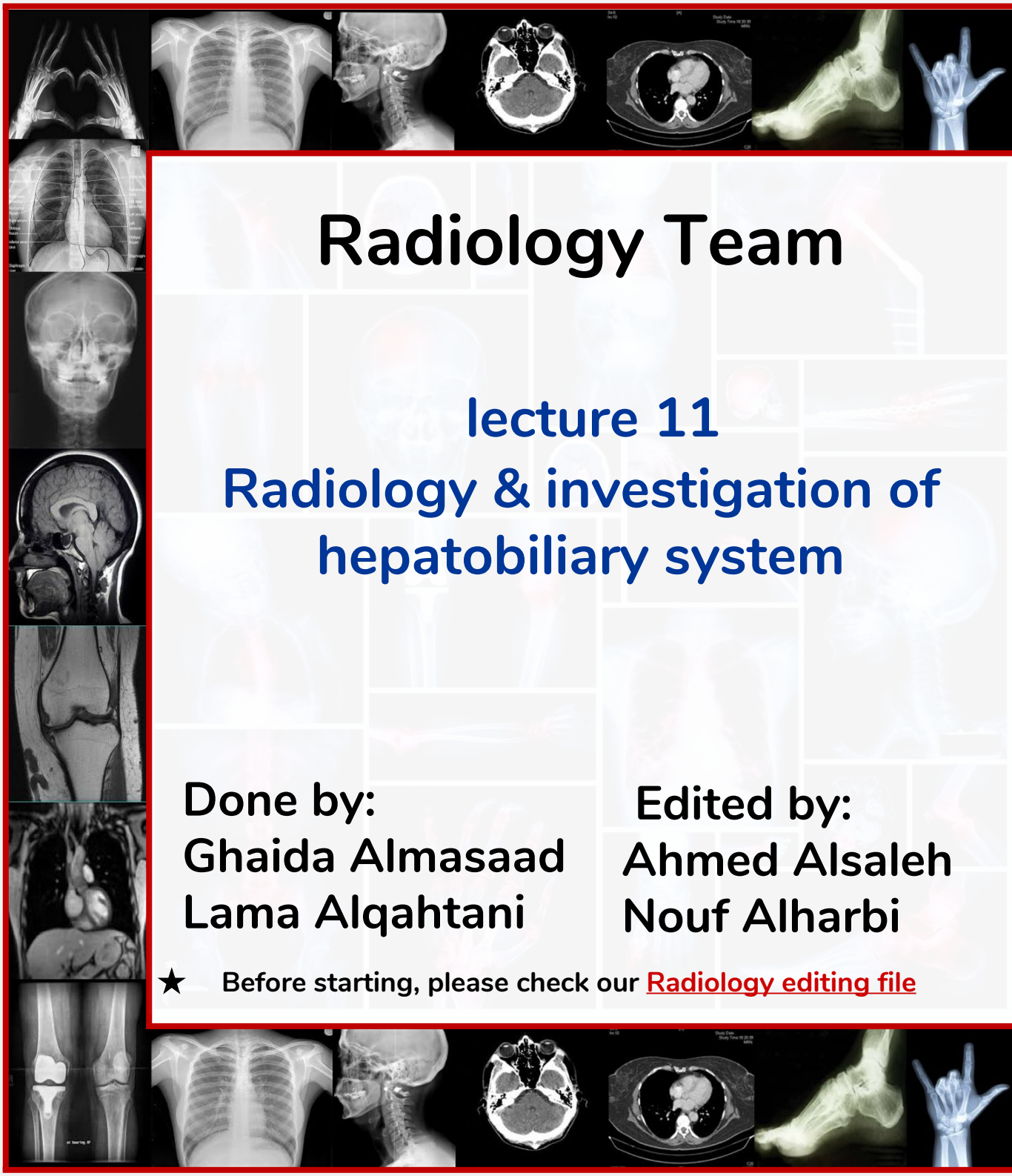

Radiology Team

lecture 11
Radiology & investigation of hepatobiliary system

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★ Before starting, please check our Radiology editing file

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Lecture outline:

- What is hepatobiliary system HBS?
- Radiological modalities used in imaging HBS.
- Advantages and disadvantages of each radiology modality.
- Indications of imaging HBS.

What is hepatobiliary system (HBS)?

It includes **liver**, **gallbladder** and **biliary ducts**.

What are the Radiological modalities used in imaging HBS ?

- X Ray.
- Ultrasound.
- Computed tomography CT scan.
- Magnetic resonance imaging MRI.
- Nuclear scan

What is X ray?

- It is energetic form of electromagnetic and ionozintng radiation that can penetrated solid objects and used to take images of the human body.

SUN is a source of radiation but it doesn't have the capability to form ionizing effect on the human body.

- Is it worthy to use X-ray in assessing hepatobiliary?

Very limited.

- In x-ray image Where is the liver ?

It's not clear. But it has certain indications.

This is an **Abdomen x-ray** or **Abdomen radiography.**

- The First x ray taken in history
- X ray was first observed and documented in 1895 by Wilhelm Conrad Roentgen.

In X-ray language:

Radio-lucent = black = air

Radio-opaque= white= bone

Anything in between black and white it's grey :) ! "scale of grey it differ according to the density of the structure"

Advantages:	Disadvantages:
• Cheap, Quick and widely available • Can be done bedside (portable) • It's good to see bones " in case of fractures	• Use ionizing radiation • Very poor in tissue details

What is this? ULTRASOUND

What is US?

- A diagnostic technique in which high-frequency sound waves penetrate the body and produce multiple echo patterns.
- It is diagnostic Medical applications in use since late 1950's
- The High frequency sound waves will pass through the body, and will be reflected according to the density of the structure.
- Dense structure e.g. bones, calcifications will reflect all sound waves.
- In fluid it will pass without reflection.
- Anything in between such as abdomen organs (as it's dense as it reflect more waves).

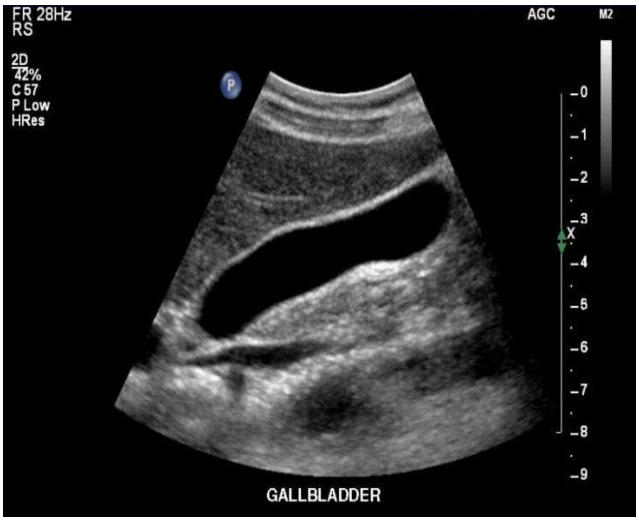
:Echo patterns

- Hyper-echoic = White
- Hypo-echoic = Light Grey
- An-echoic = Black
- White: bone
- Black: fluid

You say Hyper-echoic & Hypo-echoic when you compare the structure in the same image e.g. Liver is hypoechoic compared to fat but it's hyperechoic compared to the vessels inside.

Advantages:	Disadvantages:
•No radiation •Widely available •Relatively cheap •Very good in evaluating abdomen solid organs •Can be done bedside (portable) •real time scan e.g. in pregnant lady when scan, you able to see fetus move.	•Operator dependent •Very limited in evaluating structures with air (e.g. bowel) or calcification (e.g. bone) can't see structure behind the bone. •Also very limited in patient who is not co operative.

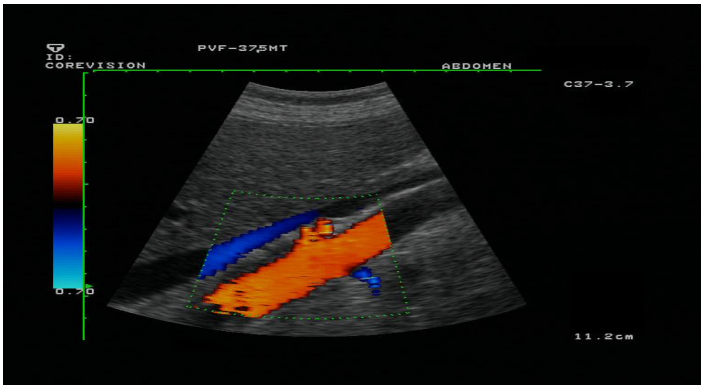
Cont.. :



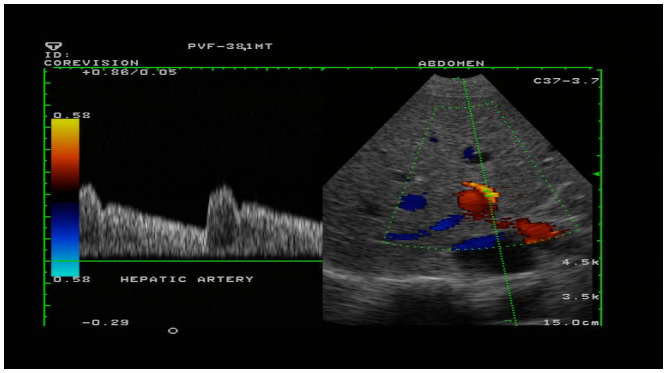
Normal gallbladder this shows how good gallbladder in ultra sound.

- In general U/S is excellent in assessing gallbladder and liver. It's good modality to start with.
- **Patient came with abdominal pain, and suspected to have gall stone, will you order x-ray, CT or U/S?**
- usually in choosing modality: You need to choose modality that is **good in showing the pathology** and at the same time **available**, (start with **more simple** and more available modality) So in this scenario **will choose U/S.**

- Different images of U/S "same patient" almost same area.
- It called grayscale image: it's same image but according what you need to see you will apply it.(B-MODE)



B- MODE

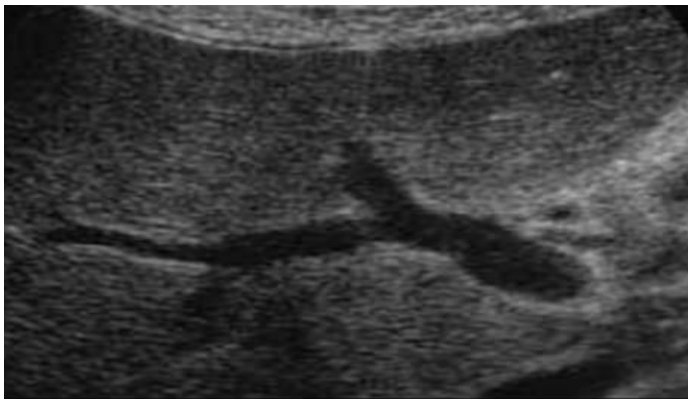


DUPLEX: It show the pulse of the vessels in graph, it differentiate artery from veins and even the veins not all having same pulse.

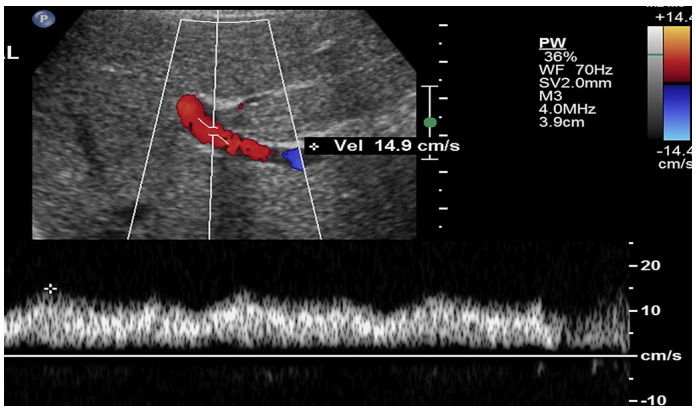
COLOR DOPPLER

what does these color mean?

- It represent vessels. If the direction of the flow toward the probe it will be red "artery", and if it's away will be blue "vein".
- In liver for example the portal vein is going into liver so we want portal vein to be red and hepatic veins is going away from liver so it would be blue.
- If we see the opposite there might be a problem.



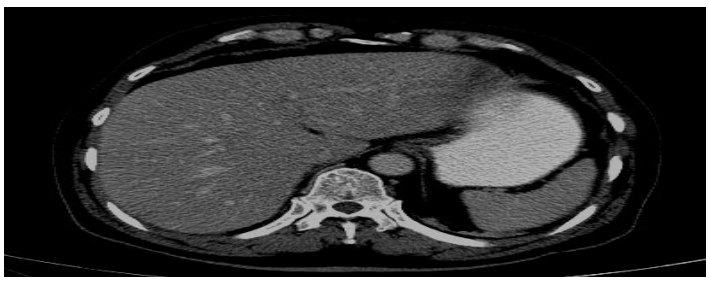
B- MODE: This is portal vein without flow known as B-MODE or greyscale.



DUPLEX: You can see the flow in this image.

What is a Computed Tomography CT scan.?

- A CT scan (Advanced technique of x-ray) makes use of computer-processed of **many x-ray** images taken from different angles to produce cross-sectional **tomographic images** =Create 3D image of specific areas of a scanned object.
- CT scan can be done with and without intravenous IV contrast.
- CT scan is limited in evaluating gallstones, Why? The composition of gallbladder is cholesterol which is fat which is black in CT, also fluid will be black " gallbladder also filled with fluid".
- And the stone is black or grey you can't see it. So you have to use U/S rather than exposing the patient to radiation for nothing.



CT language:

- Hypo-dense = grey-black
- Hyper-dense = white
- e.g. Bones are more hyper-dense when compared to the aorta

What is the modality used here?
C.T and how would you know? because **bone will appear dense white** in CT. However in **MR it will be grey to black**

Advantages:	Disadvantages:
1. It's very good at evaluating solid organs 2. Available more than MRI 3. Cheaper than MRI and more readily used	1. It uses ionizing radiation which can be harmful 2. The use of a contrast can be harmful for certain Patients like those with kidney disease 3. It is not widely available as an U/S or X-ray 4. It's relatively expensive

Pic 1 **Without IV contrast**

VS

Pic 2 **With IV contrast**

What is different between the tow images?

Both are CT, **Pic 2** is with contrast while the other is not.

How you know if there is contrast? You see the vessels and more details.

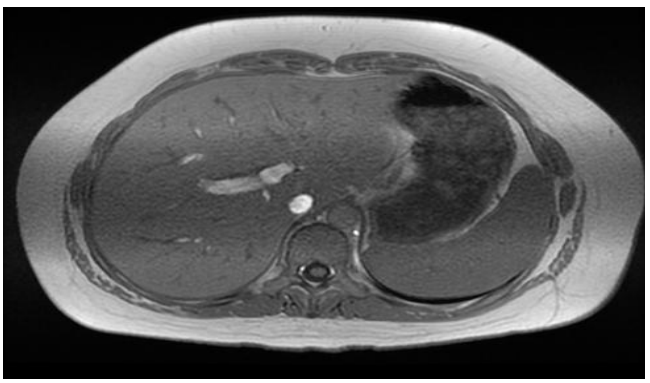
- It shows how good the image with contrast, which circulates in the body then into the vessels.
- Contrast also taken up by the liver so you can easily see details and this helps in case of mass in liver which can be missed as it has a similar density to liver but with contrast liver will take it in different way from the mass.

What modality is used here?

Magnetic resonance imaging

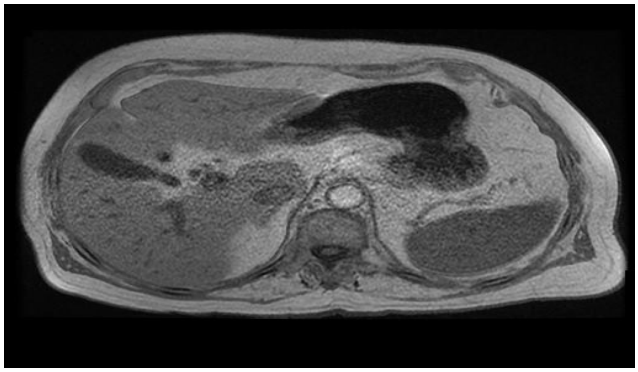
MRI

Do you notice the color of bone here!, which is different from CT.



MRI

1. A medical imaging technique used in radiology to form pictures of the **anatomy using strong magnetic field and radio waves**
2. It has no radiation.
3. It more complex then CT scan and many different images (or what called sequences) can by taken like T1 and T2 etc.
4. It gives a far more great detail of information when compared to a CT scan as it uses a sequence system.



Advantages

1. Excellent in tissue details
2. No ionizing radiation

Disadvantages

1. Expensive
2. Long scan time
3. Less available then other modalities
4. Intravenous contrast is not safe with poor renal function.

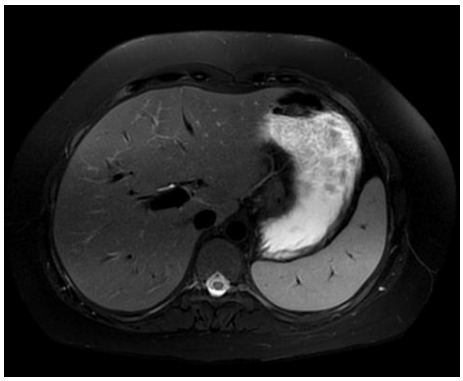
MRI language

Hyper-intense signal= more white

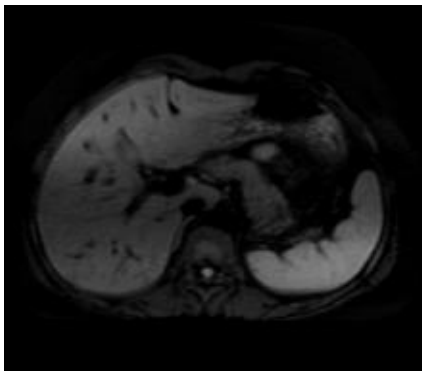
Hypo-intense signal = more grey/black

Not for all patient such as: pacemaker, claustrophobia etc.

T1: the fluid will appear black

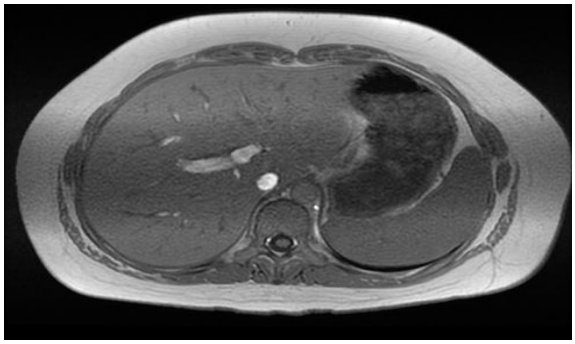


T2: the fluid will appear white



Diffusion

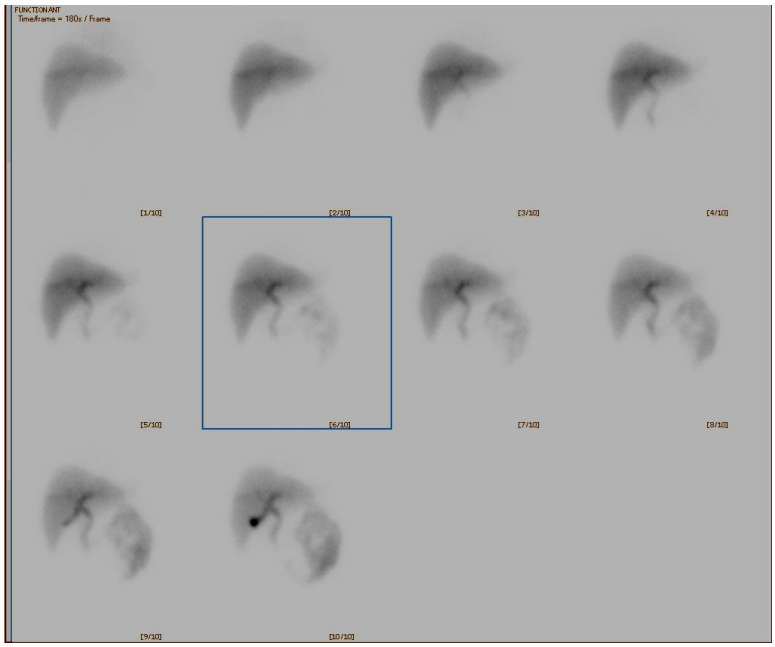
How to differentiate between a CT and an MRI ?



❖ **Always look at bone:**

CT always white, **MR** grey to black

What modality is this? Nuclear scan



What is a nuclear medicine?

- It's a Medical specialty involving the application of radioactive substances in the diagnosis and treatment of disease.
- It is good at assessing the function but poor at assessing the anatomy.

How is this procedure carried out?

Radioactive material given intravenously, is labeled with a material that mimics normal physiology of the body e.g if we wanted to scan the liver or bile duct, to be sure this radioactive material reached the organ we label it with something like bilirubin " because it is metabolized in liver" so this will make all radioactive material directed to liver, then start to scan.

Advantages:

1. Excellent in evaluating organ function/physiology

Disadvantages:

1. Use ionizing radiation(gamma rays)
2. Not widely available
3. Very poor in evaluating anatomy