Radiology
Team 438

Radiology of hepatobiliary Diseases

Lecture 13

Objectives

Reviewed By
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- To Interpret plan x-ray radiograph of abdomen with common pathologies.
- To know the common pathologies presentation.
- To understand step wise approach in requesting hepatobiliary radiology investigations.
- To know common radiological pathologies in hepatobiliary system.

Color Index: Important | Doctor's Notes | Extra | Female slides | male slides

Team Leaders


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Case 1

45 year-old female with RUQ pain radiating to right shoulder and aggravated by fatty meals associated with vomiting.

What is the most likely diagnosis?

Gallstone +/- inflammation (cholecystitis)

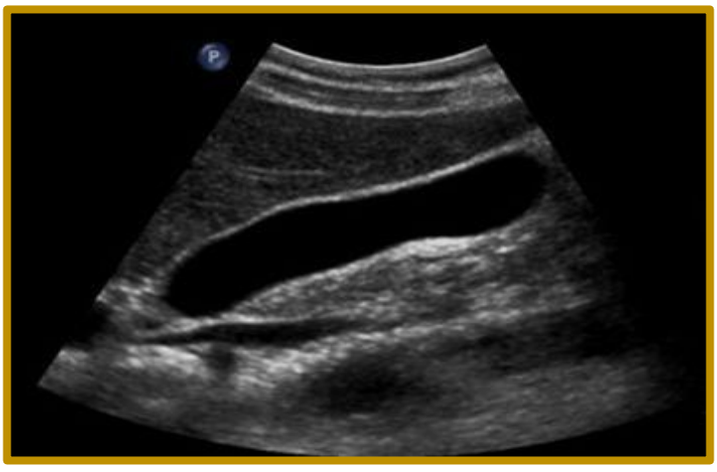
What is the best radiology modality to start with?

Ultrasound.

Why not CT? It can't detect fat

Why not MRI? Too complicated

Why not X-ray? It's not good at picking up gallstones. You can only see less than 10%, so you will miss 90%. It doesn't provide enough information about the gallbladder. You can't see inflammation.



Normal Gallbladder

Abnormal Gallbladder
(Acute calculous cholecystitis)

What is abnormal?

- Hyperechoic structure inside the gallbladder
- Posterior acoustic shadow
- Thickening of the wall
- Distended gallbladder because of obstruction.

Acute cholecystitis features in ultrasound:

- Gallbladder wall thickening (more than 3mm)
- Gallbladder distension
- Surrounding fluid
- Gallstone (calculous cholecystitis) without stone (Acalculous cholecystitis)
- **How do you know it's a stone?**

  - We have white structure "hyperechoic" with shadow (classic gallstone).

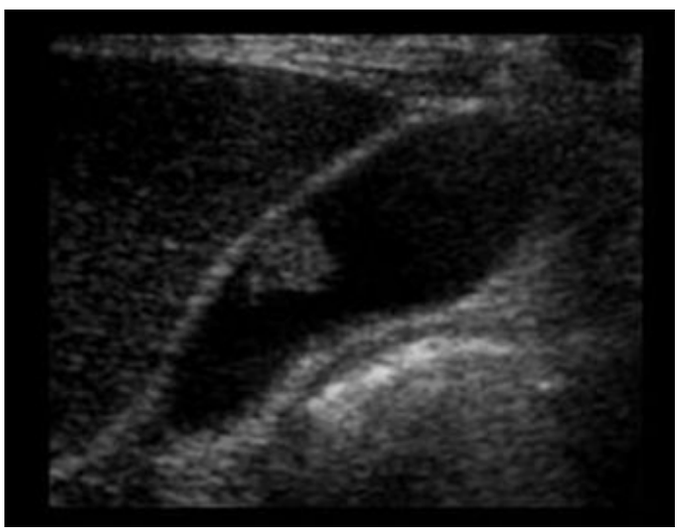
What is the difference between the two images?

Stone WITHOUT inflammation

- The stone is within the body of gallbladder.
- The Wall is normal.
- There is no inflammation.
- Usually asymptomatic

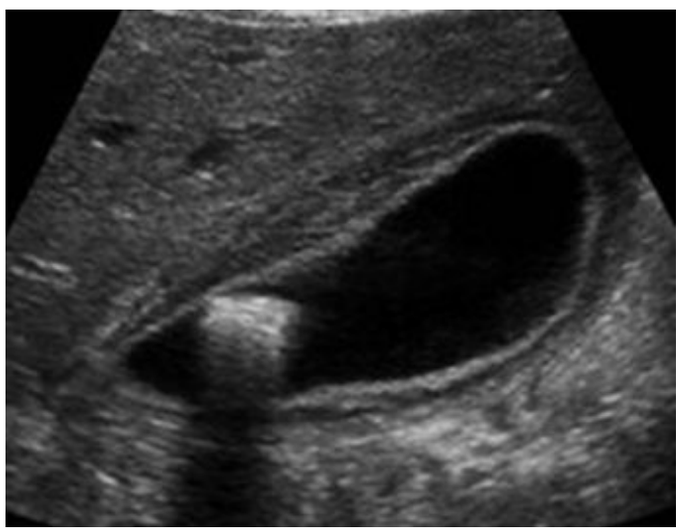
Stone WITH inflammation

- The Stone is in the neck.
- The Wall is thickened.
- There is inflammation.



WITHOUT acoustic shadow (GB polyp)

- Greyish structure
- No posterior shadow.
- There is no inflammation.
- It is a mass “gallbladder Polyp”.
- Could be benign or malignant.

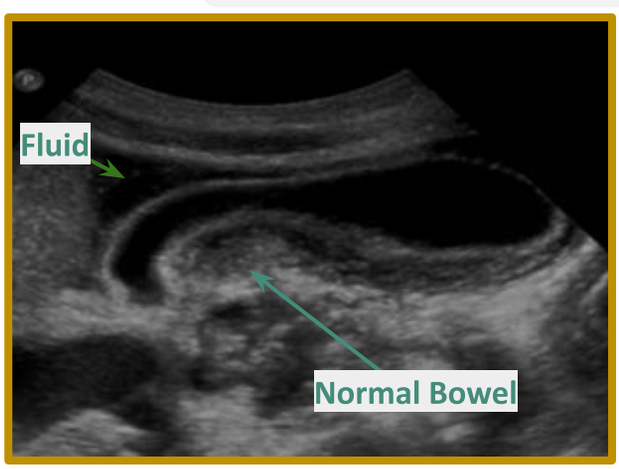


WITH acoustic shadow (GB stone)

- Calculus shadow with inflammation

The key to differentiate between a polyp and stone is the acoustic shadow

Case 1



Acalculous cholecystitis

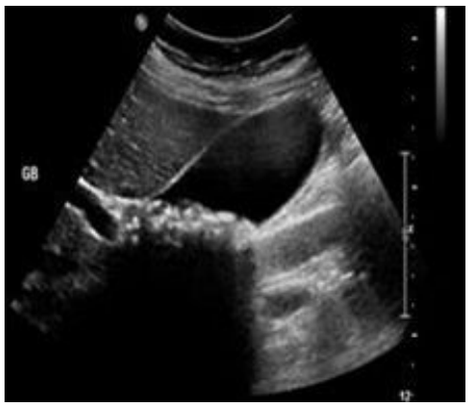
- The inflammation without stone called (Acalculous cholecystitis)
- It has some fluid around.
- Tx by relieving the distention with tube

Calculous cholecystitis

- Inflammation with stone
- Treated by cholecystectomy

Acalculous cholecystitis less common & usually happens with very sick patients. Patients in the ICU are at higher risk because they are getting their nutrients either through NGT or IV and this won't stimulate GB to contract so it will be distended because of the accumulated bile and that will cause inflammation

Different gallstones on US:

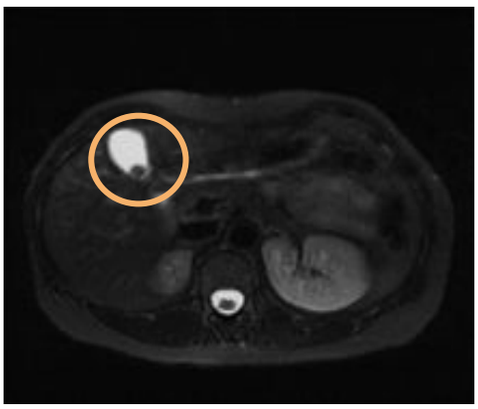


Multiple tiny stones
Big shadow

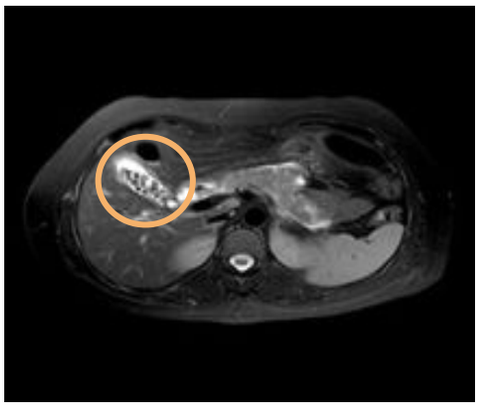
2 stones (2 shadows)
Gallbladder stones with no features of cholecystitis

1 stone (1 shadow)

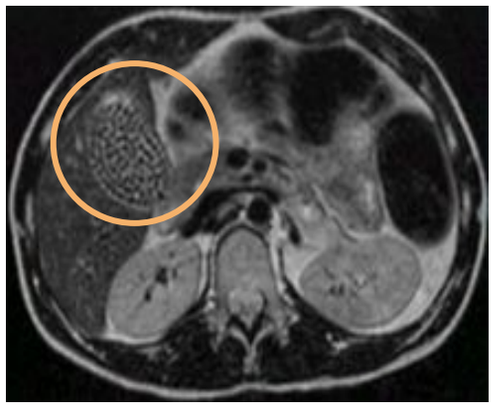
Gallstones on MRI:



1 stone, Usually gallbladder appear white/hyperintense



Multiple stones, Stones appear black/hypointense



Multiple stones replacing the whole gallbladder

Case 2

60 year old male with chronic alcoholic consumption & complaining of fatigue, disorientation and abdominal distention.

What do you think this patient has?

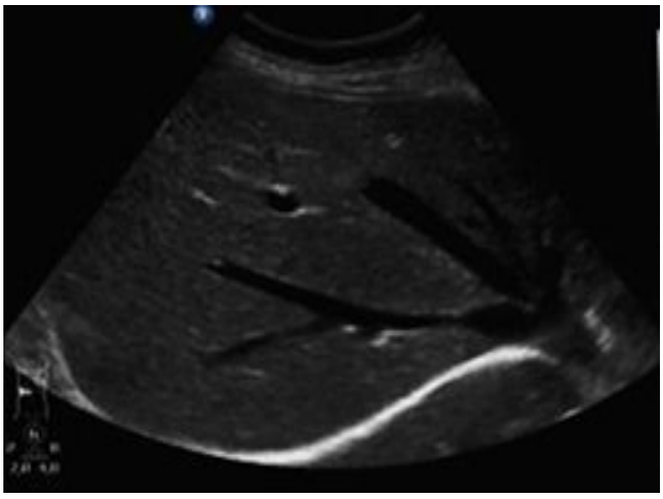
- Chronic liver disease (Liver cirrhosis) due to hepatitis

What radiology modality you will start with?

- Ultrasound. Aim is to confirm if the liver in normal or abnormal

  X-ray is not good for liver and soft tissue

what is abnormal



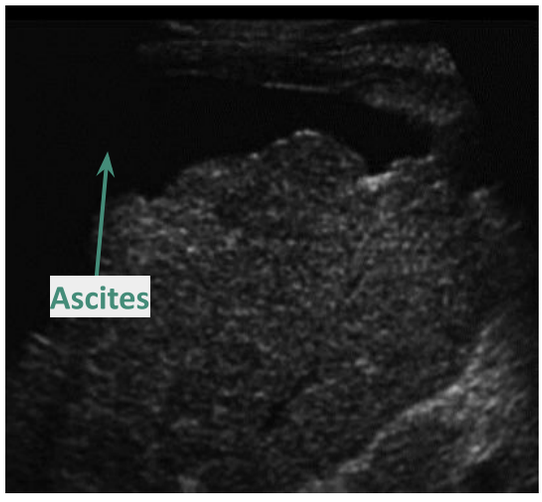
Normal Liver

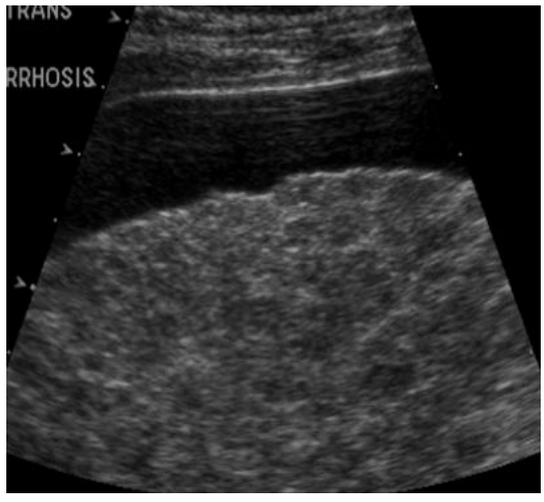
- Smooth surface
- Hypoechoic
- Normally we can't see the whole liver in one image

Liver cirrhosis

- Nodular liver surface.
- Shrunken size as part of the image contain no liver
- Hyperechoic parenchyma due to fibrosis
- Ascites (fluid)
- In liver cirrhosis, we must look for masses

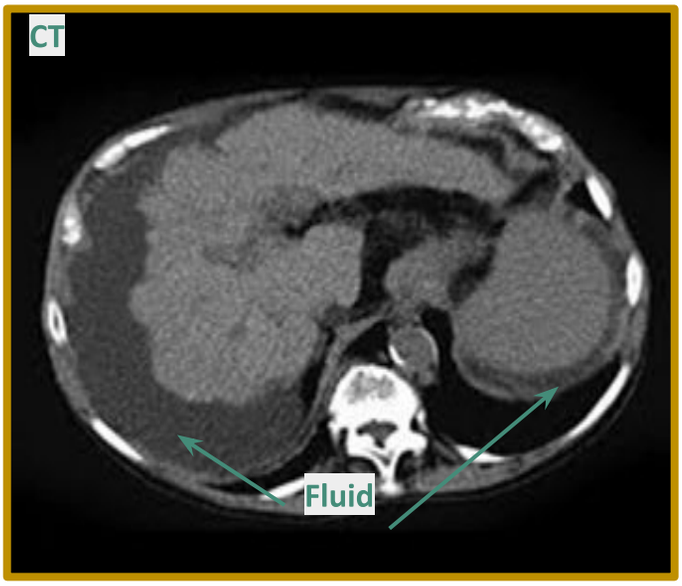
Other examples of cirrhosis:

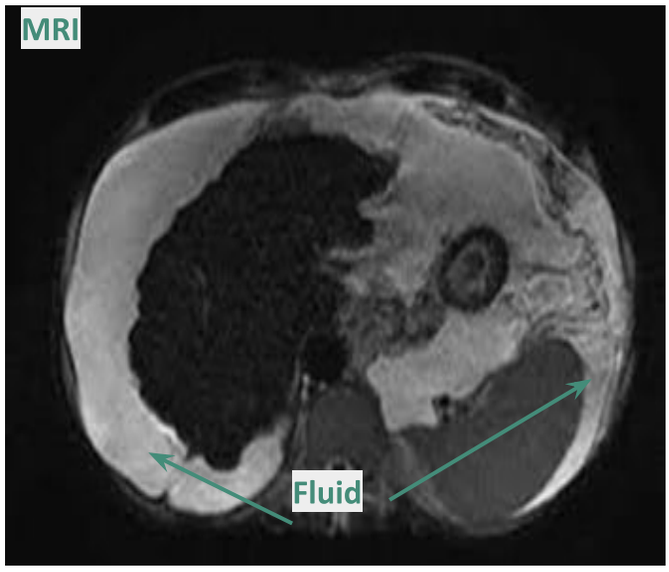




Coarse/heterogeneous appearance

Cirrhosis on CT scan and MRI:



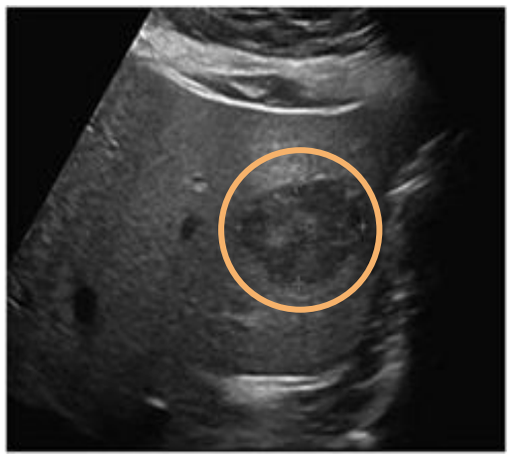


Liver cirrhosis with ascites
shrunken liver with irregular surface
surrounded by fluid

Note: in liver cirrhosis there is spleen enlargement & fluid around live because of portal hypertension

wow, such empty

US for chronic hepatitis B virus patient. What is your diagnosis?



- Hypoechoic mass within the liver. US excluded cirrhosis but we can't tell if the mass is benign or malignant.

What is DDx?

a) Benign:

1- Hemangioma. 2- Adenoma. 3- Focal nodular hyperplasia.

4- cysts e.g., hydatid cyst

b) Malignant:

1- Hepatocellular carcinoma. 2- Metastasis e.g., cholangiocarcinoma

How to tell if it's benign or malignant? DO CT scan or MRI with intravenous contrast.

What do we mean by triphasic?

Scanning liver with IV contrast in three different phases:

- Phase 1 (**arterial**): when IV contrast in arteries → 30 to 40 seconds after IV contrast injection

We wait 30-40 sec because first we'll give a contrast to a peripheral vein then it'll go to right side of the heart → pulmonary circulation → left side of the heart → systemic circulation through the aorta → organs

- Phase 2 (**portal-venous**): when IV contrast in veins → 60 to 70 seconds after IV contrast injection.
- Phase 3 (**delayed or equilibrium**): after 3 to 5 minutes after IV contrast injection to give more time for mass to wash out the contrast.

- Normal liver parenchyma is 80% supplied by the portal vein and only 20% by the hepatic artery, so liver will be enhanced in the portal venous phase.
- However, all liver tumors gets 100% of their blood supply from the hepatic artery, so the tumor will be enhanced in the arterial phase.

Triphasic scan helps in differentiating benign from malignant masses:

- **Benign**: BLACK(no enhancement) in phase 1 / WHITE in phase 3 (e.g. hemangioma → most common benign tumor of the liver).
- **Malignant**: WHITE (enhancement) in phase 1 / BLACK (no enhancement) in phase 3 (e.g. HCC → most common malignant tumor of the liver which is **hypervascular** and take the contrast in a very early stage!).

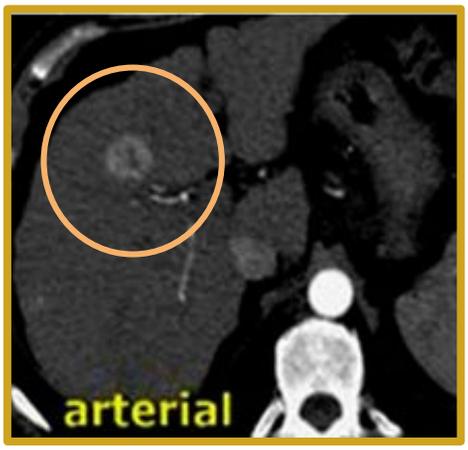
437 notes

We do 3 phases because:

1. To differentiate the tumor (e.g. HCC appears in arterial phase and doesn't appear in portal).
2. In equilibrium phase the malignant tumor may be seen as a cyst.
3. When we want to do only one phase we prefer portal phase because the whole liver will uptake the contrast.

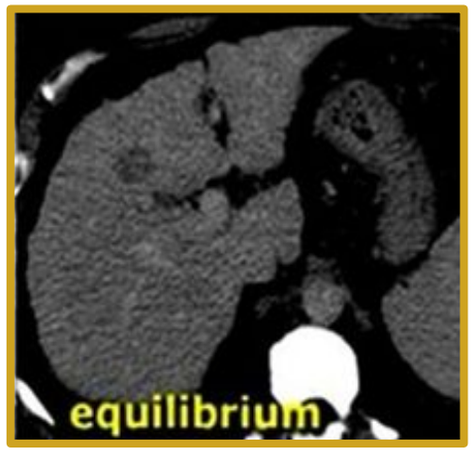
What is the difference between both cases?

a. Hepatocellular carcinoma



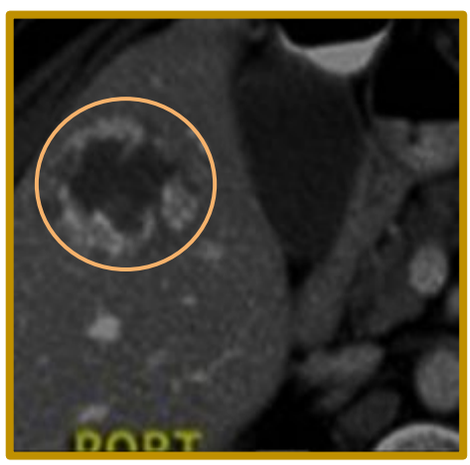
White → uptaking contrast

Lesion Similar to liver

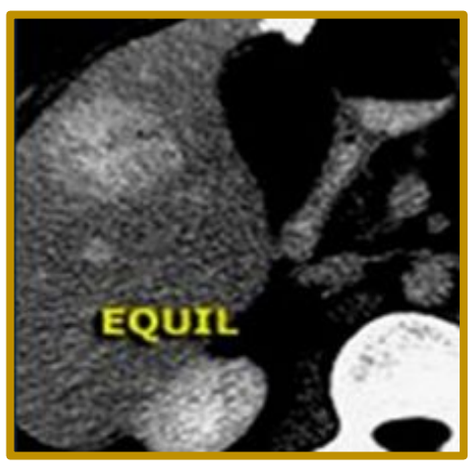


Black lesion (early washout from the lesion)

b. **Hemangioma:** blood accumulate very slowly (slower than the liver)



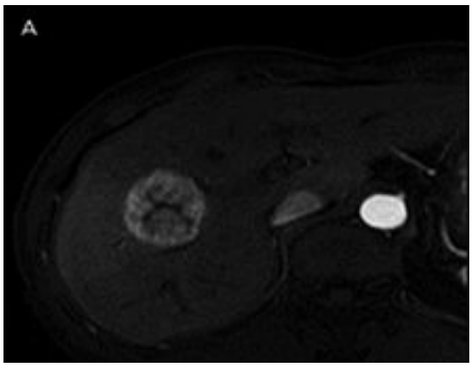
Slow accumulation of contrast only the peripheral of the lesion



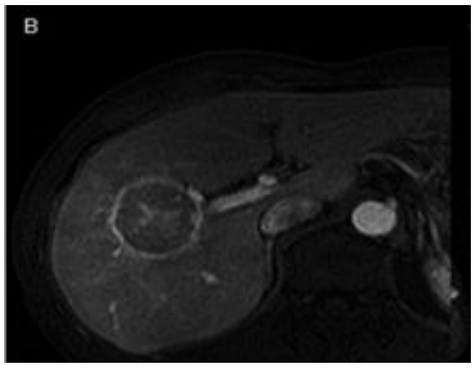
Then becomes more white in late phase

MRI of the liver:

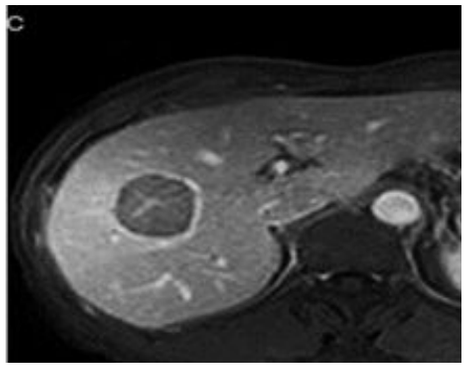
Is it Benign or Malignant? Malignant (HCC).



Arterial phase (white aorta) it's taking the contrast and rest of the liver not yet



Portal phase, liver start to uptake and lesion is almost similar, surrounded by capsule which is compressed and hyperintense



Late phase
liver uptake and lesion wash it out become black

wow, double empty

Male patient with chronic abdominal pain.

What is abnormal?

- Gallbladder calcification (Radiopaque oval shaped opacity):

• **Porcelain gallbladder** (calcification in whole GB wall).
• Gallbladder stones (NOT common to see on X-ray).

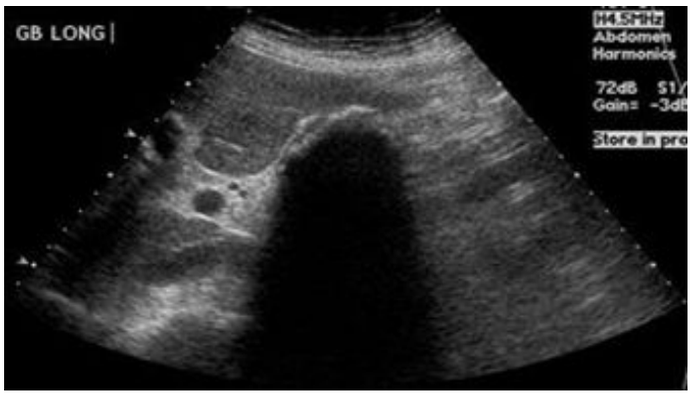
We can't reach to the diagnosis by using x-ray.

How to confirm the diagnosis?

- CT scan or US? CT scan because we don't expect US to be helpful recall that one of US limitations is a calcified structure as US can't see beyond the calcification

Which modality is better?

- CT without contrast



Not beneficial for this case because the whole wall is calcified which appears as big area of shadow which will hide the gallbladder, we can't differentiate between a large stone with shadow OR calcification on the wall

Porcelain gallbladder
In CT we can clearly see the calcification on the wall of gallbladder

Porcelain gallbladder (calcification of GB wall):

- Complete or partial GB wall calcification
- Risk of developing cancer 5 -7%.
- Needs follow every year or surgical resection.

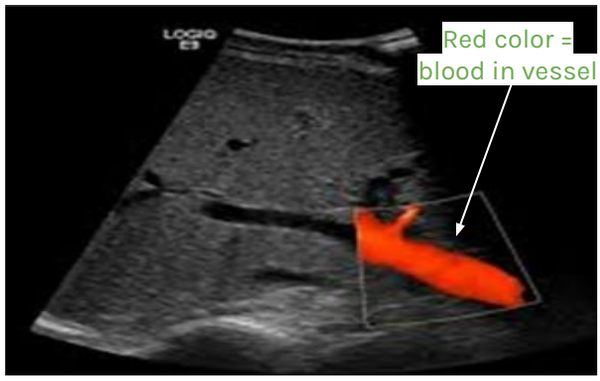
Case 5

50 year-old lady presented to the emergency with RUQ pain and yellow discoloration of sclera, pale stool and dark urine.

What is the most likely diagnosis?

- Obstructive Jaundice
- Stone (because it's painful)
- If it was painless we think about tumor as malignancy usually a silent disease patients will present if they start to have obstruction

Normal Ultrasound



Which radiology modality you prefer to start with?

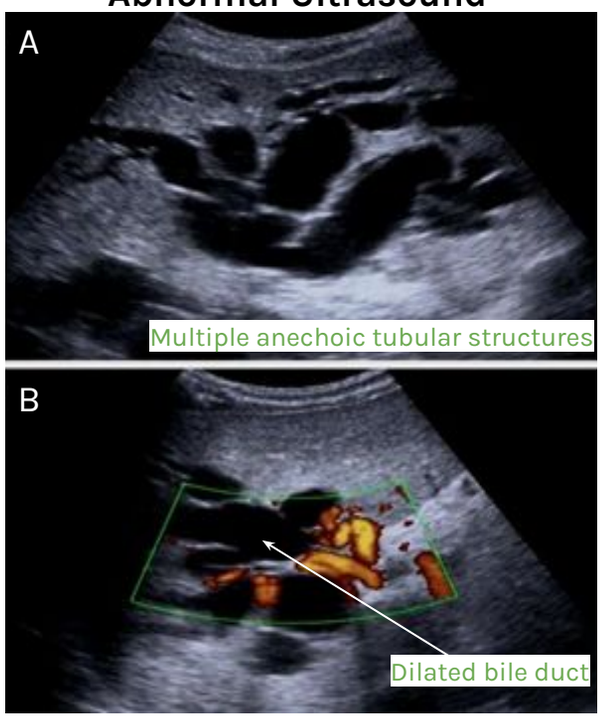
- Ultrasound

Interpretation

Abnormally:

- On ultrasound we see a tubular structures. is it bile ducts or blood vessels? you need to do doppler.
- On doppler, not all the tubular structures are blood vessels. so there is a severe intrahepatic bile duct dilatation.
- You can tell if its a bile duct or blood vessels by the flow (blood flow is continuous).
- Doppler confirms the patient has post hepatic obstruction but we can't tell what's causing the obstruction

Abnormal Ultrasound



What to do next?

- MRCP to first exclude stones as unfortunately US didn't help & sometimes common bile duct is deep & a lot of bowel over it & we can't see the area of common bile clearly. Why not CT? Because CT will only help with calcified stones & most of biliary stones are not, also if CT was negative we still can't exclude stones

Multiple gallstones in GB & common bile duct (CBD)

MRI without contrast

- **What is abnormal?**
  Multiple gallstones in GB and common bile duct (CBD).
- **Treatment:** Remove the stones use (ERCP).
- **Labels:**
  1. Dilated common bile duct.
  2. Stones.
  3. Gallbladder.
  4. Duodenum.
  5. Dilated ducts within the liver.

Yes, this Lecture is full of emptiness

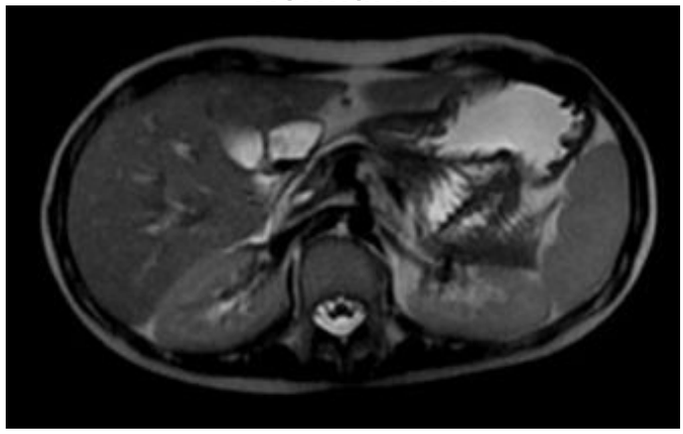
Case 6

20 year-old case of Thalassemia with repeated blood transfusion.

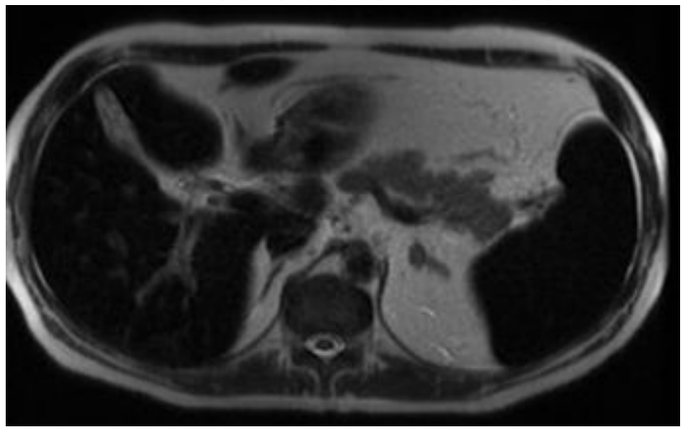
What is the Abnormality?

- The liver, spleen and bone marrow are dark in signal (hypo-intense) because of iron overload (Hemochromatosis), due to repeated blood transfusion.
- There is splenomegaly.
- The abnormalities are present in iron stores.

Normal MRI



Abnormal MRI
What is abnormal here?

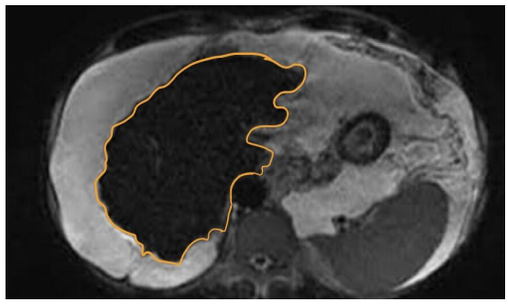


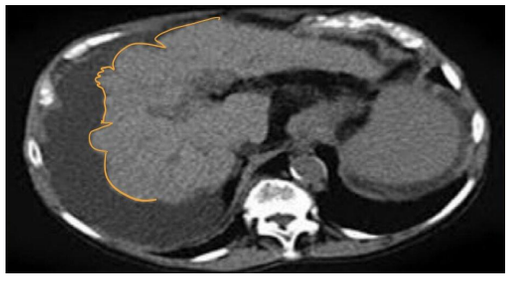
Which radiology modality is the choice?

- MRI is the modality of choice to assess and quantify iron in solid organs, and to follow up treatment & dosing of chelation therapy (an agent that bind to iron and get rid of it)

For better understanding (special thanks for team 436)

- The orange lining represents the liver edges.
- In MRI, the liver is hypointense in comparison to surrounding fat and fluid.
- In CT the liver is hypodense and shrunken with irregular edges and surrounded by fluid.





Case 7

Patient with RUQ pain suspecting cholecystitis. US and MRI were not conclusive

What to do next?

CT scan? MRI? Nuclear scan?

- Nuclear scan (HIDA scan)

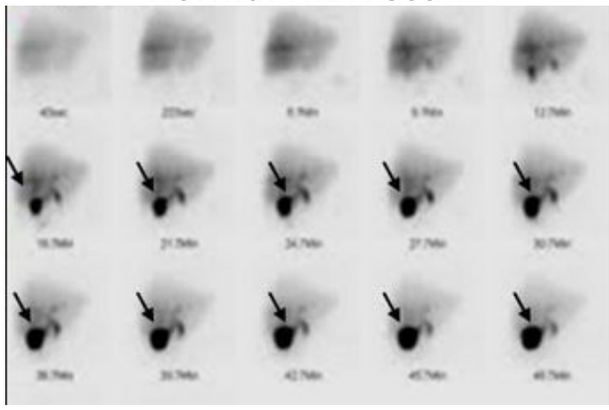
What is the difference between the images

Normally

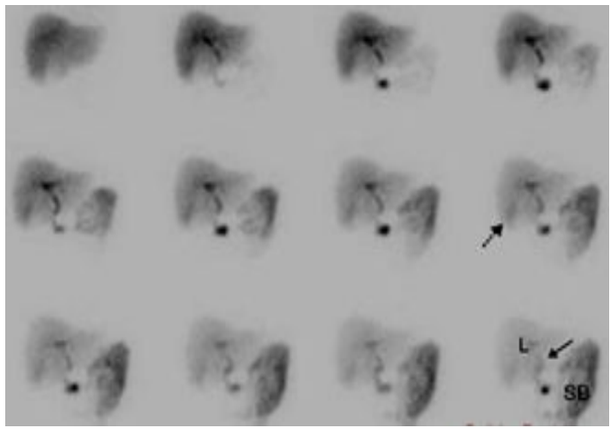
1. Liver start to uptakes radioactive material by hepatocyte.
2. Slowly increase the uptake.
3. Liver start to excrete it in the bile duct
4. Slowly start to fill in gallbladder (black arrow).

Acute cholecystitis
there is no uptake in gallbladder, means there is an obstruction.

Normal HIDA scan



Abnormal HIDA scan
what is abnormal here?



Other indications for HIDA scan

- Biliary atresia (children): everything accumulate in the liver
- Bile injury post-surgery: instead of going to the normal pathway from bile duct to the bowel, it will escape from the bile duct into the peritoneal space
- Bile obstruction: in functional obstruction (no contraction of gallbladder or no relaxation of the ampulla) it will accumulate in the gallbladder.

Summary

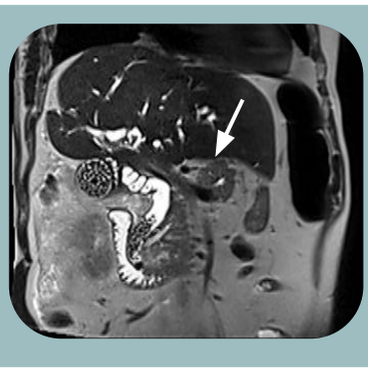
	presentation	modality	information
Gallstone	• Radiating right upper quadrant pain • Aggravated by meals • Vomiting	Ultrasound (acoustic shadow)	• Can be with or without inflammation • **With**(GB stones) or **without**(GB polyp) acoustic shadow
Chronic liver disease (liver cirrhosis)	• Chronic alcohol consumptio • Fatigue • Disorientation • Abdominal distention	Ultrasound	• Nodular and irregular liver surface. • Shrunken size. • Hyperechoic parenchyma (fibrosis) • +/- Ascites (fluid)
Mass	in our case: • US for chronic hepatitis B, a mass was noted	CT or MRI with contrast	Triphasic scan help in differentiating benign from malignant masses
Gall bladder calcification	• Abdominal pain	Better: CT (without contrast) or US	Complete or partial GB calcification need follow-up every year or surgical resection
Obstructive jaundice	• RUQ pain • Yellow discoloration of the sclera • pale stool • Dark urine	US	What to do next? MRI
Iron overload	history of: • Thalassemia • Repeated blood transfusion	MRI	present with Splenomegaly
Acute cholecystitis	RUQ pain suspecting cholecystitis Inconclusive US and MRI	Nuclear scan	Nuclear: No uptake by the gallbladder

1- what does the image show?

a. Acalculous cholecystitis
b. Hepatocellular carcinoma
c. Liver cirrhosis
d. Hemangioma
e. focal nodular hyperplasia

2- What does the arrow show?

a. Gallbladder
b. Dtones
c. Dilated duct within the liver
d. Dilated cystic duct



3- Which of the following not an indicator for HIDA scan ?

a. Bile obstruction
b. Bile duct dilatation
c. Biliary atresia in children
d. Bile injury post-surgery

4- What is the modality of choice in case of thalassemia ?

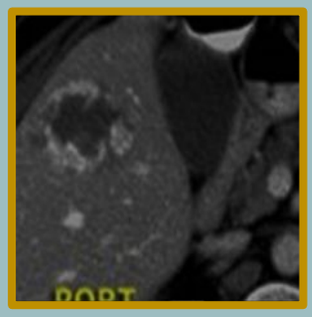
a. CT
b. Ultrasound
c. X-Ray
d. MRI

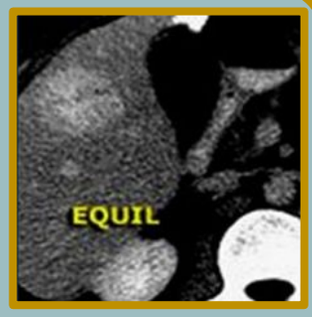
5- What is the most likely diagnosis of the image given below ?

a. Gallbladder mass
b. Liver mass
c. Common bile duct stone
d. Porcelain gallbladder

6- For the following triphasic liver CT. What is the most likely diagnosis ?

a. Liver cirrhosis with ascites
b. Hemangioma
c. Pancreatitis
d. Hepatocellular carcinoma





Answers
1) C
2) C
3) B
4) D
5) D
6) B

مي بابعير

اللهم ارحمها و اغفر لها و انظر اليها بعين لطفك و كرمك يا أرحم الراحمين

اللهمّ املأ قبرها بالرّضا، والنّور، والفسحة، والسّرور واجمعنا بها في جنتك يارب ياكريم