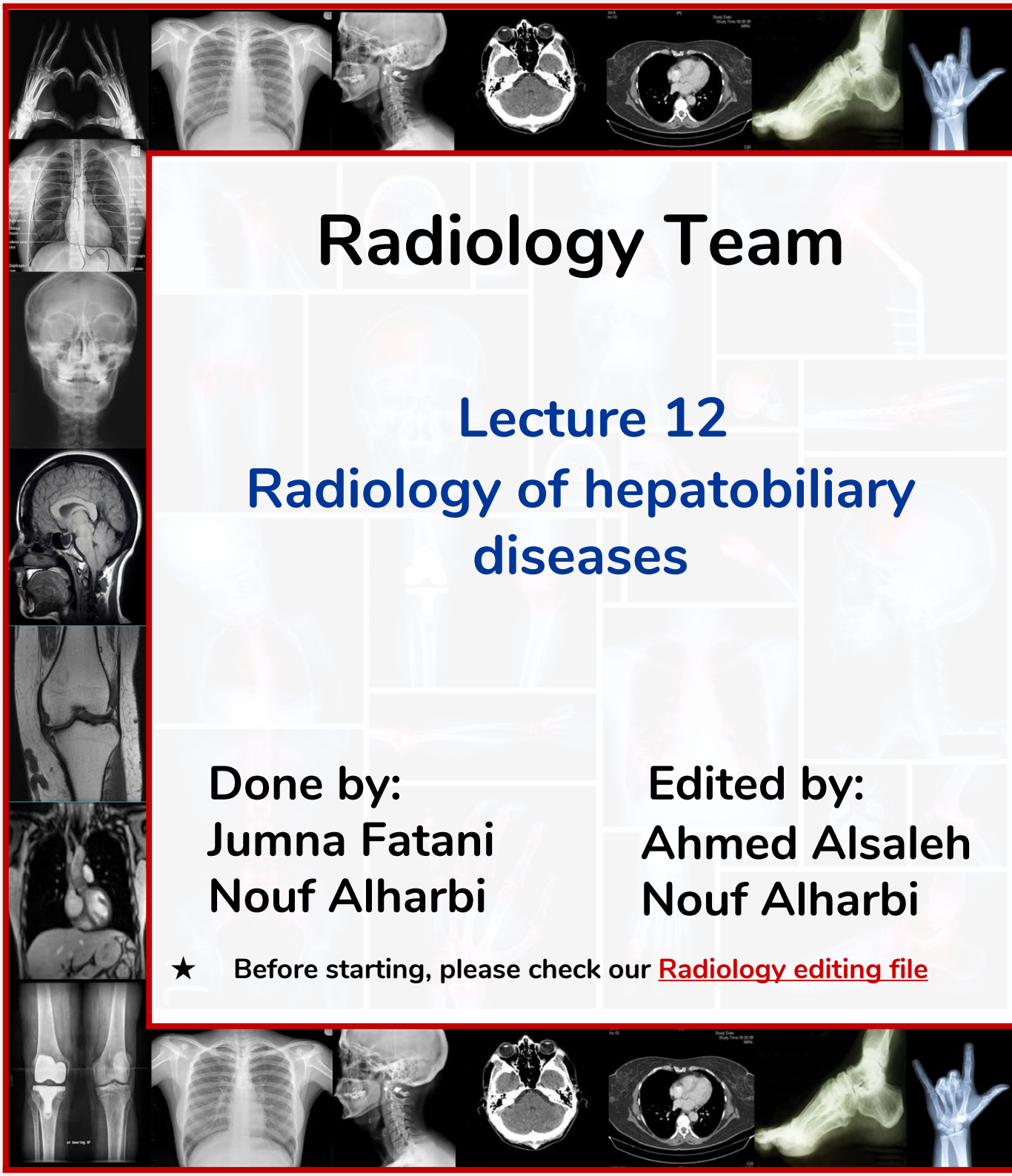


Radiology Team

Lecture 12
Radiology of hepatobiliary diseases

Done by:
Jumna Fatani
Nouf Alharbi

Edited by:
Ahmed Alsaleh
Nouf Alharbi

★ Before starting, please check our Radiology editing file

Color Index:

• Important • Females' notes • Males' notes • Explanations

• 433 & 432 Teamwork

CASE 1:

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

- What is most likely diagnosis?

Gall stone +/- cholecystitis

- What is the best radiology modality to start with?

Ultrasound (U/S)

Why not X-ray?

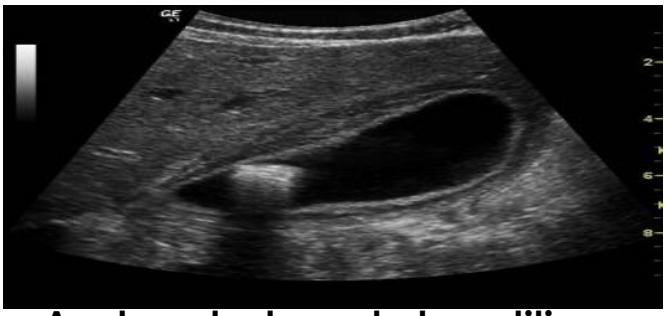
1- Not good at picking up gallstones, less than 10% you can see, so 90% you will miss.

2- if you are looking for inflammation in gall bladder you can't see.

- Always in choosing modality: choose which is available, reasonably achieved (patient can pay for) and it will give the answer.

e.g. in this case we can jump to MRI it will show stone and if there is inflammation but it's very Expensive, and not available everywhere.

What is abnormal?



Acute calculous cholecystitis

It's image of gall bladder.

- Diffusely thick wall and stone.
- How do you know it's stone? We have white structure "hyperechoic" with **shadow** (classic gallstone)

What are the common feature of cholecystitis in U/S?

Acute cholecystitis:

- Gallbladder wall **thickening** (more than 3mm)
- Gallbladder **distension**
- Usually happen when there is stone → cause obstruction → bile go inside, nothing goes out → obstruction.
- Surrounding **fluid** Around inflamed gall bladder.
- Gallstone comments cause of cholecystitis (calculous cholecystitis) without stone (Acalculous cholecystitis) sometimes inflammation can happen without stone

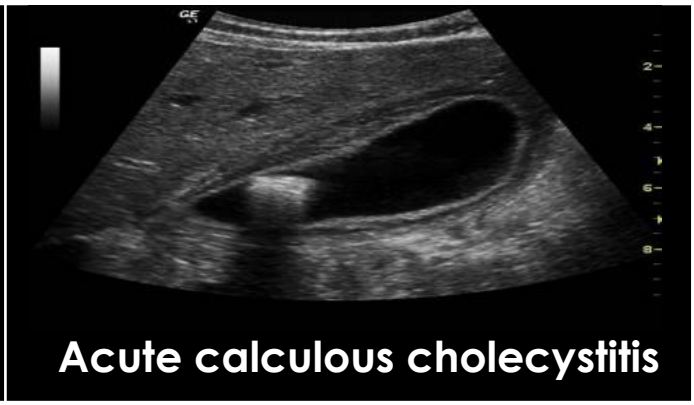
More important than the image is to know what the patient is complaining of (pain, vomiting,…).

Sometimes gall bladder can get thickened without inflammation → could be part of: systemic disease, diffuse edema in the body

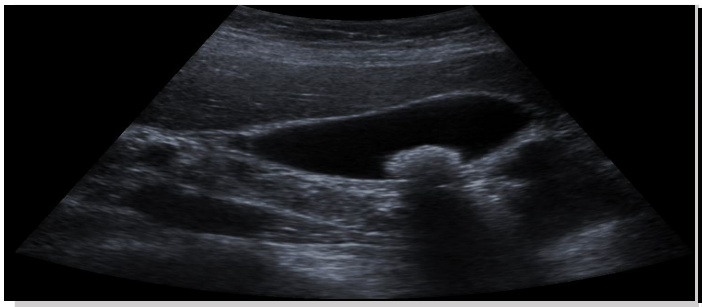
Gall bladder can get inflamed without symptoms of cholecystitis

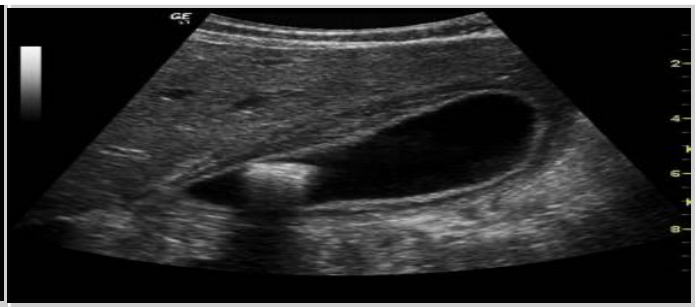
What is the difference between the two images?

Normal



Acute calculous cholecystitis



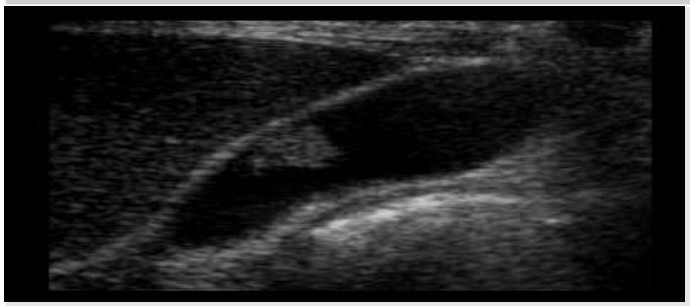


Stone **WITHOUT** inflammation

- Stone within the body of gallbladder
- **Wall is normal**
- **No inflammation.**
- (stone can happen without inflammation, with time patient may come again with inflammation because of acute cholecystitis). See the stone it's not enough to say it's cholecystitis.

Stone **WITH** inflammation

- Stone in the neck.
- **The important thing to be able to differentiate: the Wall is thick**
- inflammation because of cholecystitis



WITHOUT acoustic shadow (GB **polyp**)

- Filling defect
- No shadow
- there is no inflammation. hanging in the posterior wall.
- It is a mass " gall bladder Polyp" could be begin or malignant. It's not stone b/c no shadow and usually it's at the neck

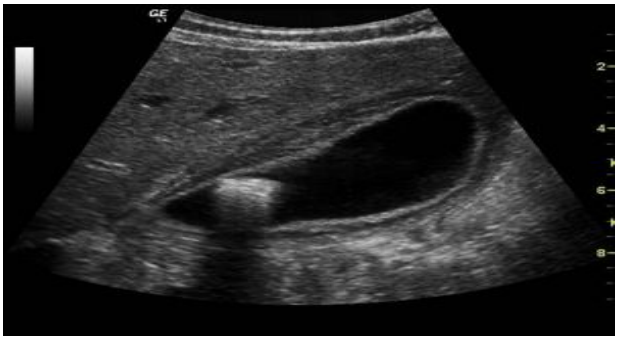
WITH acoustic shadow (GB **stone**)

- Calculus shadow with inflammation.
- The key to differentiate between polyp and stone is the shadow on the soft tissue.

- Both have thickening of the wall of gall bladder

Acalculous cholecystitis

- has some fluid around (red arrow)
- Inflammation without stone called acalculus cholecystitis. usually happen in long admission in ICU (very sick patient)



calculous cholecystitis

- Stone
- inflammation

Different gallstones:

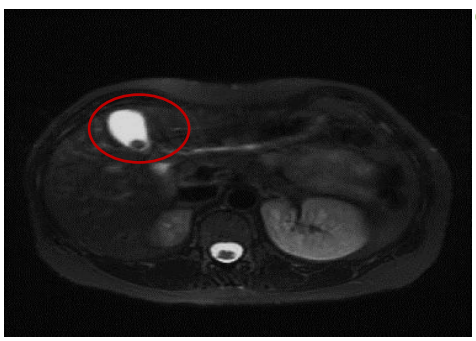
Non of these shows any inflammation

- Multiple tiny stones
- Big shadow

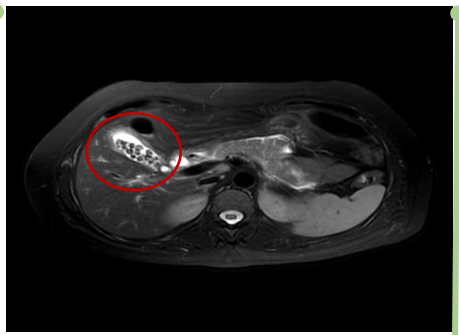
- 2 stones
- shadow

- 1 stone
- shadow

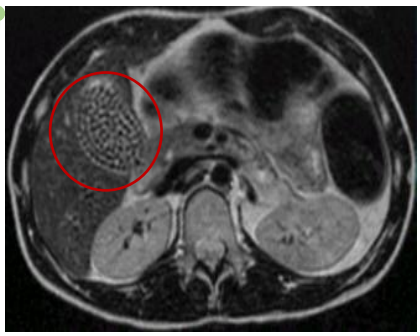
Gallstones on MRI:



1 stone



Multiple stones



Stones replacing the whole gall bladder

Why we didn't go through MRI? Not always there, expensive, long time procedure

Case 2:

60 year-old male with chronic alcoholic complaining of fatigue, disorientation and abdomen distension.

What do you think this patient has?
Liver cirrhosis
What radiology modality you will start with ?
US

How to know which modality:
What we are looking for?
Is this modality able to answer or not?
In this case we are trying to answer is there liver cirrhosis or not ?
will x-ray answer? NO
U/S? YES it's good in telling liver cirrhosis or not (not good in telling if there is mass or not, and if there is mass it mayn't tell is it benign or malignant). it can show ascites

What is abnormal?

Liver cirrhosis:

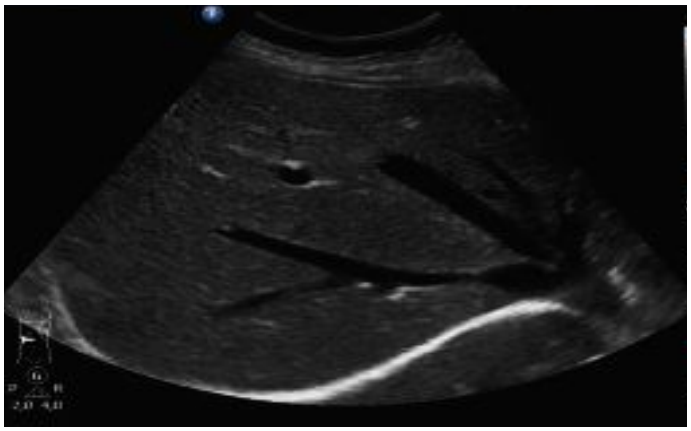
- Nodular surface
- Shrunken size
- Hyperechoic parenchyma
- Ascites

- US of the liver
- Size: small "shrink"
- Margin: irregular
- Color: hyper echoic
- Surface: nodular

Other advantage of US:

- We can see vessels (portal vein, central node)
- Direction of flow of the portal vein
- Normally direction of flow of the portal vein → toward the liver (because it's supplying the liver).
- Cirrhosis → instead of flowing to the liver, it goes back to the collaterals.

Normal

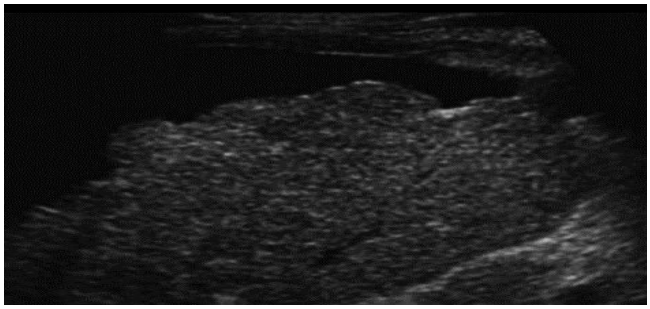


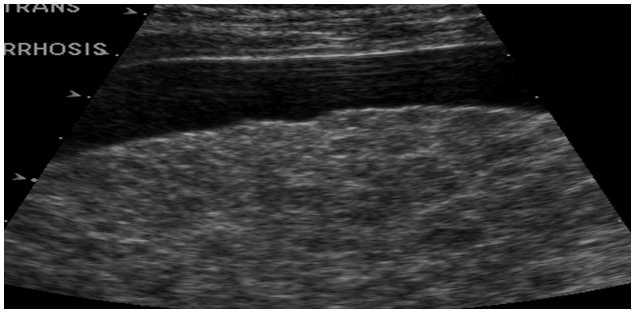
- Normally we can't see the liver in 1 image.
- Smooth surface
- Hypoechoic

cirrhosis

- Liver is small → we are able to see the liver in 1 image.
- Black → fluid → explain the abdominal distention.
- Surface very nodular
- Hyperechoic.

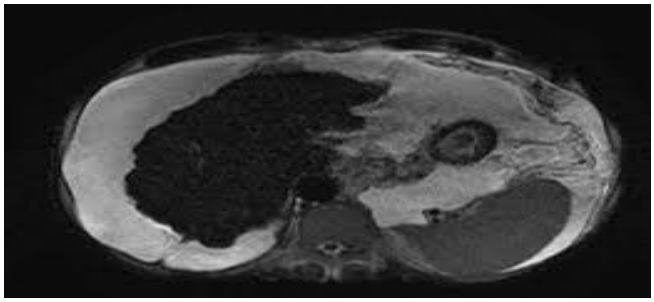
Other examples of cirrhosis:

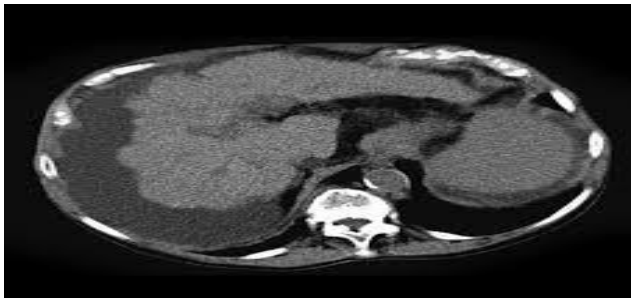




- Very Nodular surface
- Fluid around the liver
- A lot of hyperechoic lines which go with cirrhosis

Cirrhosis on CT scan and MRI:





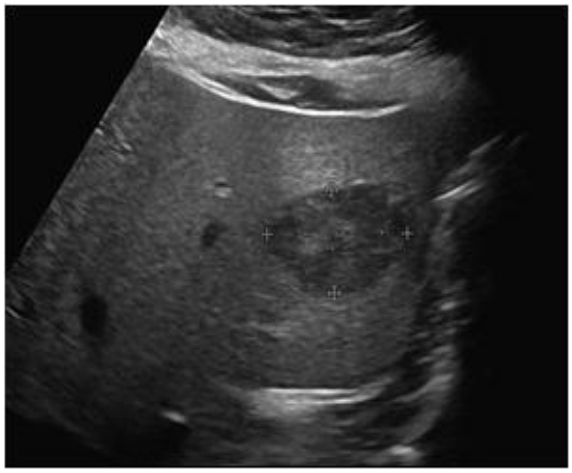
- We can use CT & MRI But U/S → save time, money, it will give the same answer

Case 3:

- U/S for chronic hepatitis B virus patient. What is your diagnosis?

Hypoechoic lesion within the liver (look like a mass). HCC.

- What is DDx?



Benign:

Hemangioma
Adenoma
Focal nodular hyperplasia

Malignant:

Hepatocellular carcinoma
Metastasis

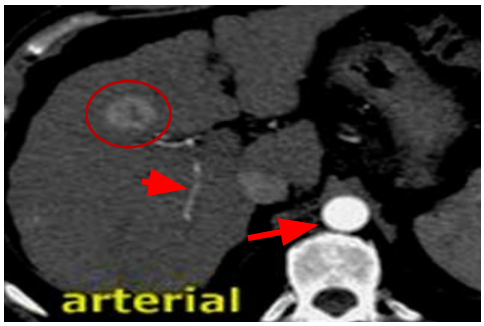
- Next step?

- In this case will take an extra step: patient known to have chronic hepatitis (most likely chronic liver disease) did U/S as routine screening incidentally you may find **hypoechoic lesion within the liver it's like mass.**
- In patient known with chronic liver disease **First thing you have to think about HCC**, could be anything else: benign but the the most important thing is to exclude the more serious case "HCC".
- **Could this be an abscess?** Usually abscess patient come very sick, fever, which is not in this hx so it's **less likely**
- **In this case what are the common lesion can affect the liver?** Could be benign as "hemangioma, adenoma, focal nodular hyperplasia " or could be malignant e.g.: HCC or metastasis.
- Cyst one of them but usually it's fluid which will be black "anechoic" it's not what we see in this image. Here it's more greyish, **so cyst not in the ddx**.

How to tell if it's benign or malignant ?

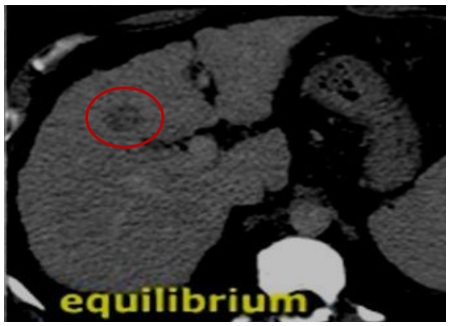
- **DO CT scan or MRI with intravenous contrast.** both will give the same answer, it depends on the availability
- Why not biopsy?
- Biopsy is an invasive procedure can cause bleeding …ect.

CT scan with IV contrast (triphasic scan)



- Lesion is white
- Red arrow show aorta and arteries in liver

- Most of the contrast in the portal vein
- Lesion is almost similar to the liver



Lesion start to wash out and become black (no contrast)

- In CT even in MR if it's with contrast usually will do "triphasic scan"
- What is the meaning of triphasic?
- Scanning liver with intravenous (IV) contrast in three different phases:
- The procedure: Inject contrast through a vein → vein take the contrast to the heart → pumped to the systemic circulation → Liver.

Phase 1 (arterial):	when IV contrast in arteries/ 30 to 40 seconds after IV contrast injection. After giving the contrast will wait for 30-40 secs then start scanning the liver usually at that time contrast will be mainly in the liver.
Phase 2 (portal-venous):	when IV contrast in veins/ 60 to 70 seconds after IV contrast injection. (most of contrast left the arteries went to the structures and know go back to the veins)
Phase 3 (delayed or equilibrium):	after 3 to 5 minutes after IV contrast injection. the contrast will be cleared from the vessels and some will stay in the solid organs

- **Triphasic scan helps in differentiating benign from malignant masses:**
- Benign = BLACK (slowly uptake) in phase 1 / WHITE in phase 3 **(e.g. hemangioma)**
- Malignant = WHITE in phase 1 / BLACK in phase 3 **(e.g. HCC)**
- HCC it's very hungry cells "malignancy" will take the contrast in the early phase, utilize whatever in blood then will wash it out. That usually before liver take contrast! Usually it enhanced before the liver and wash out

What is the difference between both cases?

Hepatocellular carcinoma

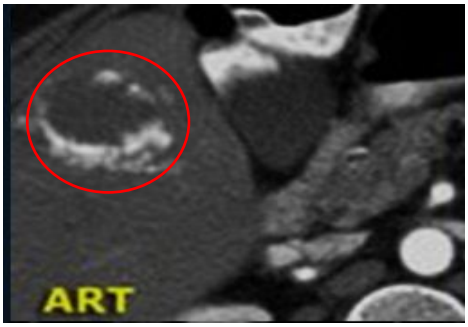
White up taking

Lesion Similar to liver

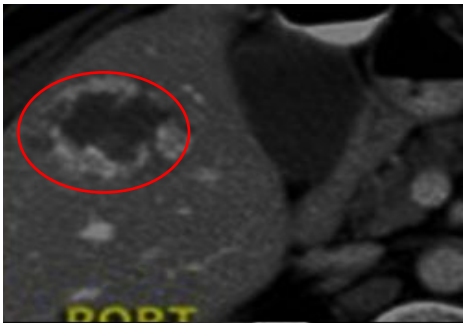
Black lesion

Usually the malignant tumor will be white in early phase & will black in the late phase

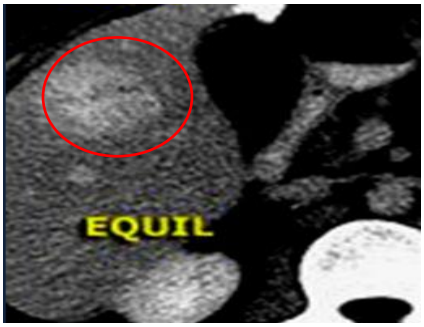
Hemangioma



More black , with some Contrast around



Contrast start to increase around "white area"

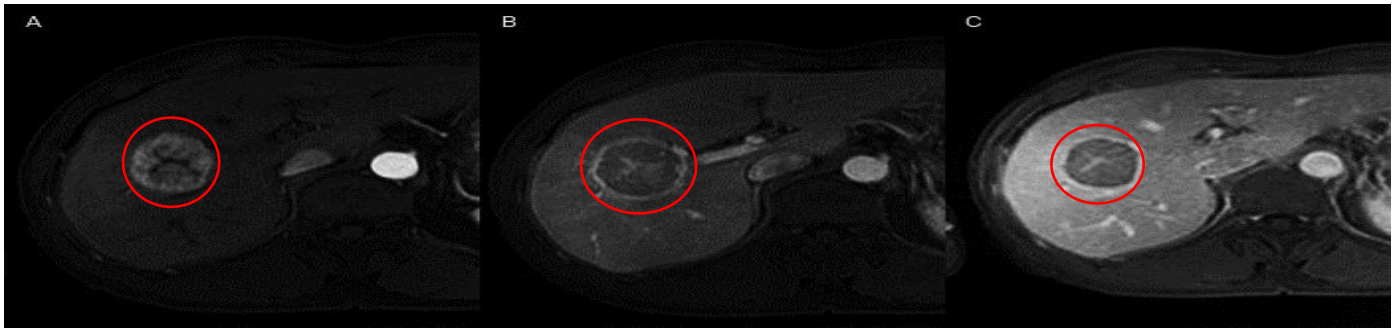


Then become more white in late phase

The opposite will be in benign which usually more relaxed cells, slowly uptake the contrast so will be first black then at late phase will take more and being more white in late phase.

MRI: b/c we don't see bones

Benign or Malignant ? Malignant (HCC)



In arterial phase it's taking the contrast and rest of liver not yet

Portal phase liver start to take and lesion is almost similar, surrounded by capsule

Late phase liver uptake and lesion wash it out become black

Case 4

Male patient with **chorionic abdomen pain.**

What is abnormal?

•Radio opaque oval shape it's look like gall bladder

- Calcification in wall of the gall bladder which could be → large Stone

X-ray, Part of RUQ

How to confirm the diagnosis?

•CT. WHY?

•X-ray is similar to CT, if you see the calcification on x-ray you able to see it more in details in CT.

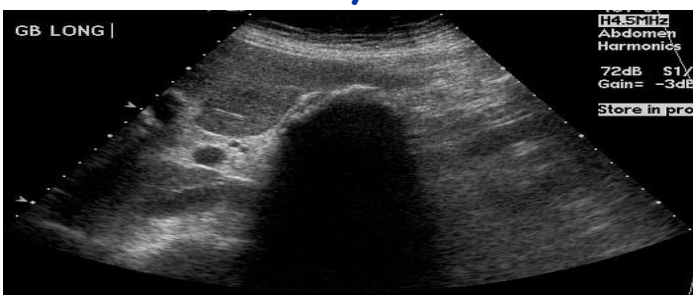
•Usually without. b/c contrast is dense and the calcification is white so it will match each other

- why not US?
- In case of stone it represent Shadow and we are not able to see what is under it.

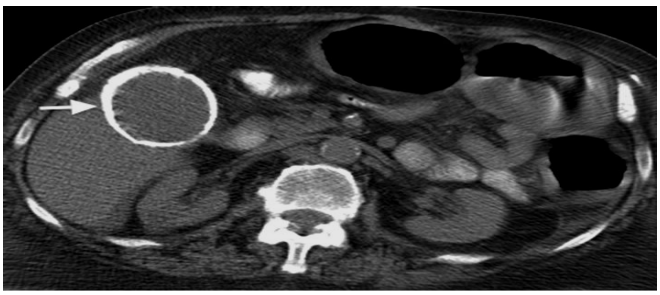
Gallbladder calcification:

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

Which modality is better? CT



In US this all calcification with shadow. can we tell is this a large stone with shadow OR calcification on the wall? We can't tell.



In CT would clearly show the calcification on the wall of gallbladder. instead of calcification like stone within gallbladder

Porcelain GB:

- Complete or partial GB wall Ca+.
- Risk of developing cancer 5 -7%.
- So usually need to take out (resect it)Or if you decide to keep it they Need follow up to make sure not Developing any cancer
- Needs follow every year.

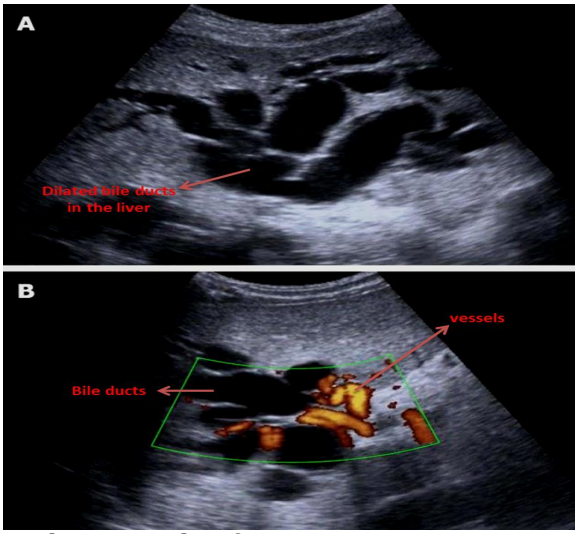
Case 5

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

What is the most likely diagnosis?

- Biliary obstruction
- Causes of biliary obstruction: stones (the most common), tumors.
- The big things try to figure out from the hx: 1. is it stone "benign" ? 2. Is it tumor "serious" ?
- What's the hint in this hx? **The pain**
- Gallstone usually present **with** pain b/c of biliary colic but neoplasm usually present **without** pain, it has other presentation

Which radiology modality you prefer to start with? US → shows if there is dilatation



Abnormal US:

- **Severe intrahepatic**
- **bile duct dilatation**

Normal US

Red Color shows vessel

- **It's not blood vessels b/c color Doppler → shows color → vessels.**
- Normally bile ducts not seen in U/S, in this image it replace the hole area
- **We can't tell the cause of obstruction by US**

What to do next? CT or MRI?

MRI. Why not CT? because CT may miss stones

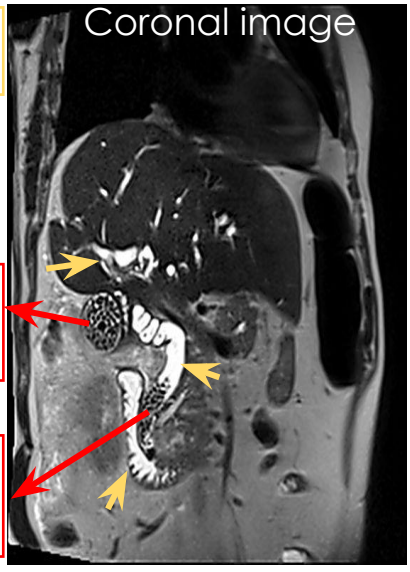
What is abnormal?

Multiple gallstones in GB & common bile duct (CBD).

Treatment:

Remove the stones use Endoscopy (ERCP) Endoscopic retrograde cholangiopancreatography →ampulla of vater will open it and try to clear stone →Later → can take out the gallbladder (surgically)

white lines → dilated ducts



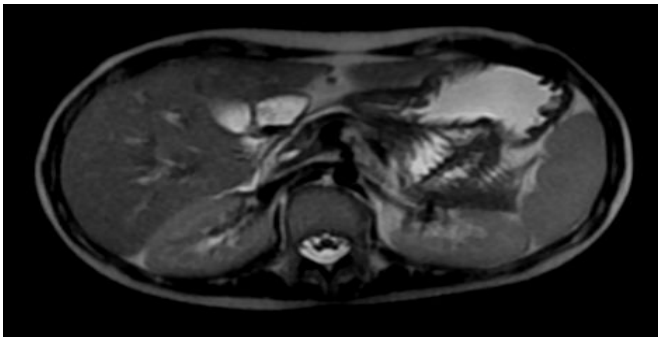
multiple stones in Gall bladder

Multiple stones filling distal CBD

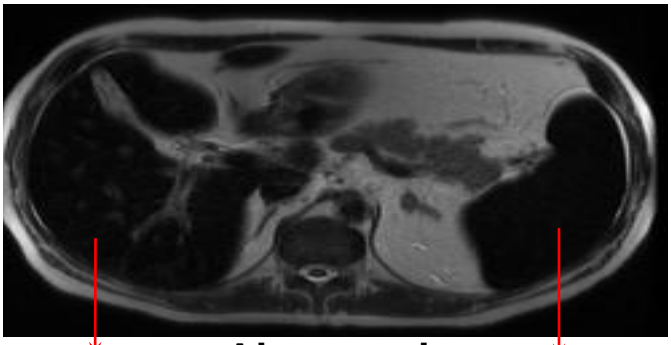
Case 6:

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

What are the differences between the 2 images?



Normal MRI



Abnormal

Liver

Spleen

1- Enlarged spleen
2- Dark spleen
3- liver very dark
4- bone marrow dark

What is abnormal in the image?

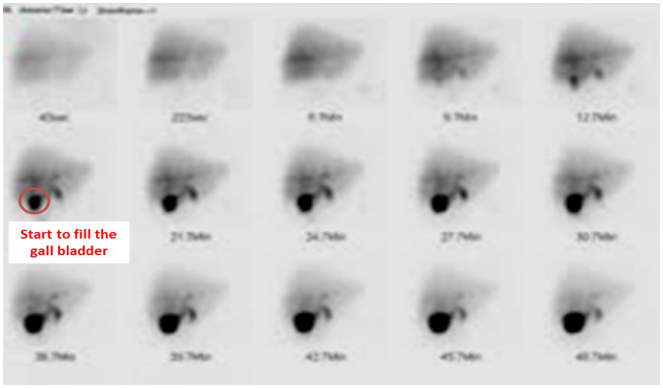
- The liver and spleen of dark in signal (hypo intense)
- Because of iron overload due to repeated blood transfusion. (iron deposition in the body in certain structure such as spleen, bone, liver, pancreas and heart)
- MRI is the modality of choice to assess and quantify iron in solid organs.

- Scan patient then quantify the iron e.g. in the liver. Then tell how much iron, after that will give patient medication **(chelation)** which will try to catch iron deposition and remove it.
- With Follow up notice that free iron in liver will decrease → indication for the medication modification (to increase, decrease or stop the medication)

- This case shows how good MRI in showing soft tissue details that may not be seen by other modality

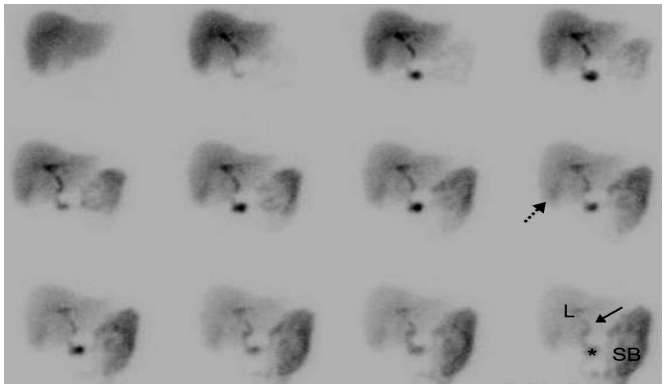
Case 7:

- Patient with RUQ pain suspecting cholecystitis. US was not conclusive. U/S **showed stone, no much thickening but** patient still having persistent pain. Is the obstructing stone causing cholecystitis?
- **What to do next? CT, MRI or Nuclear scan ? Nuclear scan**
- Because in this case we need **To assess the function. Why not MRI?** MR: shows more anatomy " if there is stone or inflammation? " but this already answered in U/S.
- Which type of nuclear? **Nuclear scan HIDA scan**: to assess the liver and its excretion
- **Procedure: Give Radioactive → label it to something similar to bilirubin → circulate in the body and metabolized in the liver** "most of it not all ".



Normal

1-liver start to uptake radioactive material by hepatocyte "very faint"
2- slowly increase the uptake
3- liver start to excrete it in the **bile duct** (there is something present as it's tube)
4- slowly start to fill in gallbladder



Abnormal

1. First step happen again
2. Everything went to the liver.
3. start to see excretion **"bile duct".**
4. **nothing filling the bladder**
5. it **start to fill small bowel** "will drain to duodenum "

- nothing go to gall bladder it means there is stone.

From this study we able to know if there is obstruction because of stone and most likely it's acute cholecystitis. This is the value of doing nuclear scan.

Nuclear scan (HIDA scan): What is abnormal here?

Acute cholecystitis. No up take **(no filling)** in gallbladder

Other indication of HIDA scan:

1.Biliary atresia (children) abnormality or absence of bile duct). Everything go to the liver → nothing comes out.

2.Bile injury post surgery. Everything go to the liver → it goes around the liver instead of going to gallbladder.

3.Bile obstruction. But this can be seen easily in other modality as MRI