



MED437
KING SAUD UNIVERSITY



Ultrasound of the liver and gallstones

Second Lecture

Team 437

Color index

Important

Doctor's note

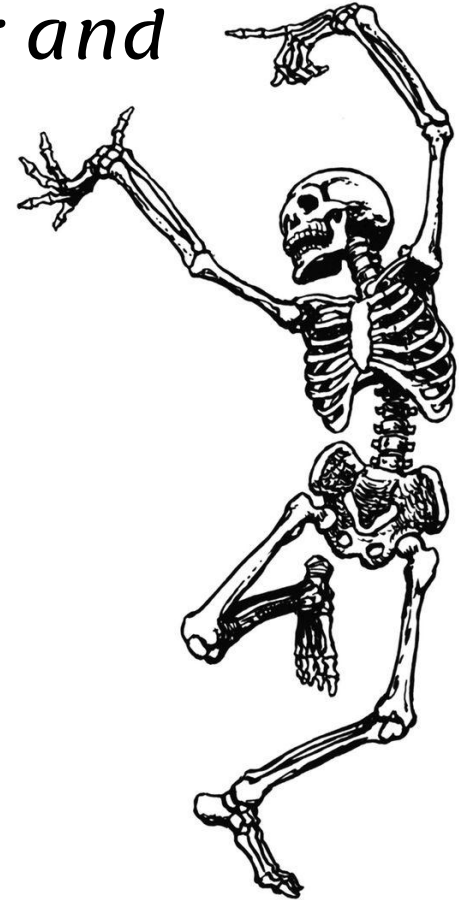
Extra explanation

Radiology

Gastrointestinal Block

Lecture objectives:

- 1- Introduction to US.
- 2- Indications of liver and gallbladder US.
- 3- Normal anatomy and radiological appearance.
- 4- Pathology of liver and gallbladder.
- 5- Common pathological cases.

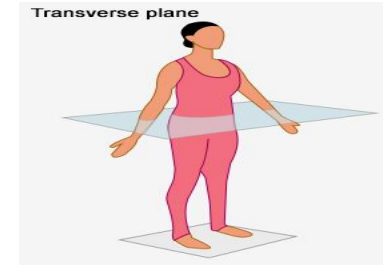
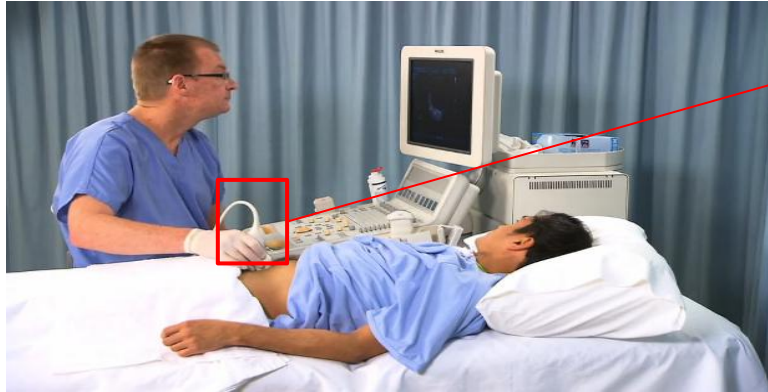


Ultrasound:

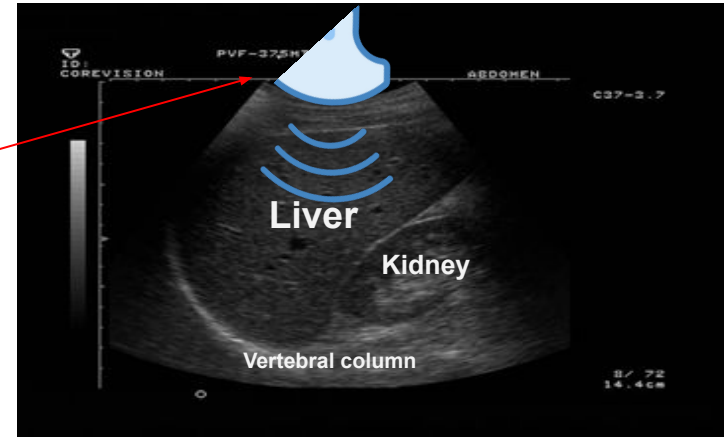
Definition:

- a Diagnostic technique in which ULTRA = high frequency sound waves (not radiation) to penetrate the body, bounce around, and produce multiple echoes; these echo patterns can be viewed as an image on a computer screen.

- Frequency ranges used in medical Ultrasound imaging are 2-20 MHz



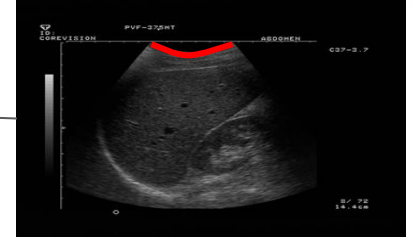
-In Ultrasound you will see a transverse picture of the inner body from where you are holding the ultrasound probe.



Ultrasound: Types of Probes:

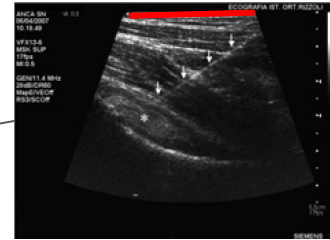
Curvilinear Probe:

used to view deep
structures
e.g Abdomen



Linear Probe:

used to view
Superficial
structures
e.g Skin



Ultrasound:

Important terms:

Extra information

Echo: when ultrasound waves hit a structure they produce echos

Echogenicity: the ability of a structure to produce sound echos.

-Tissue is **Gray**, but the denser the tissue is, the brighter it will appear in ultrasound(brightest structure is bone)

-Fluids are **Black**

Hyperechoic: more echogenic(more echoes produced) than normal, so the structure will appear **Brighter**.

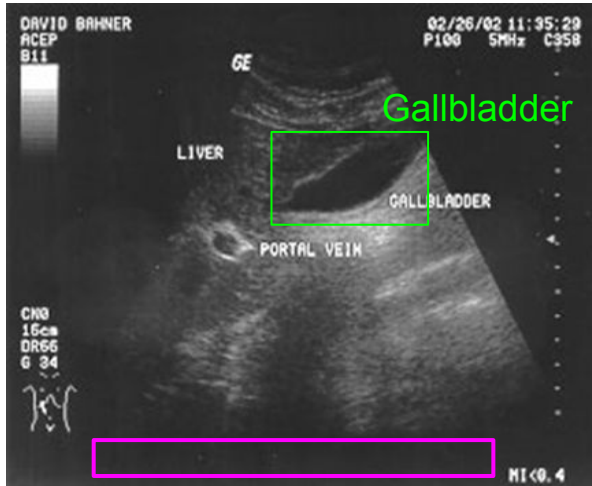
Hypoechoic: less echogenic(less echoes produced) than normal ,so the structure will appear **Darker**.

Anechoic: No echo is produced at all so the image will be **Black**, fluids are anechoic

Isoechoic: **Same** echogenicity(not less or more than normal) same as the tissue surrounding it.

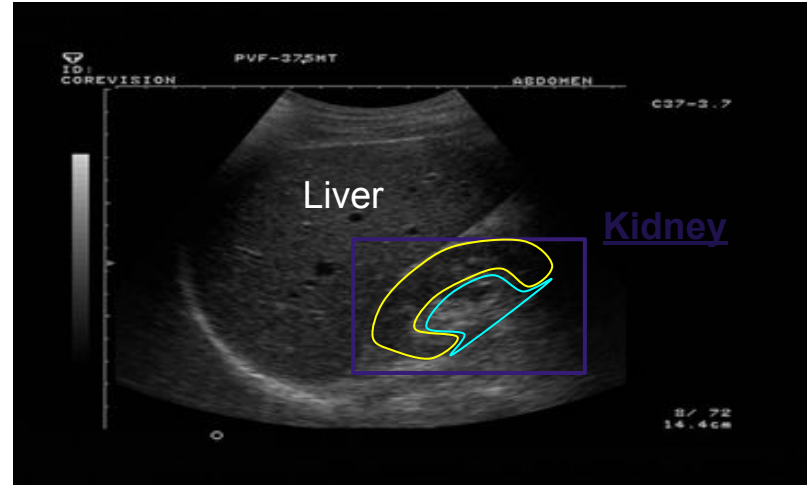
-examples will come in the following slides

Ultrasound: Extra information



-the **Gallbladder** contains fluid, that's why it appears black because its **Anechoic**(not producing any echoes).

-in the **Bottom** of the ultrasound picture we can see an **Anechoic** area referring to the bed under the patient which is metallic thus not giving any echoes.

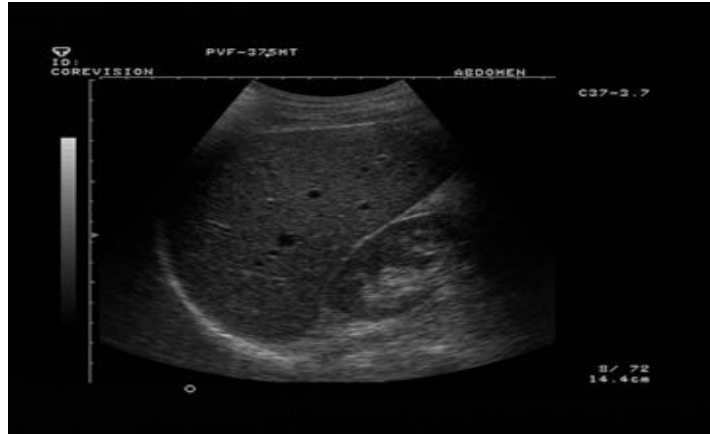


-The **Cortex** of the Kidney is **Hypoechoic**, that's why it appears Darker than surrounding tissue.

- in the other hand, the **Medulla** appears to be **Hyperechoic**, thus appearing brighter than surrounding tissue.

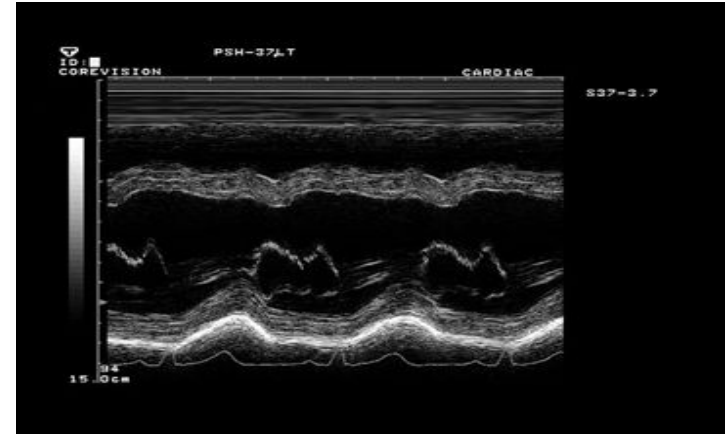
Modes of Ultrasound:

B Mode



- used to assess the anatomy/structures

M mode

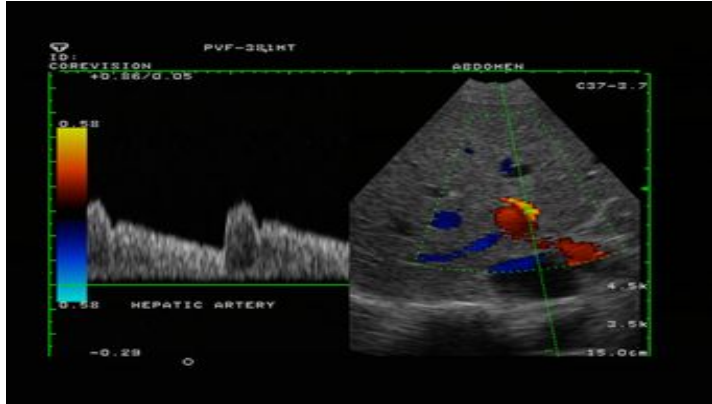


-used to assess Motions

-for examples we use it to assess the motion of blood in the blood vessels

Modes of Ultrasound:

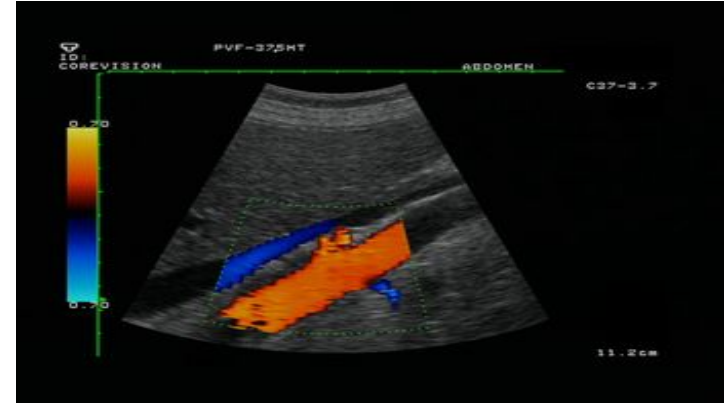
Duplex



-Deeper assessment of both structure and motion of Vessels.

-as we can see there's 2 images not one that's why it gives more details.

Color Doppler



-used to assess Vascularity.

-can study any vascularity such as artery, capillary, veins, it also assess the structure of vessels for any increased vascularity in the case of inflammation.

Advantages of US:

non-invasive

inexpensive

easy and available

safe and **non-ionizing** , **no radiation**

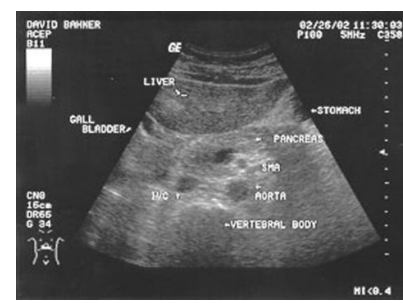
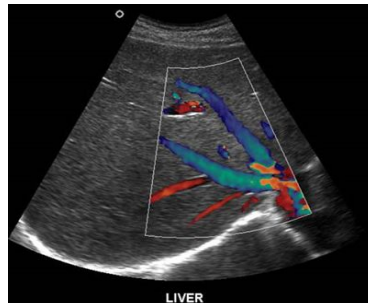
Disadvantages of US:

inability to penetrate gas or bone

operator dependant (depends on the skill of the operator)

less sensitive in some situation

Normal anatomy and radiological appearance:



Indications of liver and gallbladder US:

Ultrasound is the initial study for soft tissues

- Right upper quadrant pain
- Jaundice
- High liver function test
- Fever work up
- Screening for metastasis

Pathology of the liver: can present as:

- Size
- Diffuse liver disease
- Focal liver disease
- Hepatic vascularity
- Biliary system obstruction / pathology

Size abnormality:

normal liver size:
15 cm at MCL
(midclavicular line)

-Hepatomegaly:

1- infective eg: viral hepatitis

2- neoplastic eg: metastasis

3- degenerative eg: **Early cirrhosis**

4- raised venous pressure eg:
congestive cardiac failure

5- storage disorder eg: amyloidosis

6- myeloproliferative eg: polycythaemia
rubra vera



Normal



Small shrunken liver:

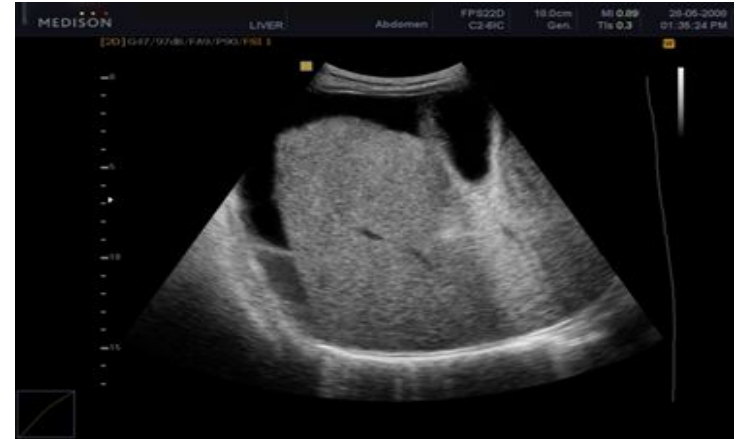
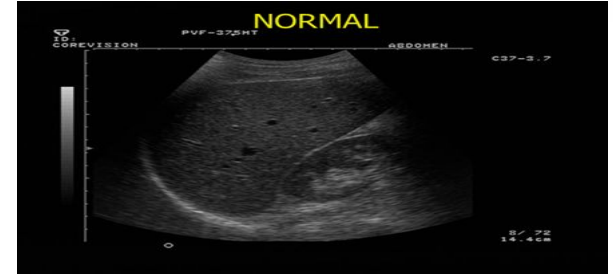
- **Late cirrhosis**

- Shrunken liver with irregular outline
- Ascites
- Portal hypertension
- +/- focal lesion

It is important to know that :

In Early Cirrhosis → Liver enlargement

In Late Cirrhosis → shrunken liver



-how can we know if the liver is shrunken or enlarged?
check the top of the ultrasound picture if you see any space separating the liver from the anterior side of the abdomen you know it's shrunken

Diffuse abnormality

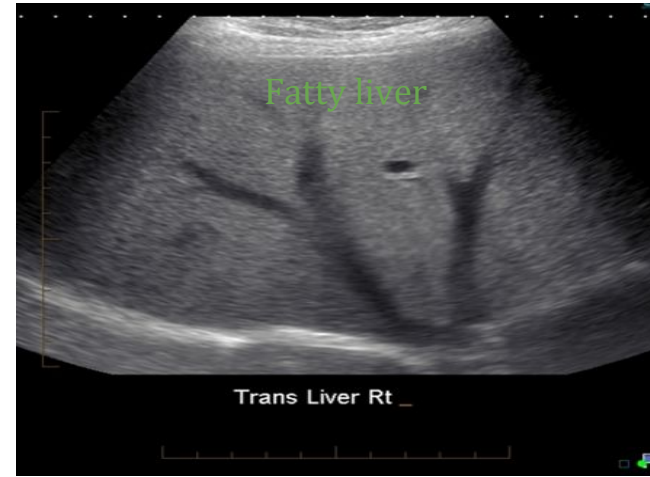
it can also be called hyperechogenic when it is bright

-Diffuse increased parenchymal echogenicity
(whiter than normal)

-Diffuse fatty infiltration

-Other infiltrative:

Malignant, infectious, or Glycogen storage disease



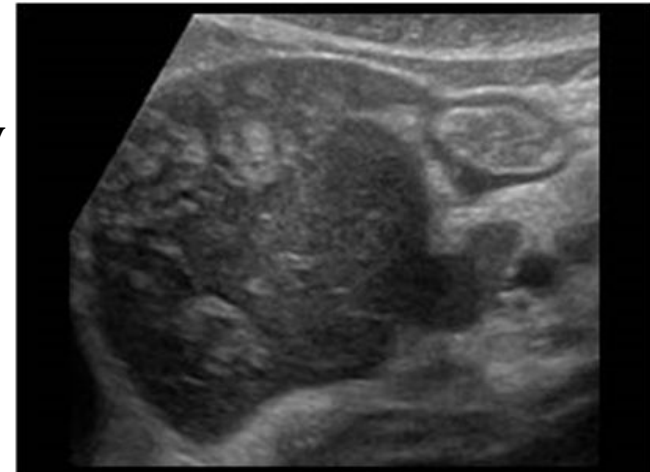
it can also can be called hypoechogenic when it is dark

-diffuse decrease in parenchymal echogenicity
(darker than normal)

-Acute hepatitis

-Other:

-Malignant infiltration



Focal liver lesions

Benign tumor:

- hemangioma

Malignant tumor:

- primary eg hepatocellular carcinoma
- secondary metastasis eg: colon breast

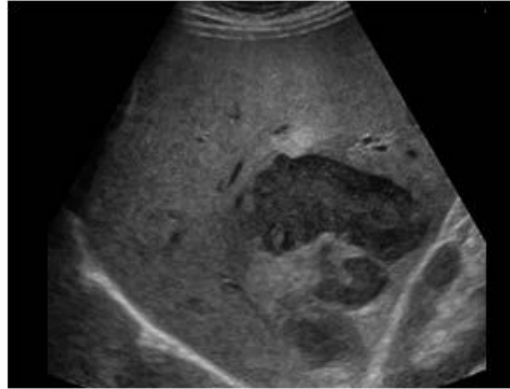
Infective:

- abscess
- hydatid cyst

Congenital:

- hepatic cyst

liver abscess



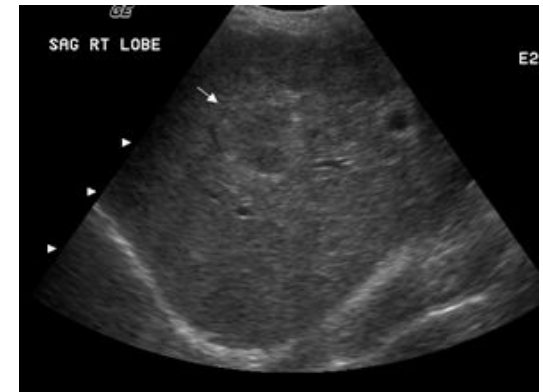
hemangiomas



metastasis



HCC



Cont.



Hydatid cyst



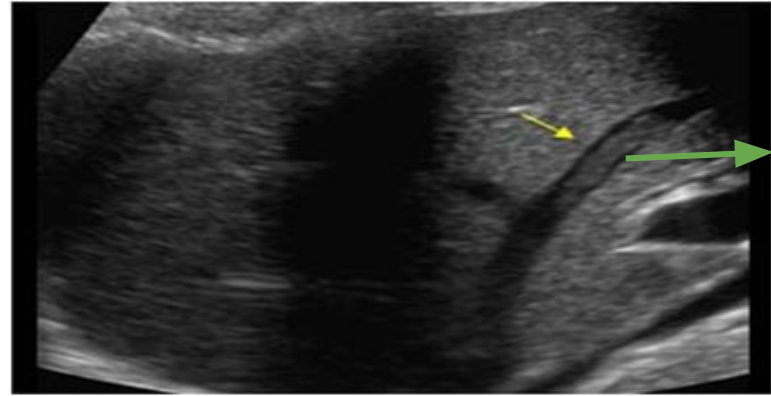
-Cysts containing fluid that's why it's Black

Vascular abnormality:

portal venous system:

1- thrombosis

2-portal hypertension

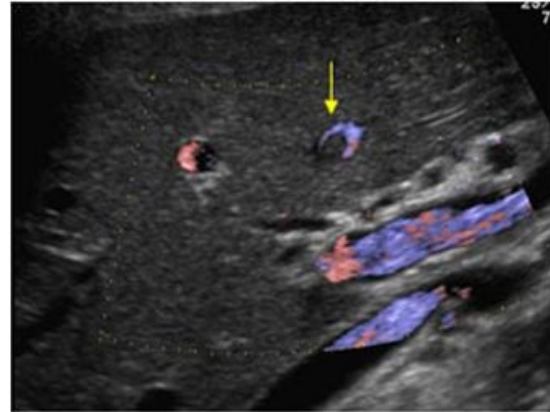


Thrombus

hepatic venous system:

1-thrombosis

2-Budd Chiari syndrome



Hepatic vein thrombosis



PV thrombosis

Biliary abnormality:

Intrahepatic biliary radicals.

→ Less than 3mm

Extra-hepatic “CBD” common bile duct

→ Less than 8mm

Causes of dilatation & obstruction:

Intraluminal:

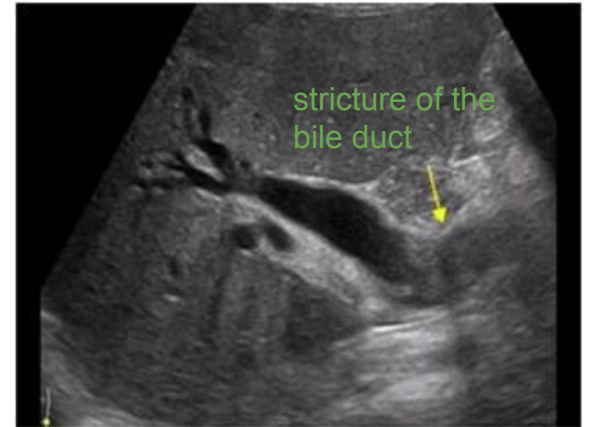
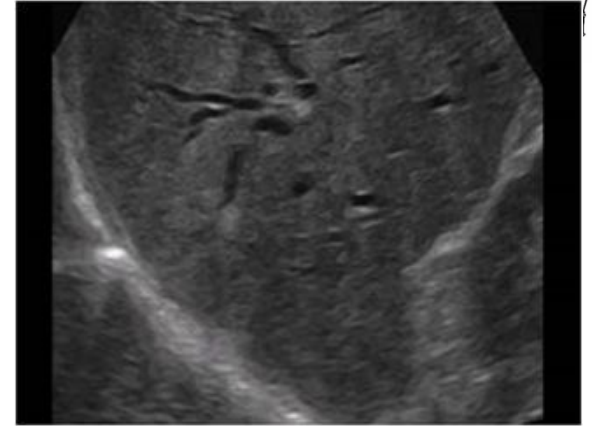
Stone & mass.

Mural:

stricture (benign (such as transplantation) & malignant)

Extrinsic:

Compression mass & Lymph node



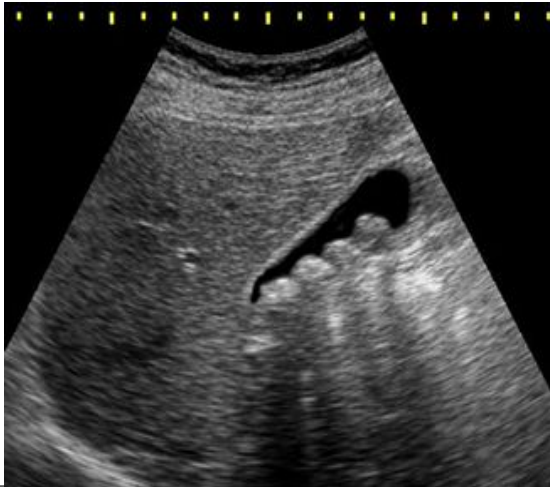
Pathology of gallbladder:

Intraluminal pathology

Gall stone:

acoustic shadowing

Why shadowing occurs? because waves can't penetrate the stones and it will be reflected as a shadow.

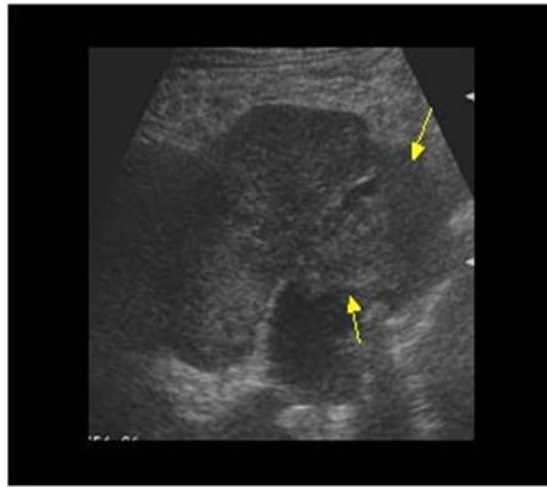


Intraluminal:

Mass lesion

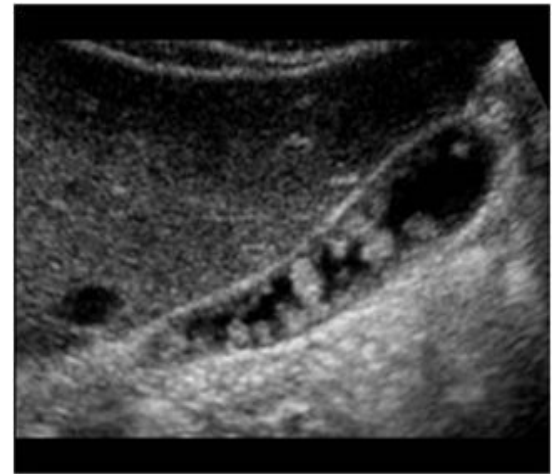
+/- invasion

gall bladder carcinoma



Polyps:

No acoustic shadowing



Pathology of gallbladder:

Mural pathology: Mural thickening

Primary:

cholecystitis

Abnormalities\ ultrasound findings of:

thickening of the wall of the gallbladder wall

+/- Stone (cholecystitis can be calcular or acalular)

Secondary:

Cardiac failure.

Cirrhosis.

ascites

Hypoalbuminemia

Renal failure.

-How did we know?

the whole gallbladder should appear black since it's holding fluid which is anechoic, in this case we can see some tissue inside the gallbladder which appear brighter.



Common pathological cases:

Case one

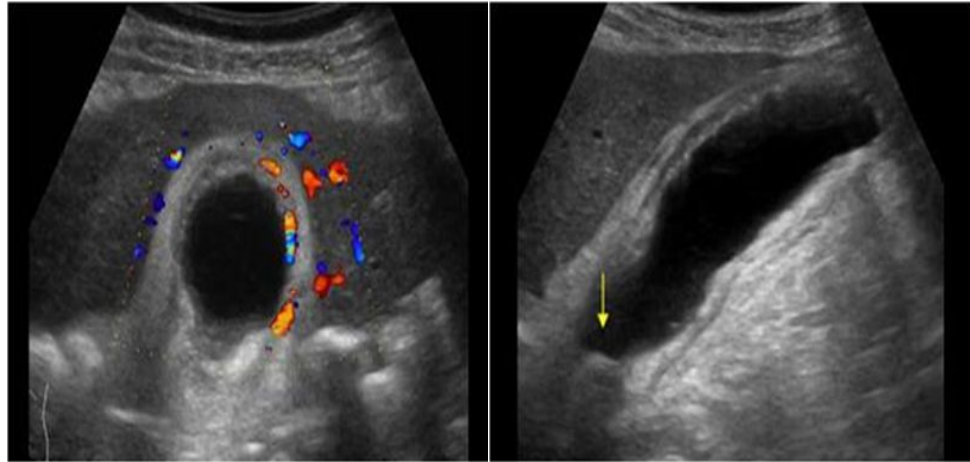
Middle age women presented to ED (emergency department) with fever
RUQ (Right upper quadrant) pain

On exam:

She looks ill, febrile and on pain

Abdomen: RUQ tenderness

Lab high LFTs & WBC.



- **Thickening of GB wall >3mm.**
- Distended GB
- Pericholecystic fluid.
- Hyperemia. (The increase of blood flow to different tissues in the body.)
- Gall stone
- Acute calcular cholecystitis

Common pathological cases:

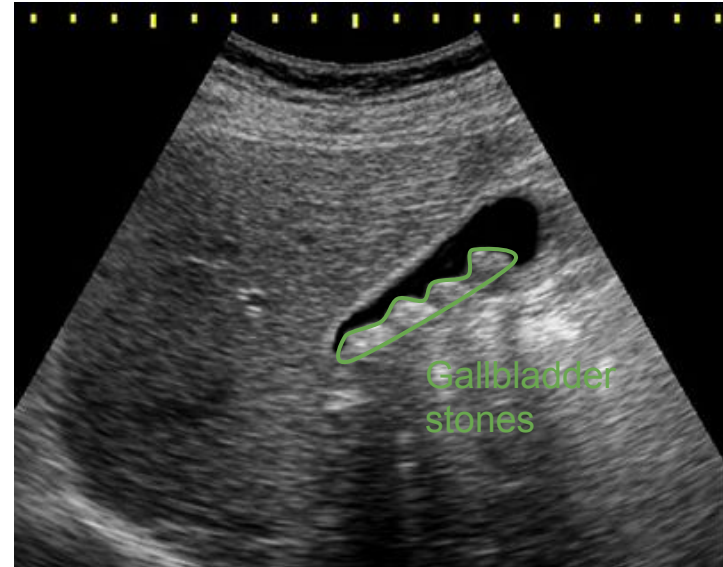
Case two

Middle age women presented to surgical outpatient clinic with 2 years history of recurrent RUQ pain mild to moderate in severity radiated to the right shoulder aggravated by fatty meal.

On exam:

obese lady well not distressed, febrile or jaundiced.

Lab LFTs normal.



- Multiple oval shaped echogenic structures seen within GB causing acoustic shadowing
- GB stones

Common pathological cases:

This case is advanced

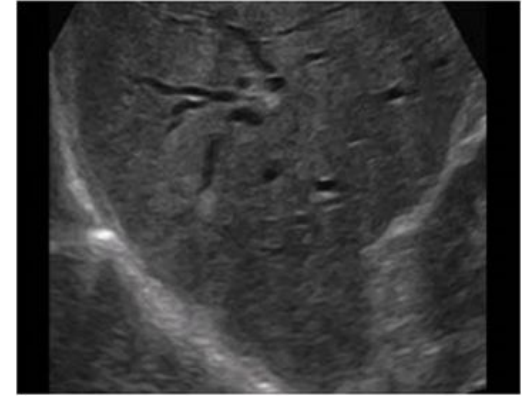


Case three:

Middle age man presented to ER with severe RUQ pain and yellowish discoloration of skin and sclera.

On exam:

he looks ill, jaundiced and on pain
but not febrile
Lab high LFTs.



- Dilated intrahepatic and extrahepatic biliary system
- Echogenic structure seen within CBD
- CBD stone causing biliary obstruction.

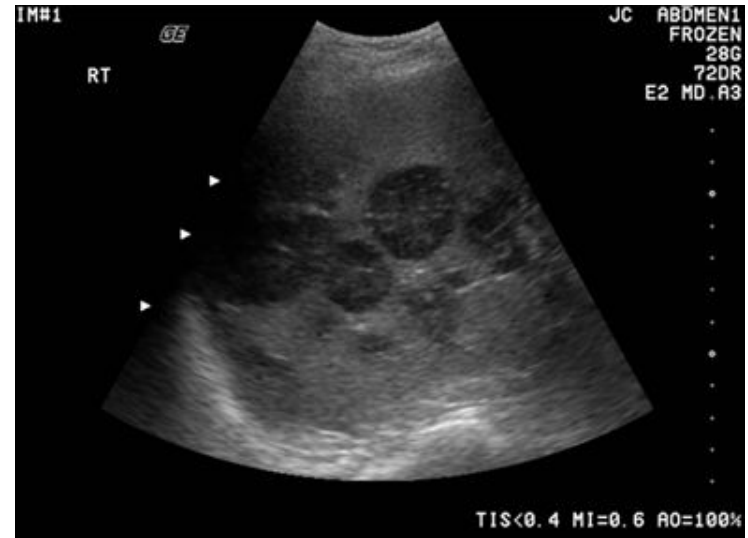
Common pathological cases:

Case four:

Old man recently discovered to have colonic cancer presented to primary health care clinic with vague upper abdominal pain

On exam:

he was thin, ill not febrile or jaundiced.
Mild abdominal tenderness enlarged liver with irregular outline.
Lab mildly elevated LFTs.



- Multiple hypoechoic focal hepatic lesions
- Metastatic liver lesions.

Common pathological cases:

Case five:

Middle age man known case of HCV+ for 10 years presented to GI outpatient clinic with history of weight loss, indigestion and mild abdominal pain. No fever.

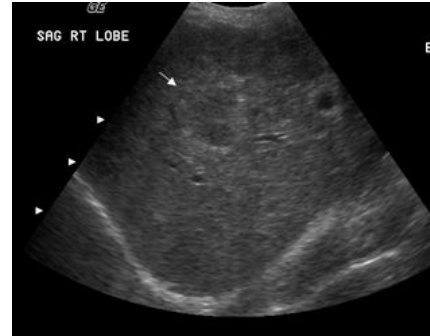
On exam:

he was ill, slim ,mildly jaundice not febrile.

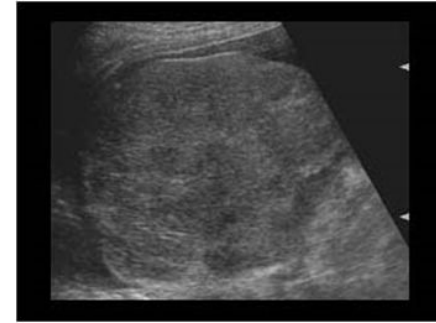
Abdomen: bulging flanks, dilated tortuous vessels around umbilicus. Mild diffuse abdominal tenderness.

Lab high LFTs.

Normal



irregular



- **Shrunken** liver with **irregular outline.**
- Heterogeneous appearance.
- Focal hypoechoic lesion.
- Cirrhotic liver with HCC.

Common pathological cases:

Case six:

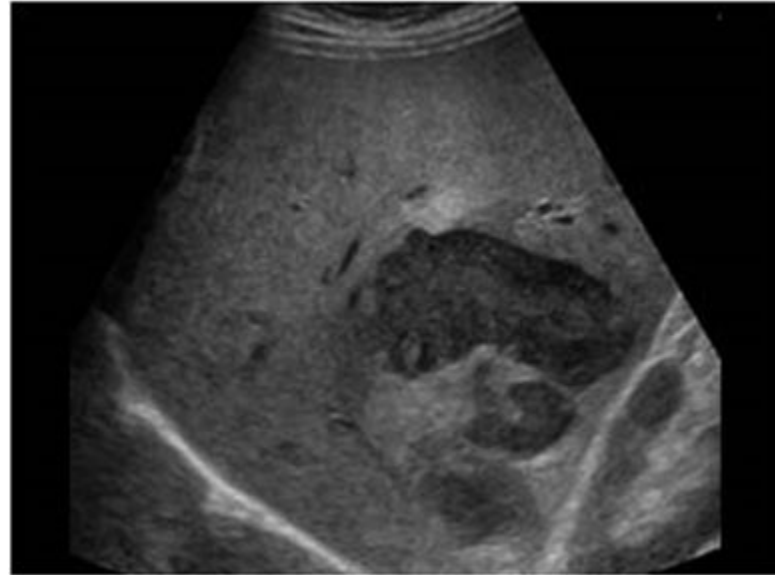
Young man known IV drug addict presented to ER with high fever, chills, upper abdominal pain and vomiting

On exam:

He looks very ill, febrile and on pain.

Abdomen: RUQ tenderness.

Lab high LFTs & WBC.



-Focal hypoechoic liver lesion with ill defined outline.
Liver abscess.

Quiz:

1. what's the state of the liver in the following picture?

A. Enlarged B. Shrunken C. Normal

2. What's the cause?

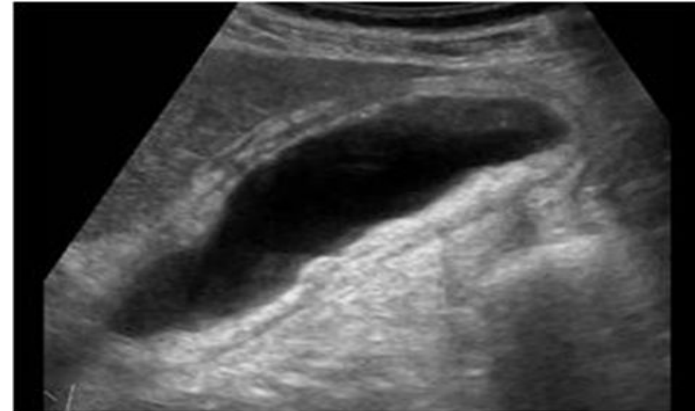
A. Viral hepatitis B. raised venous pressure
C. Late Cirrhosis D. Early Cirrhosis



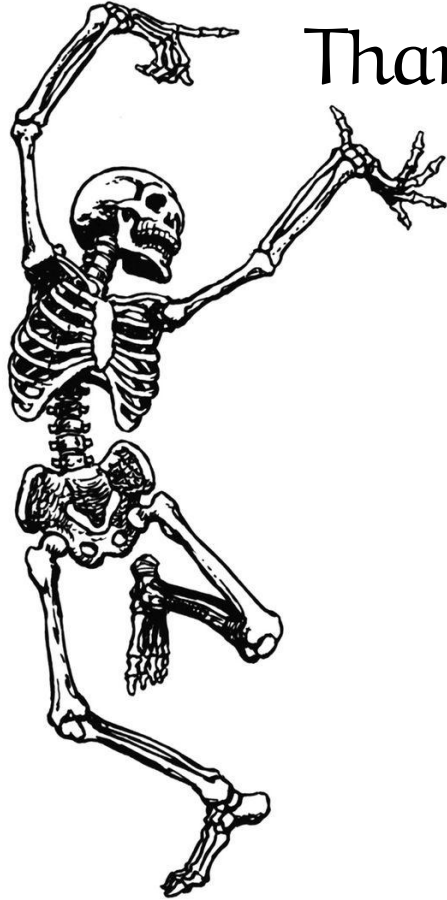
3. What's the underlying pathology affecting the gallbladder?

A. Gallbladder Stones

B. Cholecystitis



1. B
2. C
3. B



Thank you for checking our work

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