Biliary Obstruction & Biliary Stones

Surgery Team

MED 433

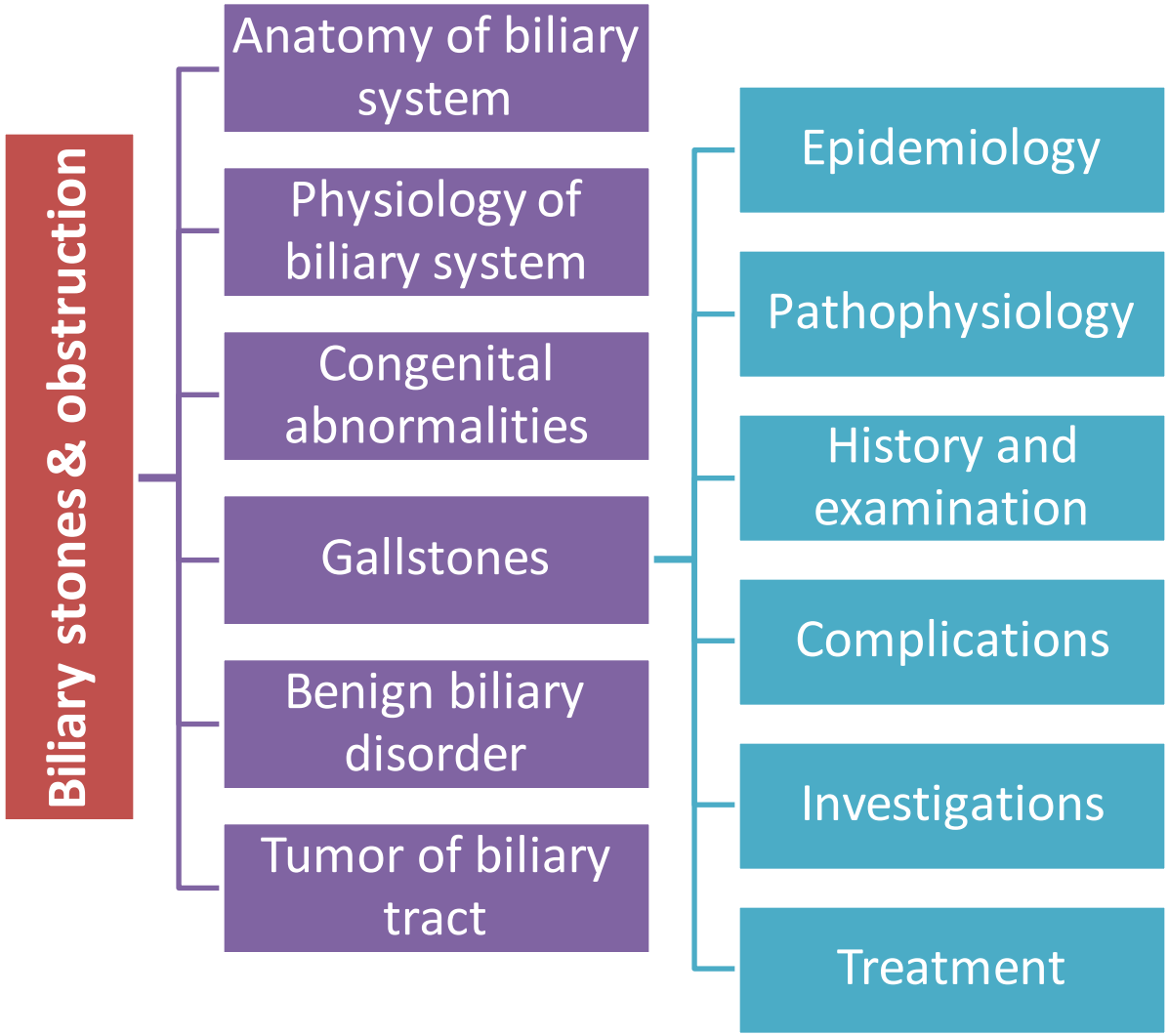
Objectives :

1. **Anatomy of the biliary system**
2. **Physiology** (Bile salts and the enterohepatic circulation)
3. **Congenital Abnormalities** (Biliary atresia, Choledochal cysts)
4. **Gallstones** (Pathogenesis, Pathological effects of gallstones, Common clinical syndromes associated with gallstones, Other benign conditions of the gallbladder, Investigation of patients with suspected gallstones, Surgical treatment of gallstones , Complications of cholecystectomy, Management of acute cholecystitis, Atypical biliary pain, Non-surgical treatment of gallstones, Management of acute cholangitis
5. **Other Benign Biliary Disorders** (Asiatic cholangiohepatitis, Primary sclerosing cholangitis)
6. **Tumors Of The Biliary Tract** (Carcinoma of the gallbladder, Carcinoma of the bile ducts)

Sources : Slides, Raslan's Notebook, Principles & Practice of Surgery by: O. James Garden

Color Index: Slides & Raslan's | Textbook | Doctor's Notes | Extra Explanation | **Important**

Mind Map


Biliary stones & obstruction
Anatomy of biliary system
Physiology of biliary system
Congenital abnormalities
Gallstones
Benign biliary disorder
Tumor of biliary tract
Epidemiology
Pathophysiology
History and examination
Complications
Investigations
Treatment

Anatomy of biliary system

The first 3 slides, are for your information and not mentioned in the lecture

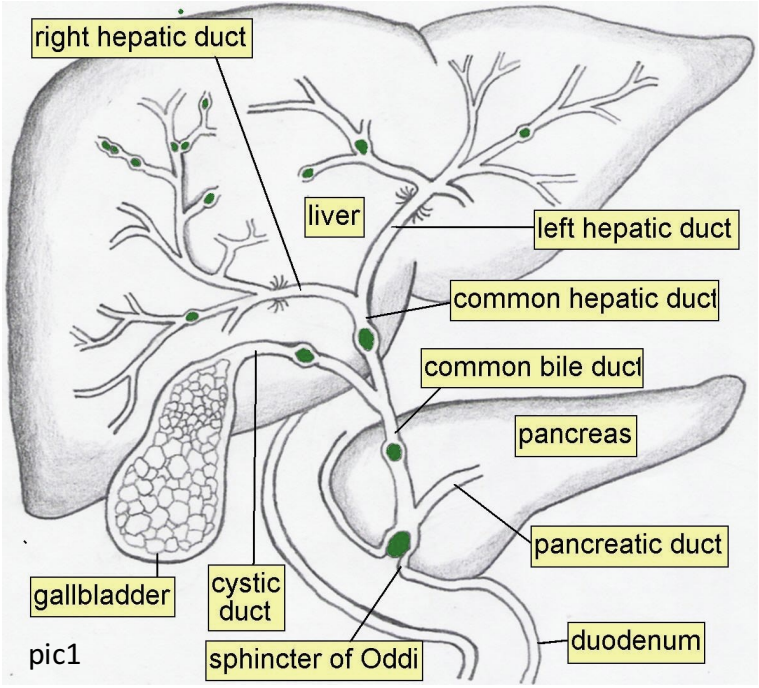
✸ Anatomy of biliary system:

The biliary tree consist of fine intrahepatic biliary radicals that drain individual liver segments before forming the Rt. & Lt. hepatic ducts. So the system consistent of gallbladder, bile ducts, and associated structure.

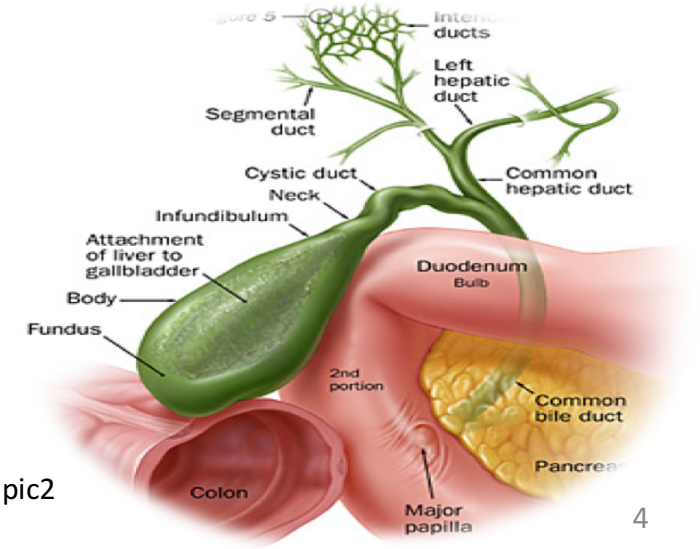
Bile route (check pic1 for elaboratrion):

1. When the liver cells secrete bile, it Is collected by a system of ducts that flow from the liver through the right and left hepatic ducts.
2. These ducts ultimately drain into the common hepatic duct.
3. The common hepatic duct then joins with the cystic duct from the gallbladder to form the common bile duct, which runs from the liver to the the 2nd part of duodenum.
4. However, not all bile runs directly into the duodenum. About 50% of the bile produced by the liver is first stored in the gallbladder, a pear--shaped organ(check pic2 of gallbladder) located directly below the liver. Then, when food is eaten, the gallbladder contracts and releases stored bile into the duodenum to help break down the fats.

- Main function of biliary system:
  1. to drain waste products from the liver into the duodenum
  2. to help in digestion with the controlled release of bile



pic1



pic2

Physiology Bile Salts & Enterohepatic Circulation

Physiology of bile salts & enterohepatic circulation:

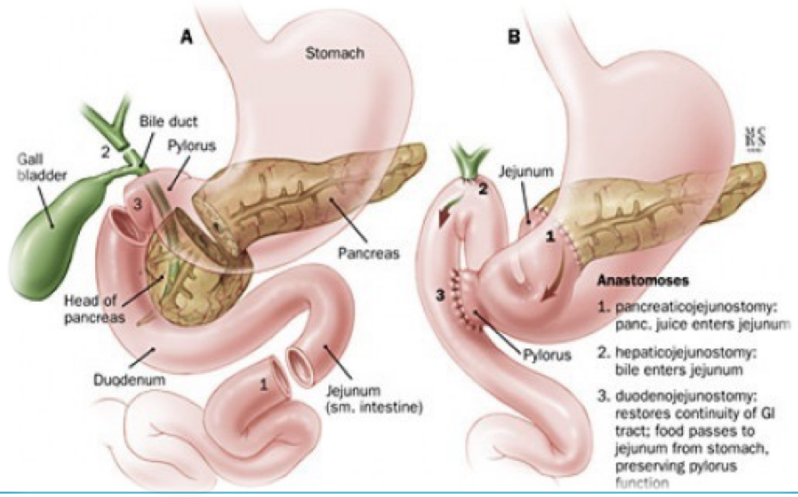
- **Bile Salts (cholates, chenodeoxycholate, deoxycholate):** these are produced by the liver's breakdown of cholesterol. They function in bile as detergents that dissolve dietary fat and allow it to be absorbed. Hence, disruption of bile excretion disrupts the normal absorption of fat, a process called malabsorption. Patients develop diarrhea because the fat is not absorbed (steatorrhea) , and develop deficiencies of the fat-soluble vitamins (A, D, E, and K).
- **Enterohepatic circulation:** refers to the circulation of biliary acids, bilirubin, drugs, or other substances from the liver to the bile, followed by entry into the small intestine, absorption by the enterocyte and transport back to the liver.

- Bile is the greenish-yellow fluid (consisting of waste products, cholesterol, and bile salts) that is secreted by the liver cells to perform two primary functions:
  1. to carry away waste.
  2. to break down fats during digestion.
- Bile salt is the actual component which helps break down and absorb fats.
- Bile, which is excreted from the body in the form of feces, is what gives feces its dark brown color.

1st :Congenital Abnormalities

Biliary Atresia

- failure of development of the duct system occurs.
- most common cause of prolonged jaundice in infancy,
- it usually becomes apparent in the first 2-3 weeks of life & liver, spleen usually enlarge.
- LFT's show obstructive pattern. In extrahepatic biliary atresia roux loop of jejunum (shown in the pic) is anastomosed to the intrahepatic duct system in he hilum of the liver.
- If we delay treatment this will give: (jaundice, cholangitis, giving cirrhosis with portal HTN, and ascites.)



Choledochal Cysts:

- It is a rare Cystic transformation of the biliary tree (choledochal cyst). The most common type results in a saccular dilatation of the common bile duct, which often enters the pancreatic duct. This may allow reflux into the biliary system, resulting in pain, inflammation, calculus formation and malignant transformation.
- In the neonate, the cyst may present with jaundice or spontaneous perforation. The adult patient usually presents with intermittent pain and jaundice, and may have attacks of pancreatitis. LFTs show a cholestatic pattern, and lecithin available for micelle formation.
- The formation of cholesterol crystals is the key event, and this ' nucleation' may be due to coalescence of cholesterol molecules or their precipitation around particles of mucus, bacteria, calcium bilirubinate or mucosal cells. Pure cholesterol stones are yellowish green with a regular shape but rough surface. They are usually solitary, whereas mixed stones are darker and are usually multiple.
- Cholesterol stones are common:
  1. in some tribes of North American Indians, where women over 40 are affected. Such individuals have a small bile salt pool.
  2. Conversely, the high incidence of stones in Chilean women reflects high levels of cholesterol excretion.
  3. Obesity and high-calorie or high-cholesterol diets favour cholesterol stone formation by producing highly supersaturated gallbladder bile.
  4. Drastic weight reduction and diets designed to lower serum cholesterol levels may also promote stone formation by mobilizing cholesterol and increasing its excretion.
  5. Disease or resection of the terminal ileum and drugs such as cholestyramine favour cholesterol nucleation by reducing the bile salt pool.
  6. Hormonal influences are reflected in an increased incidence of stone formation in women taking oral contraceptives or post-menopausal oestrogen replacement.
  7. Pregnancy may also have an effect by increasing stasis within the gallbladder.

2nd : Gallstones

Background

Background:
colic is a temporary blockage

- **Cholecystitis:** Inflammation from obstruction of Common Bile Duct or cystic duct
- **cholangitis:** Infection of the biliary tree

Risk factors of gall stones..
The 5 F's:
1-Fat (overweight),
2-Forty (age near or above 40),
3-female,
4-fertile (premenopausal- increased estrogen is thought to increase cholesterol levels in bile and decrease gallbladder contractions),
5-fair (gallstones more common in Caucasians)

Epidemiology

- **Race :**
  - Highest in fair skinned people (of northern European descent and in Hispanic populations).
  - High in Pima Indians
  - Asians with stones are more likely to have pigmented stones than other populations.
  - African descent with Sickle Cell Anemia (Hemolysis → High bilirubinemia → Pigment gall stones)
- **Sex:**
  - More common in women may be secondary to variations in estrogen causing increased cholesterol secretion, and progesterone causing bile stasis.
  - Pregnant women.
  - Women with multiple pregnancies at higher risk.
  - Oral contraceptives, estrogen replacement therapy.
- **Age**
  - It is uncommon for children to have gallstones. If they do, its more likely that they have congenital anomalies, biliary anomalies, or hemolytic pigment stones.
- **Morbidity/Mortality:**
  - Morbidity and mortality is associated only with symptomatic stones.

Pathophysiology

- Bile consists of lethicin, bile acids, phospholipids all in a fine balance.
- Gall stones formation results from an imbalance of constituent of bile.
- Types of stones: cholesterol , pigment , mixed.
- Formation of each types is caused by crystallization of bile.
- Cholesterol stones are the most common.

Pathophysiology of cholesterol stones$_1$

- Bile become supersaturated with cholesterol (because of - increase excretion of cholesterol in the bile 2- increase cholesterol intake)
- With or without stasis or decrease gallbladder contractility
- Formation of cholesterol crystals (Cholesterol + Mucus/Bacteria/Ca)
- cholesterol stones:
  a) pure cholesterol stones (**yellowish to green , solitary or few, regular shape but rough surface**)
  b) Mixed cholesterol stones (darker and multiple)
- Stone formation is promoted by the following:
  - incidence in high cholesterol diet
  - in women taking oral contraceptive
  - in pregnancy (gall bladder stasis)

Pathophysiology of pigment stones$_2$

✸ Pigment stones (15%) are from calcium bilirubinate, **causes include Diseases that increase RBC destruction** , cirrhotic patients, parasitic infections.

- Risk factors include: those disorders that result in excessive bilirubin production, such as hemolytic anemia (when hemoglobin is liberated from red blood cells it is broken down and its heme component is eventually degraded into bilirubin by the liver, which then uses the bilirubin in bile).
- **Dark, multiple and smaller.**

Gall stones are just asymptomatic stones sitting in the gall bladder, once they produce pain we call the situation **Biliary Colic**

History

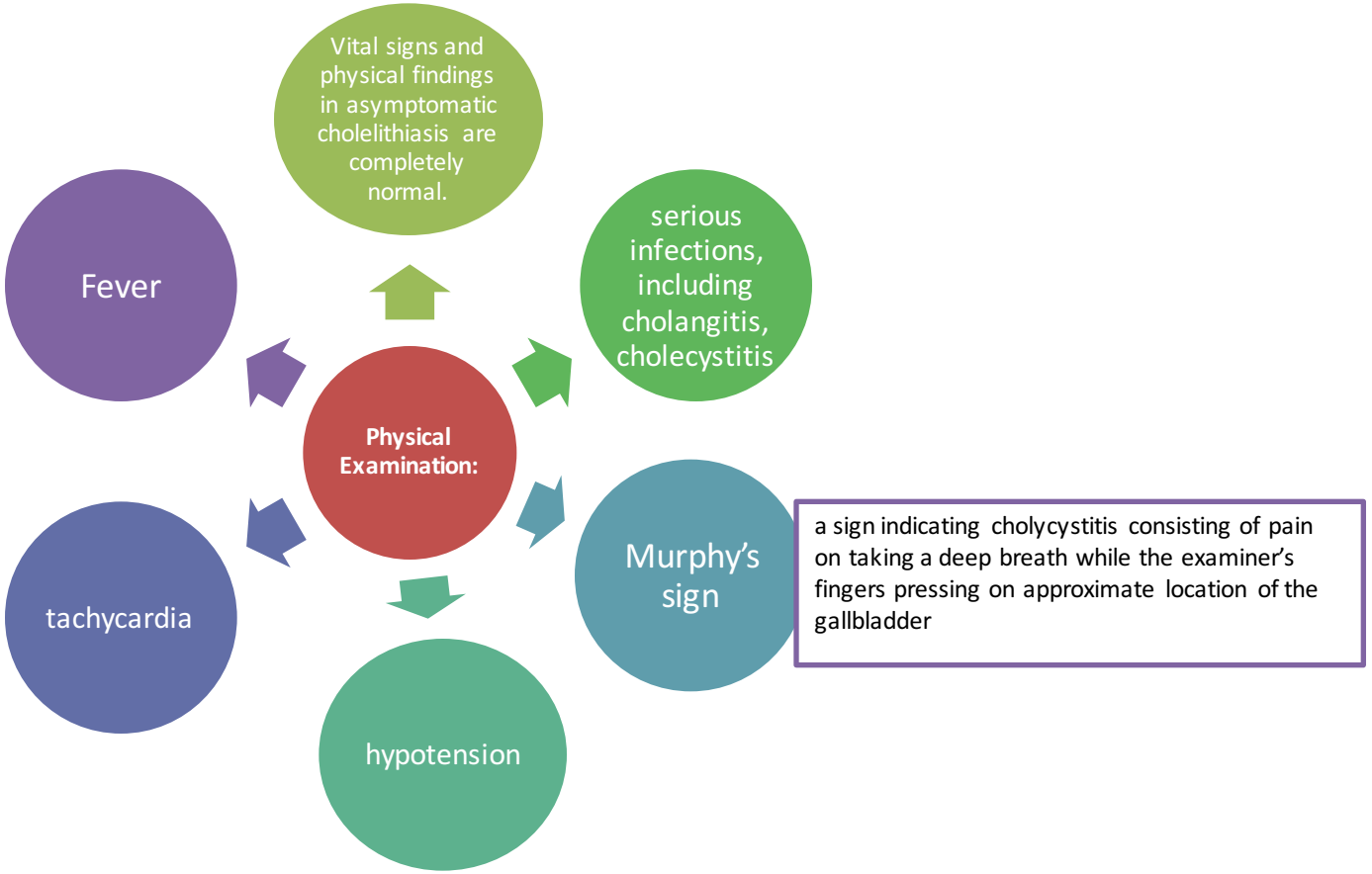
- 3 clinical stages: asymptomatic, symptomatic, and with complications (cholecystitis, cholangitis, common bile duct stones).
- Most **(60-80%) are asymptomatic**.
- A history of right upper quadrant (RUQ) pain with radiation to shoulder may suggest it.
- Detailed history of pattern and characteristics of symptoms as well as ultrasound to make diagnosis.
- Best definition of colic is pain that is severe in epigastrium or right upper quadrant that last 1-5 hrs, often waking patient at night.
- In classic cases pain is in the right upper quadrant pain, however visceral pain and gall bladder wall distension may be only in the epigastric area and **once peritoneum irritated, localizes to right upper quadrant** (parietal pain) .
- Small stones more symptomatic

Symptoms

- Vital signs and physical findings in asymptomatic cholelithiasis are completely normal.
- The majority of cases (approximately 80%) are asymptomatic (silent) gall stones , discovered accidentally by abdominal Ultrasound .
- A Gallstone may impact in the neck of gall bladder or in the cystic duct giving biliary pain (colicky pain) or cholecystitis (long standing obstruction of the neck of gall bladder causing inflammation).
- Biliary pain usually occurs in the epigastrium and right hypochondrium and radiates to the back.
- Obstruction of common bile duct leading to pain & jaundice.
- Gall stones increase risk of carcinoma of the gall bladder .

In summary, best to describe a typical biliary colic (6 symptoms):
1-Right upper quadrant pain, 2-Colicky, 3-Radiate to back and sometimes to right shoulder, 4-Aggravated by fatty food, 5-Associated with nausea and vomiting, 6-Recurrent.

Physical Examination



complication

- Cholecystitis: (This term means inflammation of the gallbladder), it is most commonly caused by cholelithiasis (formation of gall stones in gall bladder) Chronic Cholecystitis increases incidence of gallbladder carcinomas.
- Choledocholithiasis: The presence of gallstones in the common bile duct is a medical emergency because it impedes the flow of bile from the liver to the duodenum (as bile backs up into the liver, bile products and liver enzymes begin rising in the blood).
- Pancreatitis: The most common cause of acute pancreatitis (a gallstones abstractig ampulla of vater, which obstruct the pancreatic duct)
- Cholangitis (inflammation of biliary tract due to infection)
- Sepsis
- Necrosis of gall bladder and perforation
- Obstructive jaundice

Investigations

Lab investigations

- Labs with asymptomatic cholelithiasis and biliary colic should all be normal.
- WBC, elevated LFTS may be helpful in diagnosis of acute cholecystitis, but normal values do not rule it out
- Elevated ALT, AST, Alkaline Phosphatase more suggestive of common bile duct stones.
- Elevated Amylase in case of pancreatitis

imaging:

➢Ultrasound: **IT IS THE FIRST IMAGING TEST YOU DO:**

- It is 95% sensitive for stones & 80% specific for cholecystitis.
- It is 98% sensitive and specific for simple stones.
- Sometimes it might show Wall thickening (2-4mm), might be false positives!
- Distension
- Pericholecystic fluid, sonographic Murphy's

3 Things to ask about in US of GB:
1- Any stone?
2- GB wall thickness? *increase with cholycystitis*
3- Dilatation of biliary system? *indicate obstruction*

➢Endoscopic retrograde cholangiopancreatography (ERCP): is diagnostic and therapeutic. Provides radiographic and endoscopic visualization of biliary tree. Do when common bile duct (CBD) is dilated and elevated LFTs. Complications include bleeding, perforation, pancreatitis, cholangitis. If a patient presented with jaundice, you admit him for ERCP. *Remember: not used in pregnant lady, use MRCP instead*

➢HIDA Scan: cholescintigraphy or Hepatobiliary Imino-Diacetic Acid scan documents cystic duct patency.94% sensitive, 85% specific GB should be visualized in 30 mins. If GB visualized later it may point to chronic cholecystitis, CBD obstruction appears as non visualization of small intestine. False positives, high bilirubin.

➢CT Scan: IT IS THE BEST IMAGING EXAMINATION Used for complications, ductal dilatation, surrounding organs. Misses 20% of GS. Done if diagnosis is uncertain.

Ultrasound and Hida are the best. Plain x-rays, CT scans ERCP are adjuncts.

ER

- Consider acute cholecystitis in those with longer duration of pain, with or without fever.
- Elderly and diabetics do not tolerate delay in diagnosis and can proceed to sepsis.
- Primary goal of emergency care is diagnosis of acute cholecystitis with labs, US, and or Hida. Once diagnosed, hospitalization usually necessary. Some are treated as outpatient.
- After assessment of ABCs, perform standard IV, pulse oximetry, EKG, and monitoring. Send labs while IV placed, include cultures if febrile.
- Administer pain control early. A courtesy call to surgery may give them time to examine without narcotics.

Treatment

- Medication: 1-Anticholinergics such as Bentyl (dicyclomine hydrochloride)to decrease GB and biliary tree tone. 2-Demerol. 3-Antiemetics (phenergan, compazine) 4-Antibiotics (need to cover E.coli, klepsiella, enterobacter) Unstable patients may need more urgent interventions with ERCP, percutaneous drainage, or cholecystectomy
- Lap Cholecystectomy very effective with few complications (4%). 5% convert to open Cholecystectomy (through Kocher incision). In acute setting up to 50% are open.
- If there is abscess → treat like any abscess in the body : Drainage ± antibiotisc.

Patient with acute cholesystitis → Admit → evaluate :
1- pain for 24-48 hs → Operate
2- Pain for >48 hs → IV + Antibiotics → after patient become stable → Operate.

Prognosis

- Uncomplicated cholecystitis has a low mortality.
- The mortality rate for emphysematous GB is 15% .
- Perforation of GB occurs in 3-15% of patients with a mortality rate up to 60% .
- Gangrenous GB has a mortality rate up to 25%.

3rd :Other Benign Biliary Disorders

From textbook, included In the objectives but was not mentioned in the lecture

Asiatic cholangiohepatitis	• Suppurative cholangitis develops and pigment stones form in the intrahepatic and extrahepatic biliary tree. • occurs in the Far East and is particularly common in coastal Chinese communities. • clinical features are those of obstructive jaundice, pain and fever, and liver abscesses may form. • Cholangitis is treated with antibiotics, and stones in the duct can be removed by percutaneous, endoscopic and operative means. • Ductal obstruction may be treated by choledochoduodenostomy or hepaticojejunostomy. • A limb of the Roux loop of jejunum may be left in a subcutaneous position to facilitate subsequent percutaneous manoeuvres to treat residual or recurrent calculi. • Hepatic resection may be indicated if suppuration and obstruction have led to regional destruction of liver tissue.
Primary sclerosing cholangitis	• It is both intrahepatic and extrahepatic bile ducts may become indurated and irregularly thickened. • There is a marked chronic inflammatory cell infiltrate and fibrous narrowing of the biliary tree. • Its aetiology is unknown, but it may have an immunological basis since most patients have evidence of autoantibodies. • Over 3\4 of patients suffer from ulcerative colitis; other associated conditions include retroperitoneal fibrosis, immunodeficiency syndromes and pancreatitis. • Bile duct carcinoma can develop, and obstruction can give rise to bacterial cholangitis and secondary biliary cirrhosis.

4th :Tumors of The Biliary Tract

From textbook, included In the objectives but was not mentioned in the lecture

1- Carcinoma Of The Gallbladder

- Carcinoma of the gallbladder is rare and almost invariably associated with the presence of gallstones.
- The condition is 4 times as common in females as in males.
- 90% of lesions are adenocarcinomas; the remainder are squamous carcinomas.
- Direct invasion commonly obstructs the bile duct or porta hepatis, and early lymphatic and haematogenous dissemination is common.
- Initial symptoms are indistinguishable from those of gallstones but jaundice, if present, is unremitting.
- A mass may be palpable.
- Many tumors are detected incidentally at cholecystectomy, Some surgeons recommend an aggressive approach of resection of segments of the liver and dissection of the regional lymph nodes.
- Tumors presenting with jaundice cannot be cured by resection, and palliation by endoscopic or percutaneous insertion of a stent or surgical bypass is required.
- The 5-year survival rate is less than 5%.

2- Carcinoma Of The Bile Ducts

- Cholangiocarcinoma is a relatively uncommon cancer that affects the elderly and is increasing in frequency.
- Such lesions may arise at any site within the biliary tree and can be multifocal. Most common at the hilum.
- Tumours can be classified based on the level of involvement of the biliary tree. A) Polypoidal tumours are uncommon but carry a more favourable outlook. B) Sclerotic lesions involving the confluence of the hepatic ducts (Klatskin tumour) pose considerable problems in management.
- The lesions are said to be slow-growing, but this has been over-emphasized.
- Cholangiocarcinoma may develop in patients with underlying primary sclerosing cholangitis or choledochal cyst.
- Clinical features: A)Progressive obstructive jaundice, B)preceded by vague dyspeptic pain, is the usual presenting feature. C) mucocoele or empyema can develop, but generally it is impalpable. D)Anorexia and weight loss are common. E) Pruritus is often.

Summary:

- Bile is excreted in the form of feces and it gives feces its dark brown color
- Bile salt is the actual component which helps break down and absorb fats
- Biliary Atresia most common cause of prolonged jaundice in infancy
- Gallstones More common in women may be secondary to variations in estrogen causing increased cholesterol secretion
- Remember the 5 F's "Fat Forty, female, fertile and fair
- Ultrasound: first imaging test to evaluate GB.
- Carcinoma Of The Gallbladder 90% of lesions are adenocarcinomas; the remainder are squamous carcinomas
- On physical examination, you will see Murphy sign, hypotension and tachycardia
- Carcinoma Of The Bile Ducts most common site is at the hilum

MCQs

Q1: A 73-year old previously healthy man presents to the emergency room with several days of jaundice followed by 12 hours of RUQ pain and fever. He is mildly hypotensive. CT scan of the abdomen revealed dilation of the biliary tree. What is the most likely diagnosis? Answer: Cholyangitis

Management includes which of the following?

- A. Laproscopic cholecystectomy.
- B. Open cholecystectomy and T tube replacement.
- C. Open cholecystectomy and choledochojejunostomy.
- D. Fluid resuscitation, antibiotics, and ERCP.
- E. Fluid resuscitation and hepatitis serology.

Q2: 2- Risk factors for gallstones include all of the following except:

- A. Obesity.
- B. Contraceptive pills.
- C. Sickle cell anemia.
- D. High protein diet .
- E. Rapid weight loss.

Q3: In Endoscopic ERCP, stone extraction from the common bile duct (CBD) is NOT possible in all of the following except:

- A. Multiple stones in CBD.
- B. Intrahepatic stone .
- C. Multiple gall stones .
- D. Pt has CBD stone with prior gastrectomy .

Q4: A 70 years old male with progressive painless jaundice is referred to your clinic. You order LFT that shows abnormal pattern of obstruction jaundice, US shows dilated CBD 2 cm. Which procedure do you suggest?

- A. ERCP
- B. Laparoscopic Cholecystectomy
- C. Modified barium swallow
- D. Laparoscopic abdominal exploration
- E. Upper GI endoscopy

Answer Key: 1=D, 2=D, 3=A, 4=A

Clinical Scenarios from Kaplan Videos:

Female patient 45 years old obese with 4 children came to ER with right upper quadrant abdominal pain aggravated by eating fatty food and relived by anti-cholinergic, physical exam was normal what is initial step to do ? And what's next ?

First, we do Ultrasound to confirm the diagnosis , then we plan for elective surgery

Female patient 50 years old married with 3 children came to ER with history of right upper quadrant pain that started 6 hours ago associated with nausea and vomiting, for the last 2 hours pain was constant. On physical exam there was tenderness felt on deep palpation. Her WBC 1000 count, and her LFT was normal. What is the diagnosis and what is initial step to do? And what's next?

Acute Cholecystitis , we do ultrasound to confirm the diagnosis, Give the patient Medical treatment and if :

She responds well we plan for elective surgery

She don't respond to treatment then we do emergency surgery

Thank You..

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