Biliary obstruction and biliary stones

Objectives: (Not given)

- Anatomy of biliary system
- Physiology of bile salt and enterohepatic circulation
- Gallstones
- benign biliary disorders

Resources:

- Davidson's.
- Slides
- Surgical recall.
- Raslan's notes.

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الدكتور قال مافيه ولا سؤال ما قلته بالشرح + انتم مطالبين بال diagnosis and investigation فقط .

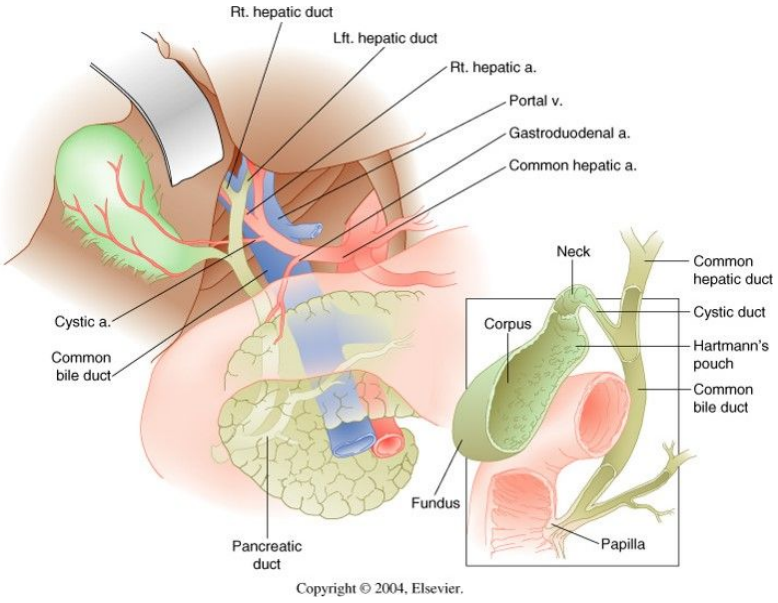
Basic review:

Anatomy:

Biliary tree:

consists of fine intrahepatic biliary radicles that drain individual liver segments before forming the right and left hepatic ducts.

The left hepatic duct joins the right hepatic duct to form ⇒ common hepatic duct ⇒ common bile duct which ends at the ampulla of Vater (usually in the second part of the duodenum). It is usually joined by the pancreatic duct just before entering the duodenum.



Gallbladder:

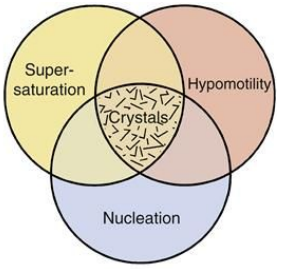
lies in a bed on the undersurface of the liver between its right and left halves with a fundus, body and neck. Hartmann's pouch is a dilatation of the gallbladder outlet adjacent to the origin of the cystic duct, in which gallstones frequently become impacted.

Blood supply:

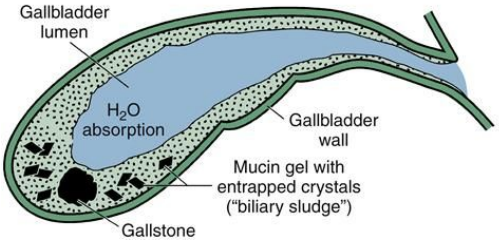
Gallbladder and cystic duct are supplied by the cystic artery.

Celiac trunk →common hepatic a. →right hepatic a. →cystic a.

Pathophysiology:



- Bile consists of 3 component in a balance.
  - **Lecithin**
  - **bile acids**
  - **phospholipids** (cholesterol)
- The solubility of cholesterol in bile depends on the concentration of lecithin, bile salts and cholesterol.
- **Lecithin** and **cholesterol** are insoluble aqueous solutions but dissolve in bile salt-lecithin micelles.
- Conversely, increasing the biliary concentration of lecithin and bile salts should hinder cholesterol stone formation.
- Normal bile (normally 1 Liter/day) contains glucaro-1,4-lactone, which inhibit the conversion of conjugated to unconjugated bilirubin, and thus stop the formation of calcium bilirubinate stones.



- Impaired motility can predispose to stones.
- Sludge is crystals without stones. It may be a first step in stones, or be independent of it.

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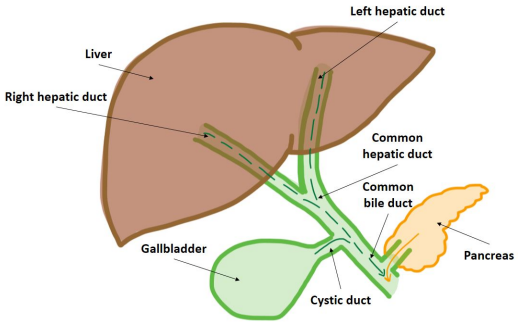
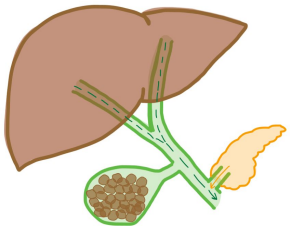
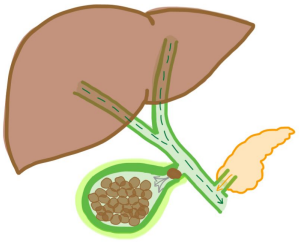
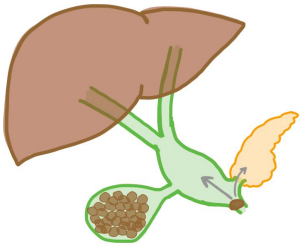
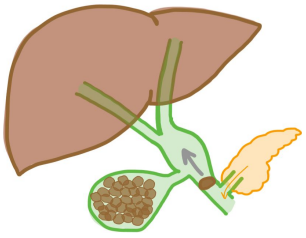
EXTRA

Tip: go through this table before studying the lecture and make sure you read it after 👌

Normal →



		Cholelithiasis	Cholecystitis[1]	Choledocholithiasis	Cholangitis
Definition		presence of **gallstones** in the gallbladder	**Inflammation** of the gallbladder	Presence of a **gallstone** in the common bile duct	**Infection** of the Common bile duct
					
Site of obstruction		**NO** obstruction	Cystic duct	Common bile duct	Common bile duct
Clinical presentation		* Pain ~ RUQ ~ **Colikcy[2]/Intermittent** ~ Radiates to right shoulder ~ worse with fatty food * +/- N/V	* Pain ~ RUQ ~ **Constant[3]** ~ Radiates right shoulder or back ~ worse with fatty food * +/- N/V * Fever	* Pain (mild) ~ RUQ ~ Radiates to shoulder * Jaundice * +/- hepatitis * +/- pancreatitis * +/- N/V * +/- Fever	**Charcot's triad:** RUQ pain + jaundice + fever (with rigors) Mnemonic: CHArcot's Color = yellow(jaundice) Hot = fever (+rigors) Ache right= RUQ pain
Murphy's sign		-	+ (acute type)	-	-
Obstructive jaundice		-	-	+	+
Diagnostic methods	**Lab**	NORMAL	↑ WBC	↑ WBC ↑ LFTs (ALP & GGT)[4] +/- ↑ amylase & lipase	↑ WBC ↑ LFTs (ALP & GGT)
	Imaging	**US:** • Gallstones	**US:** (3 findings) 1. Stones 2. Thickened wall 3. Pericholecystic fluid **HIDA**	**US:** • Obstruction • Dilated ducts **MRCP**	**US:** • Obstruction • Dilated ducts
Management		* Avoid fatty meal * Elective cholecystectomy + Ursodeoxycholic acid[5]	* NPO + IVF + IV Abx * Urgent Cholecystectomy[6]	* NPO + IVF + IV Abx * ERCP + Elective cholecystectomy	* NPO + IVF + IV Abx * Urgent ERCP + urgent cholecystectomy

[1] Remember there is two types of cholecystitis: calculous cholecystitis (gallstones) & acalculous cholecystitis (without gallstones)

[2] المريض يقول لك الالم يجي ويروح ويتكرر بين كل فتره

[3] Not colicky as its an inflammation so nothing will relieve it

[4] Obstructive pattern + conjugated (direct) bilirubin

[5] Effective agent for dissolving cholesterol gallstones

[6] If cholecystectomy is of an option

Types of stones:

Gallstones are conveniently classified into cholesterol, pigment stones, and of mixed composition.

Cholesterol gallstones

Most common

Account for 80% of all gallstones

- Cholesterol is held in solution in bile by its association with bile salts and phospholipids in the form of micelles and vesicles.

(phospholipids (lecithin) + bile salt solubilize cholesterol)

- Cholesterol will only crystallize into stones when the bile is supersaturated with cholesterol relative to the bile salt and phospholipid content.
- **In gallstone disease, the liver produces bile that contains a relative excess of cholesterol. Which promotes a lithogenic bile.**

Crystallization can be due to either of the following:

- Relative deficiency of bile salts
- Relative excess of cholesterol

Pathogenic factors leading to production of lithogenic bile:

- Defective bile salt synthesis (hepatic dysfunction)
- Excessive cholesterol secretion (Increased HMG-CoA reductase activity)
- Abnormal gallbladder function (impaired motility)
- Excessive intestinal loss of bile salt

Pigmented stones

Account for 15-20% of all gallstones, Composed of calcium bilirubinate. Dark, multiple, and smaller in size.

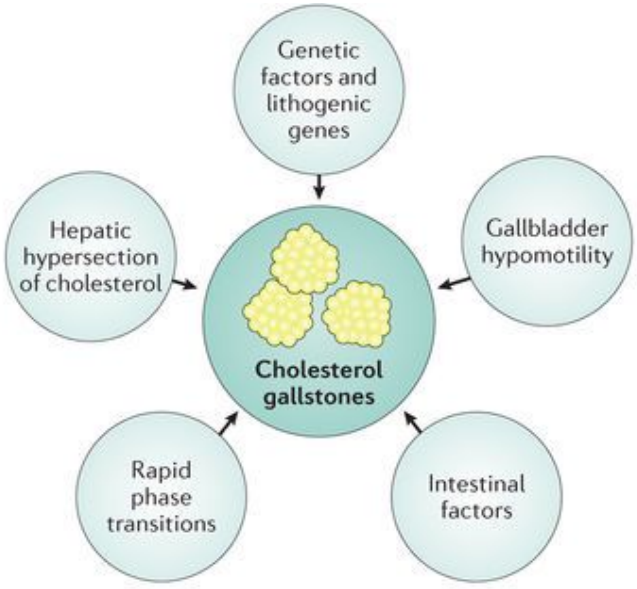
A-Black stones:[7]

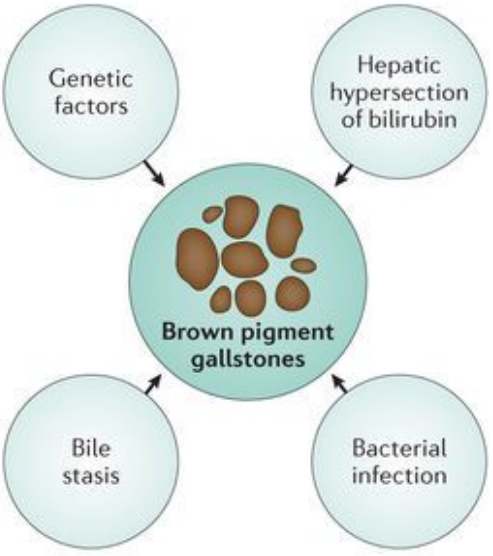
Black pigment stones are mostly seen in patients with **hemolytic conditions** such as: sickle cell disease and spherocytosis, which there is a chronic excess in bilirubin production.

They can be also found in Cirrhotic patients.

B- Brown stones:[8]

These stones are composed of calcium salts of fatty acids as well as calcium bilirubinate. They are almost always found in the presence of bile stasis and/or **biliary infection.**





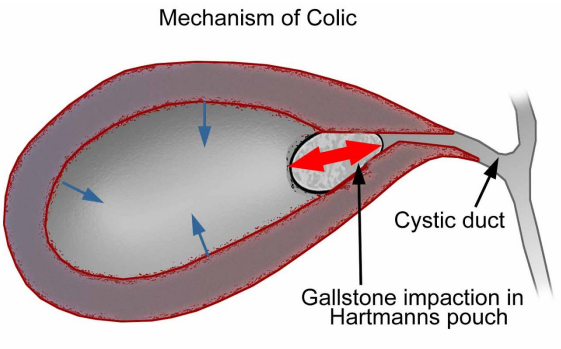
[7] form primarily in the gallbladder in sterile bile and are associated with advanced age, chronic hemolysis, alcoholism, cirrhosis, pancreatitis, and total parenteral nutrition

[8] Brown stones form not only within the gallbladder but also within the intrahepatic and extrahepatic ducts; they are uniformly infected with enteric bacteria and are **usually associated with ascending cholangitis**.

Gallbladder stones (Cholelithiasis)

Background:

- **Cholelithiasis** is the presence of gallstones in the gallbladder.
- Presentation and complications:
  - May remain **asymptomatic** for decades.
  - May cause **biliary colic**[9] type of pain
  - May lead to **Cholangitis**[10]**, choledocholithiasis**[11] **or cholecystitis**[12]**.**
- approximately **80% are asymptomatic** not painful (**silent**) gallstones, discovered accidentally by abdominal sonar.
- Other **symptoms are related to site of obstruction of stone**
  Obstruction of:
  - **Common bile duct** leading to pain & jaundice.
  - **Pancreatic duct** leading to pancreatitis.
- Gallstones increased risk of carcinoma of the gallbladder.
- Biliary pain usually manifest in the epigastrium and right hypochondrium (RUQ).



Epidemiology, causes and risk factors:

affected by race, ethnicity, sex, medical conditions, fertility..

- Internationally: 20% of women, 14% of men.
- Patients over 60 prevalence was 12.9% for men, 22.4% for women. F > M
- Every year 1-3% of patients develop symptoms.
- **Morbidity and mortality is associated only with symptomatic stones.**

Risk factors[13]	
Race	- Highest in fair skinned people of northern European descent and (in Hispanic populations 1-2% yearly.). - High in Pima Indians (75% of elderly). AND Asians are more likely to have pigmented stones than others. - African origin with Sickle Cell Anemia.
Sex	- More common in women. Etiology may vary being 2ndary to **estrogen**[14]**(plz read footnote)**; causing increased cholesterol, and **progesterone** causing bile stasis. • Pregnant women more likely to have symptoms. • Women with multiple pregnancies at higher risk • Oral contraceptives, estrogen replacement therapy. - 5F's: Forty, Fair[15], Fat, Female & Fertile.
Age	- **It is uncommon for children to have gallstones.** If they do, it's more likely that they have congenital anomalies, biliary anomalies, or hemolytic pigment stones disease.. - Incidence of gallstones increases with age 1-3% per year.

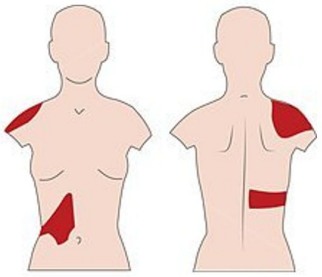
[9] Pain associated with temporary gallbladder contraction against a stone
[10] Infection of the biliary tree.
[11] Gallstone in bile duct
[12] Inflammation of gallbladder from obstruction of CBD or cystic duct
[13] Nowadays there is new risk factors including: Hormonal replacement therapy, oral contraceptives and lifestyle changes
[14] Estrogen increase HMG coA which will lead to: 1.more cholesterol synthesis and secretion to GB 2.increase the lipoprotein receptors on hepatocytes = more lipid uptake.
[15] common in Caucasians pupolation.

Causes	Differential diagnosis
- High fat diet, Obesity - Rapid weight loss, TPN, Ileal disease, NPO. - Increases with age, alcoholism. - Diabetics have more complications - Hemolytics	- AAA - Appendicitis, Cholangitis, cholelithiasis - Diverticulitis, Gastroenteritis, hepatitis - IBD, MI, SBO - Pancreatitis, renal colic, pneumonia

History:

- 3 clinical stages: **asymptomatic (60-80%)**, **symptomatic**, and with **complications** (cholecystitis, cholangitis, CBD stones).
- Typical symptoms of **biliary colic**:
  (why did we say biliary colic and not gallstones? Because typically **gallstones are asymptomatic)**
  - **RUQ colicky pain**, **Radiating** to the **back** and **shoulder**[16]
  - Aggravated by **fatty food**

  If pain is associated w/ empty stomach ⇒ think more of duodenal ulcer.
  - Associated with **nausea** and **vomiting**
  - Usually **recurrent pain**



Mechanism of pain in case of gallstones:
Cholecystokinin (CCK) will be secreted **after eating a fatty food** (CCK affect is in the layer muscles of gallbladder causing it to **contract**) when the gallbladder contract **it won't release bile** (stones obstruct release of bile) stomach will secrete more and more CCK to get the bile so more and more contraction in the gallbladder causes pain

- Sometimes the pain can be **relieved** by vomiting, (how? When you vomit → less CCK secreted → less contraction → less pain)
- A **detailed history** of the pattern and characteristics of symptoms along with the use of **ULTRASOUND** will help in the diagnosis.
- Most patients develop symptoms before complications.
- Indigestion, bloating and fatty food intolerance occur in similar frequencies in patients without gallstones, and are not cured with cholecystectomy.
- Best definition of **colic** is pain that is severe in epigastric and RUQ that last 1-5 hrs, can wake the patient at night.
- **atypical symptoms** of gallstones could be **in the epigastric area**, could be also **without** nausea and vomiting, but if the pain is in the LUQ this is less likely to be gallstones
- **Once peritoneum irritated, pain will be localized to RUQ.**
- Small stones are more symptomatic. How? It can move and obstruct ampulla of vater thats will lead to (obstructive jaundice/pancreatitis)

Physical examination:

- Vital signs and physical findings in **cholelithiasis are completely normal.**
- Fever, tachycardia and tachypnea[17], hypotension, alert you to more serious infections, including cholangitis, cholecystitis.
- Negative Murphy's sign[18].

[16] Due to diaphragmatic irritation
[17] tachycardia and tachypnea due to pain.
[18] it is performed by asking the patient to breathe out and then gently placing the hand below the costal margin on the right side at the midclavicular line (the approximate location of the gallbladder). The patient is then instructed to inspire (breathe in). If the patient stops breathing in (as the gallbladder is tender and, in moving downward, comes in contact with the examiner's fingers) and winces with a 'catch' in breath, the test is considered positive.

Investigation:

Labs:

- Labs with **asymptomatic cholelithiasis** and **biliary colic** will **normal.**
- **WBC**, **elevated LFTS** may be helpful in diagnosis of **acute cholecystitis**, but normal values do not rule it out.

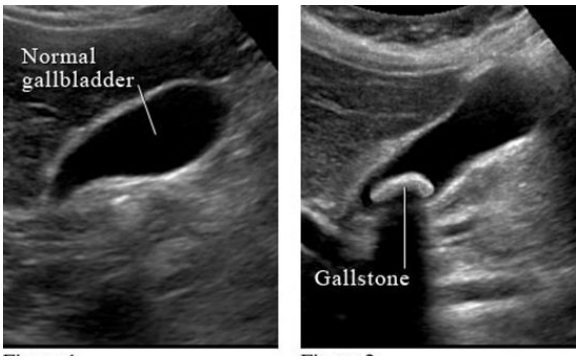
Test labs to order:

- **CBC** (to rule out infection and cholecystitis), It will be high in case of infection and cholecystitis.
- **LFTs**: **AST+ALT** (to know if there is any disease or viral infection in the hepatocyte itself), **Alkaline phosphatase**, **GGT**, **total bilirubin + direct bilirubin**[19] to know:
    a. if the patient has jaundice [20]or not
    b. what type of jaundice he has: obstructive or cholestatic
- A**mylase** (to rule out pancreatitis), U&E (urea and electrolyte), renal function test , and coagulation profile[21]

Imaging studies:

US and HIDA[22] are the best. Plain x-rays, CT scans ERCP are adjuncts[23].

What to do for a patient coming with pain: cannula "painkillers (1g paracetamol) and IV fluid (1L saline)" after 1 hour the patient is no longer tachypnic nor tachycardic → meaning the pain is relieved. If you examine him/her abdomen will be soft and lax. All the lab tests will be normal, so how to confirm your diagnosis? By ultrasound.

Xrays	CT	Ultrasound
15% stones are radiopaque, porcelain GB may be seen. Air in biliary tree, emphysematous GB wall. 	for complications, ductal dilatation, surrounding organs. Misses 20% of GS. done only if diagnosis was uncertain. 	- 95% sensitive for stones, 80% specific for cholecystitis. **It is 98% sensitive and specific for simple stones.** - Wall thickening (2-4mm) false positives - Distension - Pericholecystic fluid, sonographic Murphy's sign. - Dilated CBD(7-8mm). Last portion of common bile duct is normally invisible, thus if seen == it is dilated !! 

What do you need to know from **ultrasound** 3 things to look for:

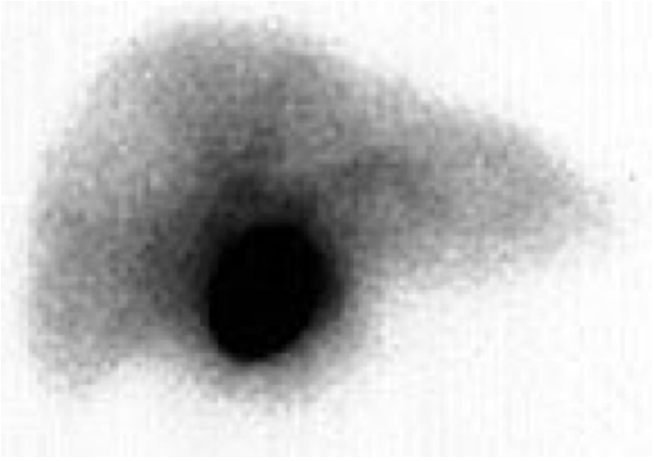
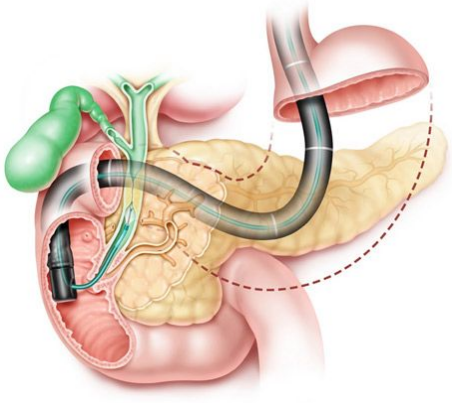
1. presence of **stones**
2. is there any radiological signs of cholecystitis? "**wall thickening**[24] of the gallbladder or **pericholecystic fluid**" (if present it indicate inflammation "cholecystitis" not gallstones)
3. **Dilation** of the biliary system

[19] The direct bilirubin test provides an estimate of the amount of conjugated bilirubin present. Total bilirubin level (unconjugated plus conjugated bilirubin).
[20] Inspecting the sclera and skin color changes is not enough to find jaundice as it depends on the fairness of the patient skin tone and also dark skinned people has yellow sclera normally
[21] For any future procedure
[22] Cholescintigraphy or **H**epatobiliary **I**mino**D**iacetic **A**cid
[23] ERCP is diagnostic and therapeutic, but used mostly to treat due to its side effects (therapeutic)
[24] Normal thickening of the gallbladder is 3mm

So in biliary colic (Cholelithiasis) :

1. presence of stones
2. no wall thickening
3. no dilation

• Imaging studies (cont..)

HIDA scan:	ERCP[25]
• Hida scan documents cystic duct patency. • **94% sensitive, 85% specific** • GB should be visualized in 30 min. normal • If GB visualized **later** it may point to chronic **cholecystitis**. • CBD obstruction appears as **non visualization** of small intestine. • False positives, high bilirubin. 	• ERCP is **therapeutic not diagnostic[26].** • Never do if patient is having active pancreatitis, cholangitis, or is hypotensive. • Provides radiographic and endoscopic visualization of biliary tree. • Obstruction is visualized as a filling defect of contrast. • Done only when **CBD is dilated** (if you can't prove dilation with US, **don't use it as diagnostic**) and elevated LFTs. • Complications include bleeding, perforation, **pancreatitis**, cholangitis (all complications are fatal) **Preparations of ERCP:** - Consent (listing all complications). - NPO - Correct coagulation profile, b/c we're doing sphincterotomy which may result in bleeding. - Prophylactic antibiotics 

IMPORTANT MCQs

patient 30 y/o (with all symptoms of biliary colic).

- What is the **best** option to confirm biliary colic or (presence of stones in the gallbladder)? **Ultrasound**
- What is the **most sensitive** for gallbladder stones (biliary colic)? **Ultrasound**
- The **most cheapest** or the **most available**? **Ultrasound**

أي سؤال يجيكم بأي صيغة كانت جوابه US إلا إذا كان السؤال عن biliary system

- What is the most sensitive for **"BILIARY TREE SYSTEM" stones** "not the gallbladder"? **EUS (endoscopic ultrasound)** You can use US if it dilated. **If not available MRCP is used, if stone present we do ERCP to remove it. if still there are multiple other stones we couldn't remove we do stenting. Then after sometime we do ERCP again !! it's a must.**

Management:

- Historically cholithiasis was operated on emergently which increased mortality.
- Surgical consult is appropriate, and depending on the institution, either medicine or surgery may admit the patients for care. (elective surgery)
- Get GI doctor involved early if suspect CBD obstruction.

[25] Endoscopic Retrograde CholangioPancreatography.
[26] ERCP is diagnostic and therapeutic, but in case of gallstones its used to remove CBD stones

Surgical approaches: IMPORTANT

Non-febrile

Patient comes to ER with

- typical biliary colic symptoms and history of recurrent episodes of biliary colic. (متعودة دايماً)
- Order labs (CBC, LFT'S, E&U, coagulation profile) >> all NORMAL
- US: confirm presence of stones in gallbladder.
- US (3)Qs
    1. Presence of stones? Yes
    2. Thickened wall/ peri-cholecystic fluid ? **NO**
    3. Dilated biliary tree? No

In ER:

- Given pain killers and rehydrated (IV saline) (symptoms will subside completely)

How to treat him?

- You advise him to do cholecystectomy (electively), waiting won't increase risk as 80% are asymptomatic.

Febrile (cholecystitis)

Patient comes to ER with:

- Same symptoms, BUT **febrile** (maybe perforation)
- Order labs : (CBC, LFTS, E&U, coagulation profile)>> **CBC: ↑ WBC** (inflammation)
- Suspecting cholecystitis
- US (3)Qs
    1. Presence of stones? Yes
    2. Thickened wall/ pericholecystic fluid ? Yes
    3. Dilated biliary tree? No

In ER:

- Given pain killers and rehydrated (IV saline) (symptoms won't subside completely there will still be tenderness)
- **Admit patient (acute cholecystitis)**

At this stage you think of your "surgical window"[27]

E.g. **2 days** (within surgical window)	E.g. **4 days** (beyond surgical window)	If no improvement of previous case of pt came after **6 days** (way beyond surgical window)
- Gallbladder wall thickness is **5mm** , it is not extremely inflamed >>> surgery can be done with minimum bleeding **5ml** or non. - ↑ WBC (15) - Schedule elective surgery -	- gallbladder wall thickness is **10mm**, GB is too inflamed to operate[28]. there will be a lot of bleeding **100-200 ml**. - **Conservative management** (NPO, IV fluid, Antibiotic,Painkiller) until stable, **how to know?** By checking daily for improvement of **5 clinical** features and **1 laboratory** feature Clinical: Tenderness, Tachycardia, Tachypnea, fever, Tolerating food orally **Lab:** ↑↑ WBC (20) Now send patient home with antibiotic for 6-8 weeks, so all the inflammation heals then -Schedule an semi-elective surgery.-	- Gallbladder wall is **15mm**. - More tachycardia - More tachypnea - ↑↑↑WBC (22) - Higher fever. - Rebound tenderness → peritonitis - Emergency surgery[29]- مجبر اخاك لابطل if we waited patient may die

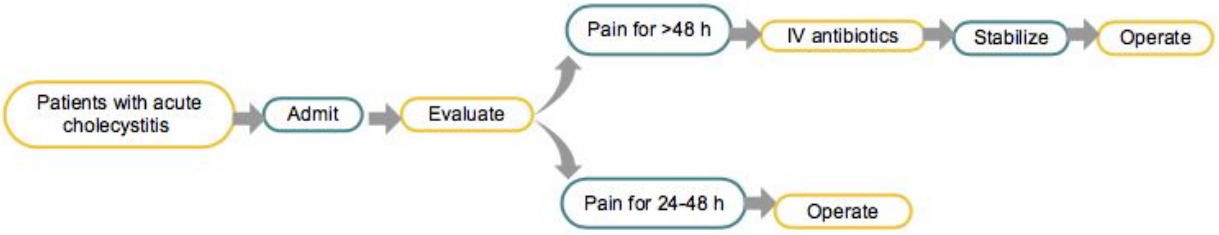
[27] it's time frame from the beginning of the inflammation till presentation where it's the safest to do the surgery varrieng upon your experience and the institute you work in

[28] you won't differentiate cystic duct from cystic artery, everything is friable and erythematous

[29] Surgery most likely will convert to open , maybe won't be even able to remove gall bladder and only remove necrotic tissue

Emergency Department Care:

- Patients with **RUQ** pain of less than 4-6h duration radiating to back → Suspect GB colic.
- In those with longer duration of pain, with or without fever → Consider acute cholecystitis. Elderly and diabetics do not tolerate delay in diagnosis and can proceed to sepsis.
- After assessment of ABCs, perform standard IV, pulse oximetry, EKG, and monitoring. Send labs while IV placed, include cultures if febrile.
- **Primary goal of ED care:** is diagnosis of acute cholecystitis with labs, US, and or Hida. Once diagnosed, hospitalization usually necessary. Some treated as OP.
- In patients who are unstable or in severe pain → consider a bedside US to exclude AAA and to assist in diagnosis of acute cholecystitis.
- Replace volume with IVF, NPO, +/- NGT.
- Administer pain control early. A courtesy call to surgery may give them time to examine without narcotics.



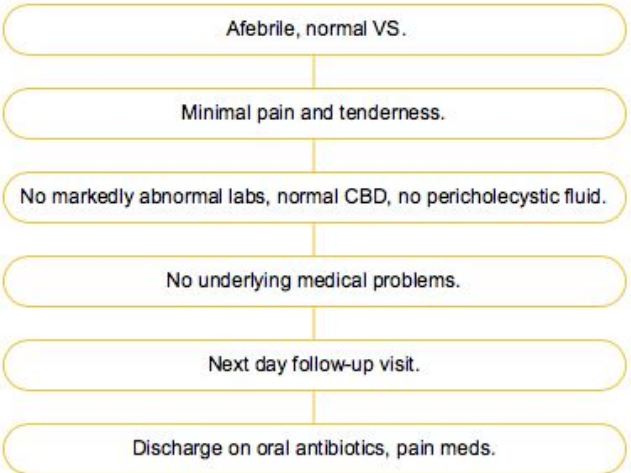
Medication :

Anticholinergics	such as Bentyl (dicyclomine hydrochloride)to decrease GB and biliary tree tone. (20mg IM q4-6).
Demerol	25-75mg IV/IM q3
Antiemetics	(phenergan, compazine).
Antibiotics	(Zosyn (Piperacillin/tazobactam) 3.375g IV q6) need to cover E.coli (39%), Klebsiella(54%), Enterobacter(34%), enterococci, group D strep.

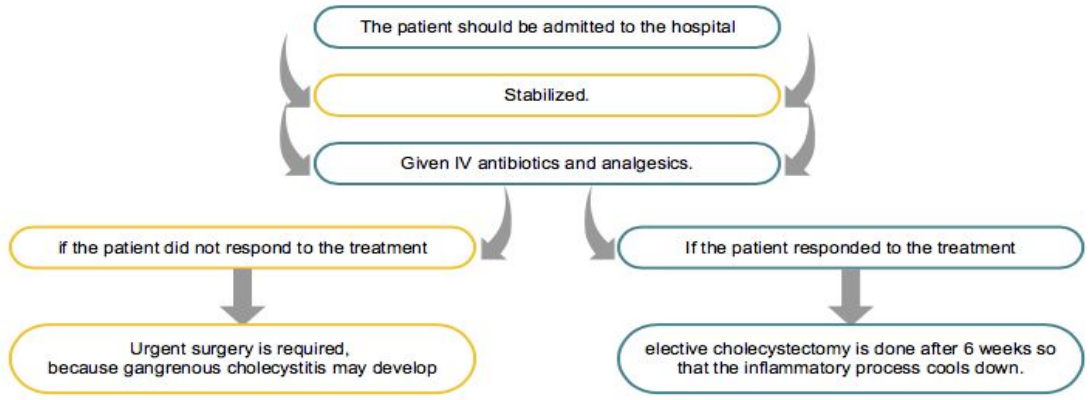
Further Inpatient Care :

Open cholecystectomy	Laparoscopic cholecystectomy
can be performed after the first 24-48h or after the inflammation has subsided. Unstable patients may need more urgent interventions with ERCP, percutaneous drainage, or cholecystectomy.	very effective with few complications (4%). 5% convert to open. In acute setting up to 50% open.

Further Outpatient Care:



Complications:

Cholecystitis	
It's an inflammation of the gallbladder secondary to calculi	
Characteristics	• Continuous pain. • Fever. • High WBC count due to inflammation. • Murphy's sign on examination. • Distended gallbladder and thickening of the wall on Ultrasound due to inflammation.
Management	

when stones pass they'll either cause:

- acute pancreatitis if it lodges in ampulla of vater.
- cholangitis if accompanied by infection.
- Obstructive jaundice if it lodges in CBD

Cholangitis	
Infection of the biliary tree .	
Characteristics	**Charcot's triad :** - RUQ pain. - Jaundice. - Fever. **Reynolds pentad**[30]**:** Charcot's triad + septic shock and altered mental status
Management	- **No ERCP,** because patient is hypotensive on ionotrops , if sedated to do ERCP BP will drop . - Percutaneous transhepatic cholangiography (PTC)[31]; by placing a percutaneous stent to **drain inflammation and infection** (pus) - Patient doesn't need ionotrops anymore → ERCP → Cholecystectomy (within the same admission)

[30] serious infection of the biliary system

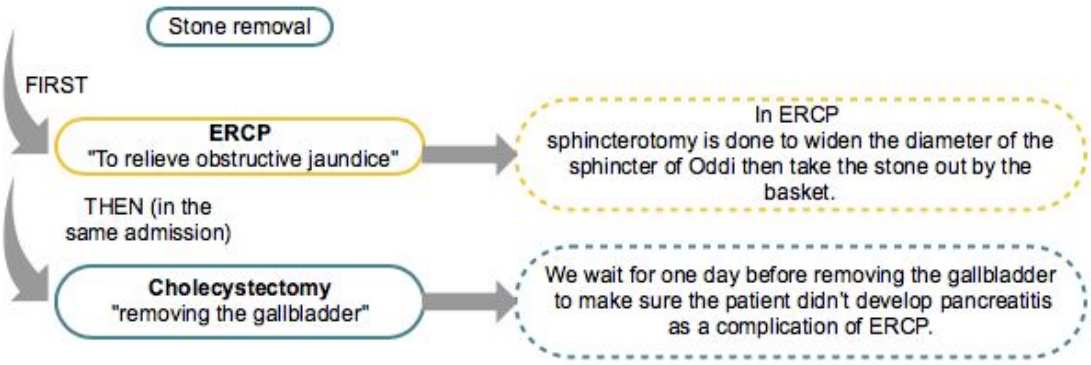
[31] Like any other pus collection needs drainage.

Obstructive Jaundice

- When obstructive jaundice occurs it means that one of the stones moved down to the common bile duct and caused an obstruction which will obstruct the flow of bile from the liver to the small bowel.
- It can also be a mass (pancreatic head) that's causing the obstruction.

Symptoms & Signs	• **Jaundice:**
	  - Look for it in the **sclera**[32] (specially dark skinned people and during the sun light), skin and mucosa
	  - The bilirubin level in the blood is at least double the normal (Upper normal level is 17 mmol)
	• **Pale stool** (could be delayed up to 3 days)
	• **Dark urine (first sign)**
	• **Itching** (due to accumulation of bile salts under the skin)

Differential Diagnosis	• **Cancer** (obstruction develops gradually), **Painless** [33]obstructive jaundice with significant weight loss.
	  ○ **Head of pancreas cancer**
	  ○ **ampulla of Vater cancer**
	  ○ **Distal CBD cancer**

Investigations	**↑Total bilirubin, 80% is direct** **↑ alkaline phosphatase** **↑ GGT** **(obstructive pattern of obstructive jaundice)** **US 3 Q?** 1. Presence of stones? Yes 2. Thickened wall/ peri-cholecystic fluid ? No 3. Dilated biliary tree? Yes Then ERCP [34] to remove the stone as part of management.
Management	 [35]

[32] Inspecting the sclera and skin color changes is not enough to find jaundice as it depends on the fairness of the patient skin tone and also dark skinned people has yellow sclera normally

[33] Unlike stones which cause PAINFUL obstructive jaundice + young patient and acute onset in stones, old and progressive (e.g. noticed by family members) in cancer

[34] If patient just had the CBD obstructed yesterday he may not have biliary tree dilatation just yet, so you don't have proof to perform such an invasive procedure with fatal complications like ERCP. instead you do Endoscopic ultrasound (EUS) (If EUS is not available do MRCP). EUS is done using an endoscope with an US probe, place the probe on ampulla of vater to visualize obstruction then replace probe by ERCP with the same endoscope.

[35] Perform cholecystectomy in the same admission as 40% of patients will have obstructive jaundice recurrence 4months after.

Other Complications:

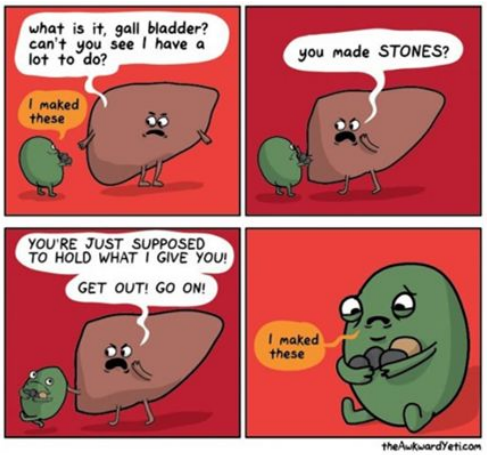
- **Sepsis, Cholangitis**
- **Pancreatitis** **(80% of pancreatitis is due to stones)**
- **Perforation** (10%)
- **GS ileus** (mortality 20% as diagnosis difficult).
- **Hepatitis**
- **Choledocholithiasis**

Prognosis:

- Uncomplicated cholecystitis has a low mortality.
- Emphysematous GB mortality is 15%
- Perforation of GB occurs in 3-15% with up to 60% mortality.
- Gangrenous GB 25% mortality.

Summary from doctors slide:

Complication	History	Examination	Blood tests
Biliary Colic	- Intermittent RUQ/epigastric pain (minutes/hours) into back or right shoulder - N&V	-Tender RUQ -No peritonism -Murphy's - -Apyrexial, HR and BP (N)	-WCC (N) CRP (N) - LFT (N)
Acute Cholecystitis	-Constant RUQ pain into back or right shoulder -N&V -Feverish	-Tender RUQ -Periotnism RUQ (guarding/rebound) -Murphy's + -Pyrexia, HR (↑)	-WCC and CRP (↑) -LFT (N or mildly (↑)
Empyema	-Constant RUQ pain into back or right shoulder -N&V -Feverish	-Tender RUQ -Peritonism RUQ -Murphy's + -Pyrexia, HR (↑), BP (⟷ or ↓) -More septic than acute cholecystitis	-WCC and CRP (↑) -LFT (N or mildly (↑)
Obstructive Jaundice	-Yellow discolouration -Pale stool, dark urine -painless or assocaited with mild RUQ pain	-Jaundiced -Non-tender or minimally tender RUQ -No peritonism -Murphy's - -Apyrexial, HR and BP (N)	-WCC and CRP (N) -LFT: obstructive pattern bili (↑), ALP (↑), GGT (↑), ALT/AST (⟷) -INR (⟷ or ↑)
Ascending Cholangitis	Becks triad -RUQ pain (constant) -Jaundice -Rigors	-Jaundiced -Tender RUQ -Peritonism RUQ -Spiking high pyrexia (38-39) -HR (↑), BP (⟷ or ↓) -Can develop septic shock	-WCC and CRP (↑) -LFT : obstructive pattern bili (↑), ALP (↑), GGT (↑), ALT/AST (⟷) -INR (⟷ or ↑)
Acute Pancreatitis	-Severe upper abdominal pain (constant) into back -Profuse vomiting	-Tender upper abdomen -Upper abdominal or generalised peritonism -Usually apyrexial, HR (↑), BP (⟷ or ↓)	-WCC and CRP (↑) -LFT: (N) if passed stone or obstructive pattern ifstone still in CBD -**Amylase (↑)** -INR/APTT (N) or (↑) if DIC
Gallstone Ileus	- 4 cardinal features of SBO	-distended tympanic abdomen -hyperactive/tinkling bowel sounds	



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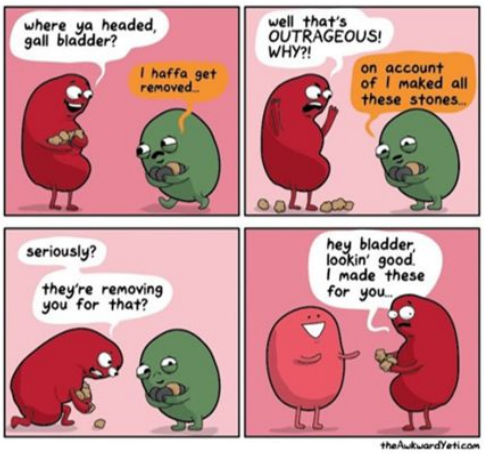

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Recall:

Define the following terms:

- **Cholelithiasi:** Gallstones in gallbladder
- **Choledocholithiasis:** Gallstone in common bile duct
- **Cholecystitis:** Inflammation of gallbladder
- **Cholangitis:** Infection of biliary tract
- **Biliary colic:** Pain from gallstones, usually from a stone at cystic duct: The pain is located in the RUQ, epigastrium, or right subscapular region of the back; it usually lasts minutes to hours but eventually goes away; it is often postprandial, especially after fatty food.

What are the indication for cholecystectomy in the asymptomatic patient?
Sickle-cell disease, calcified gallbladder, patient is a child.

What are the "Big 4" risk factors? The " **four F**s":

- **F**emale
- **F**at
- **F**orty
- **F**ertile (multiparity)

What is thought to cause biliary colic?
Gallbladder contraction against a stone temporarily at the gallbladder/cystic duct junction; a stone in the cystic duct; or a stone passing through the cystic duct

What are the five major complications of gallstones?

- Acute cholecystitis
- Choledocholithiasis
- Gallstone pancreatitis
- Gallstone ileus
- Cholangitis

What is in bile?
Cholesterol, lecithin (phospholipid), bile acids, and bilirubin

What are the types of stones?
Cholesterol stones (75%), Pigment stones (25%)

What are the types of pigmented stones?
Black stones (contain calcium bilirubinate), Brown stones (associated with biliary tract infection)

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

What is the pathogenesis of cholesterol stones?
Secretion of bile supersaturated with cholesterol (relatively decreased amounts of lecithin and bile salts); then, cholesterol precipitates out and forms solid crystals, then gallstones.

What is a cholecystectomy?
Removal of the gallbladder laparoscopically or through a standard Kocher incision

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

What are the boundaries of the triangle of Calot? The **3 C**'s:

- **C**ystic duct
- **C**ommon hepatic duct
- **C**ystic artery

What is cholangitis?
Bacterial infection of the biliary tract from obstruction (either partial or complete); potentially life-threatening

What are the most common causes:

- Choledocholithiasis
- Stricture (usually postoperative)
- Neoplasm (usually ampullary carcinoma)
- Extrinsic compression (pancreatic
- pseudocyst/pancreatitis)
- Instrumentation of the bile ducts (e.g., P C/ERCP)
- Biliary stent

What is the most common cause of cholangitis?

- Gallstones in common bile duct (choledocholithiasis).

What are the signs and symptoms?

- Charcot's triad: fever/chills, RUQ pain,and jaundice.
- Reynold's pentad: Charcot's triad plus altered mental status and shock.