/dL, Hematocrit 30%, Leukocyte count 7,000/mm3, Platelet count 135,000/mm3
Serum: Total bilirubin 3.9 mg/dL, Indirect bilirubin 3.7 mg/dL, Direct bilirubin 0.2 mg/dL, Aspartate aminotransferase (AST) 60 U/L, Alanine aminotransferase (ALT) 92 U/L

A) Biliary obstruction
B) Hepatocellular injury
C) Increased formation of bilirubin
D) Intrahepatic cholestasis
E) Impaired conjugation of bilirubin
F) Decreased hepatic uptake of unconjugated bilirubin

Q2: A previously healthy 2-year-old girl is brought to the physician because of a 1-week history of yellow discoloration of her skin, loss of appetite, and 3 episodes of vomiting. Her parents also report darkening of her urine and light stools. During the last 2 days, the girl has been scratching her abdomen and arms and has been crying excessively. She was born at 38 weeks' gestation after an uncomplicated pregnancy and delivery. Her family emigrated from Japan 8 years ago. Immunizations are up-to-date. Her vital signs are within normal limits. Examination shows jaundice of her skin and sclerae. Abdominal examination shows a mass in the right upper abdomen. Serum studies show:
Bilirubin (total) 5 mg/dL, Direct 4.2 mg/dL, Aspartate aminotransferase (AST) 40 U/L, Alanine aminotransferase (ALT) 60 U/L, γ-Glutamyltransferase (GGT) 110 U/L (N = 5–50)
Abdominal ultrasonography shows dilation of the gallbladder and a fusiform dilation of the extrahepatic bile duct. Which of the following is the most likely diagnosis?

A) Biliary cyst
B) Mirizzi syndrome
C) Biliary atresia
D) Caroli disease
E) Hepatic abscess
F) Pancreatic pseudocyst

Answers

Q1	C	Q4	
Q2	A	Q5	
Q3		Q6	

Extra Questions

Good Luck!

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439	438
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Feedback