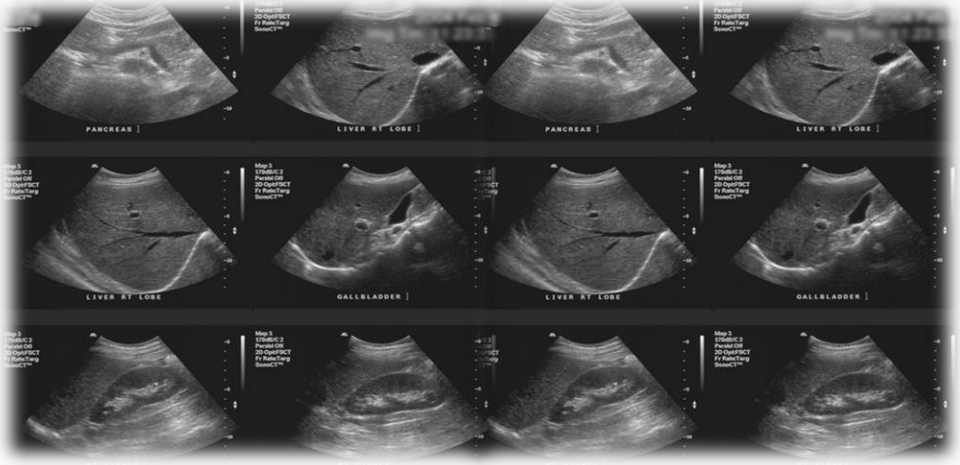
Radiology
Team 436

436
MEDICINE
KING SAUD UNIVERSITY

Gastrointestinal tract Block



Ultrasound of Liver and Gall Stone

Lecture -2-

تمت المراجعة
شوق الأحمري & عبدالعزيز العنقري

Objectives

- Introduction to US.
- Indications of liver and gall bladder US.
- Normal anatomy and radiological appearance.
- Pathology of liver and gall bladder.
- Common pathological cases.

Color codes

Doctor notes Important! Extra

Introduction to US

Definition

- A diagnostic technique in which ULTRA= high-frequency sound waves (not radiation) penetrates the body, bounce around, and produce multiple echoes; these echo patterns can be viewed as an image on a computer screen. (Solid abdominal organs: Spleen, liver, pancreas. and extra abdominal: thyroid lymph nodes)
- Frequency ranges used in medical Ultrasound imaging are 2-20 MHz (Frequency unit)*.

US machine

MACHINE

(the old one)

PROBES

(Have crystals contains waves reflects the image on the machine)

* We can adjust the frequency according to the depth of the target organ. To asses deep organ we lower the frequency to penetrate it better. So we can control the frequency.

Introduction to US EXTRA Slide

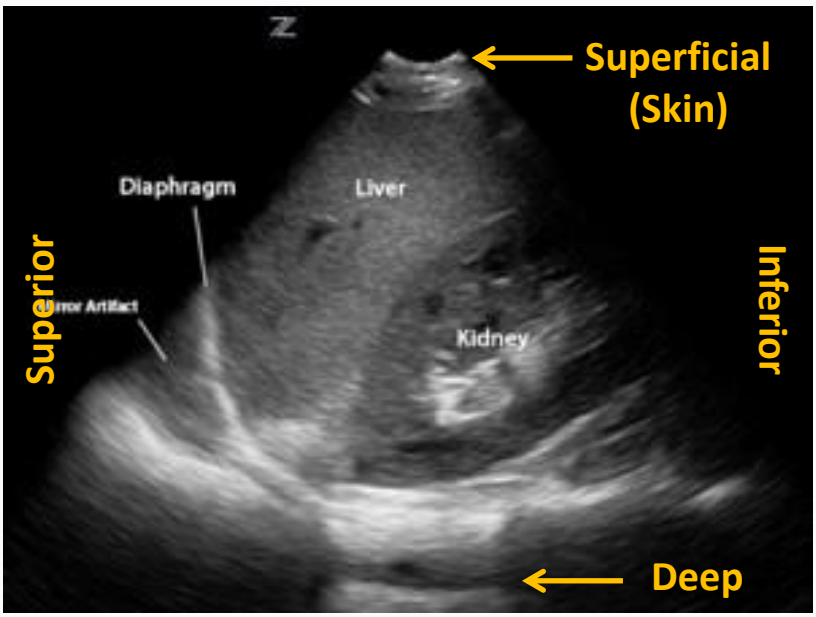
Echogenicity

Because we are dealing with ultrasound waves, the descriptive terms are based in “echogenicity”, or the way the ultrasound wave is reflected back to the transducer. Each tissue type, such as liver, spleen or kidney, has a particular echogenicity in its normal state. In diseased states, the echogenicity of an organ can be altered.

Ultrasound terms

Hyperechoic: more echogenic (brighter) than normal.
Hypoechoic: less echogenic (darker) than normal.
Isoechoic: the same echogenicity as another tissue.

FLUID is always **BLACK** and TISSUE is **GRAY**. The denser the tissue, is the brighter **white** it will appear in **ultrasound** the brightest **white** being bone.

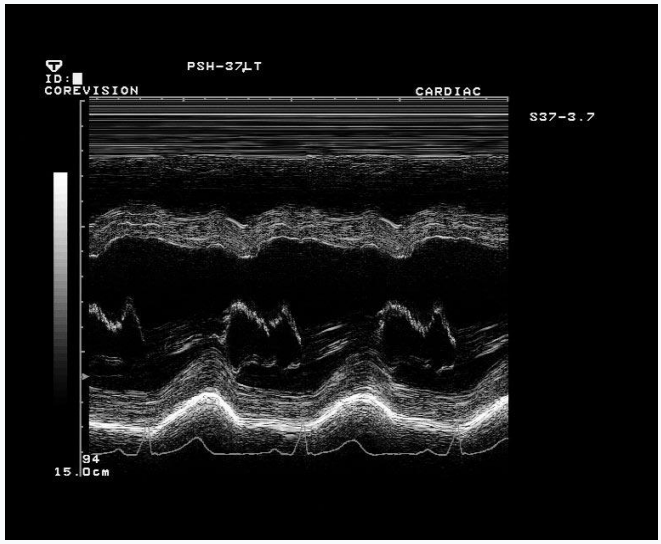


Right upper quadrant

US sensitivity is very high but specificity is low.

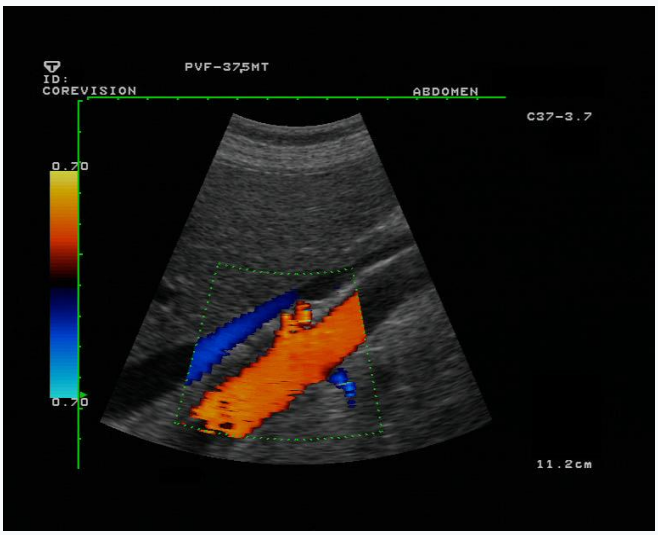
All are done by the same machine but we change the mode

B- MODE. (the normal 2D)



M*- MODE.

DUPLEX**



COLOR DOPPLER***

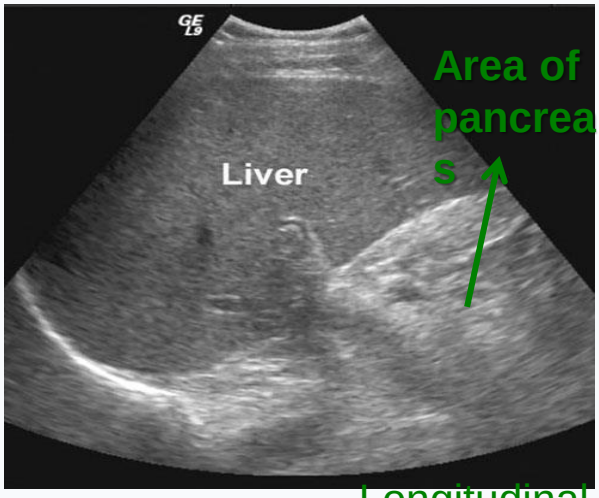
Indications of liver and gall bladder US:

- Right upper quadrant pain. Gall stone and cholecystitis
- Jaundice. Evaluate liver and pancreatic head cancer (+ weight loss).
- High liver function test, fever work up.
- Screening for metastasis.

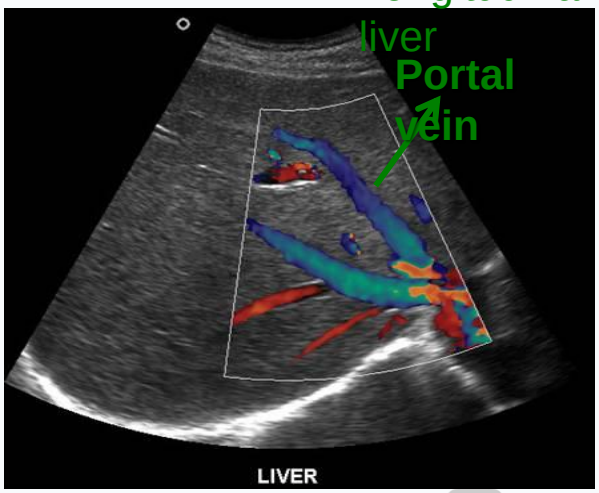
* M= motion (eg. Vascular movements) like in DVT.
** To asses the diastolic & systolic blood pressure.
*** B mode + coloring, to asses the internal vasculature.
The color in the pic depend on the direction of blood flow.

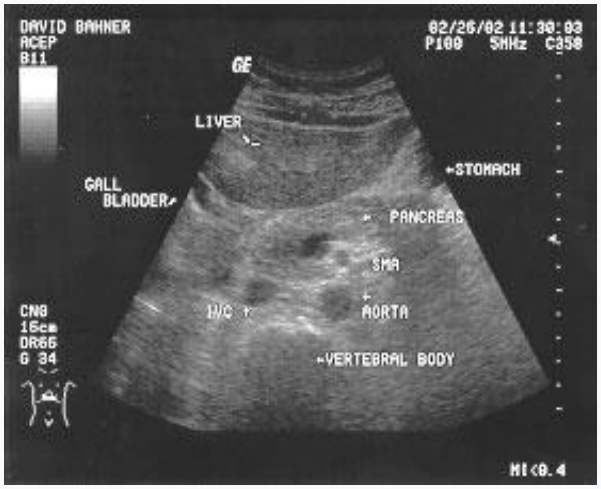
Advantaged of US	Disadvantages of US
Noninvasive, inexpensive	Inability to penetrate gas or bone. Not used in bowel that have gas.
Easy and available.	Operator dependent. Need skills depend in person that do it.
Safe and non-ionizing (NO radiation).	Less sensitive in some situations.

Normal anatomy and radiological appearance:



Longitudinal cut of the liver





Modality: Doppler

Pancreas is hyperechoic

Echogenicity is the ability to bounce an echo, e.g. return the signal in ultrasound examinations. **Echogenicity** is higher when the surface bouncing the sound echo reflects increased sound waves.

Pathologies of the liver:

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

Size abnormalities:

- **Normal liver size:**

- 15 cm at MCL (mid-clavicular line).

- **Hepatomegaly is caused by:**

- Infective, e.g. Viral hepatitis.

- Neoplastic, e.g. Metastasis.

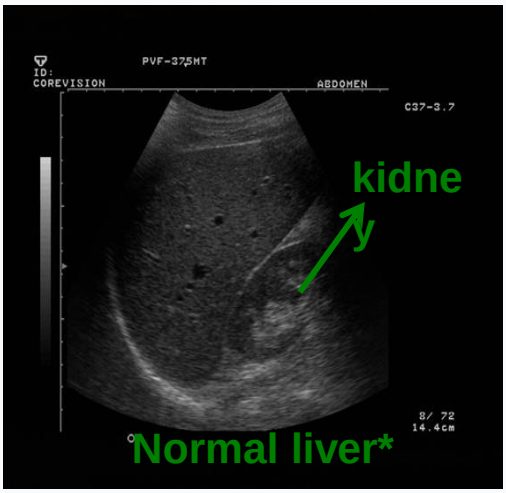
- Degenerative, e.g. Early cirrhosis.

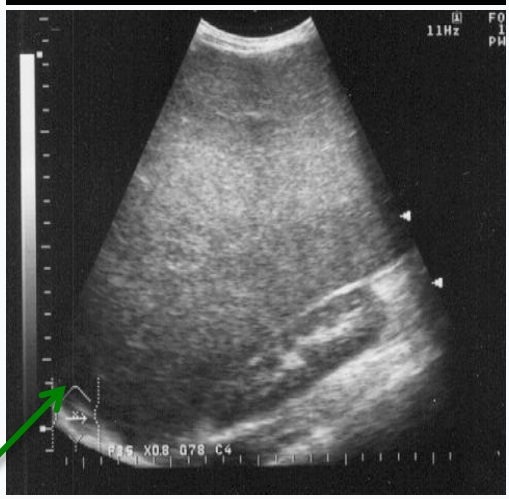
- Raised venous pressure, e.g. Congestive cardiac failure.

- Storage disorder, e.g. Amyloidosis.

- Myeloproliferative disorder, e.g. Polycythaemia rubra vera**.

- Fatty liver.



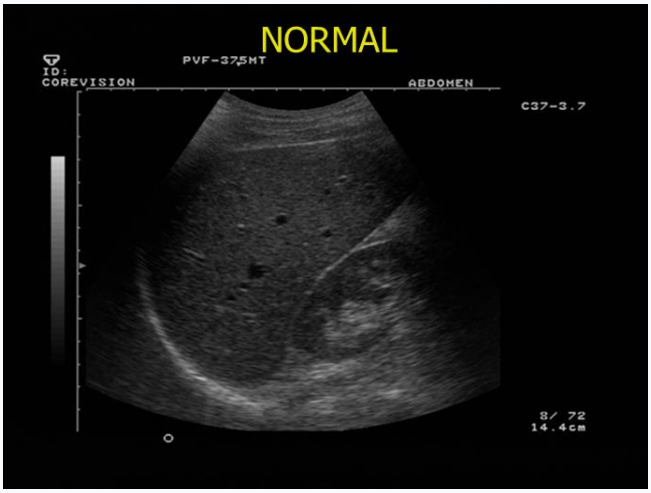


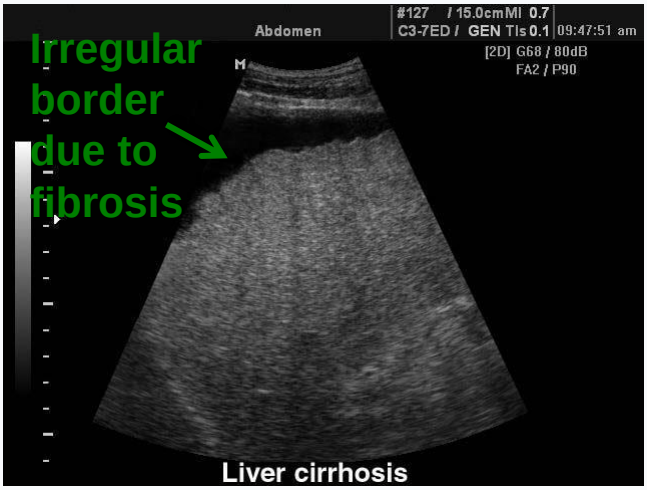
* Smooth boarder line.

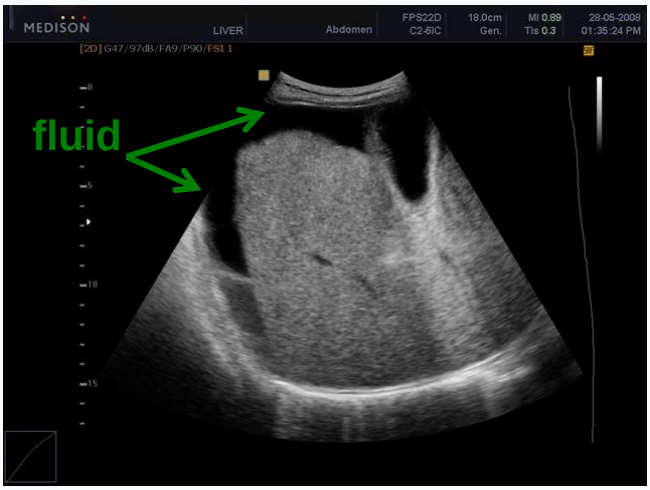
** It's a neoplasm in which the bone marrow makes too many red blood cells. It may also results in overproduction of WBCs and platelets

Small shrunken liver:

- Late liver cirrhosis:
  Shrunken liver with irregular outline.
- Ascites
- Portal hypertension.
- +- focal lesion.







Diffuse abnormality:

- Diffuse increase parenchymal echogensity (whiter than normal).
- Diffuse fatty infiltration.
- Other infiltrative:

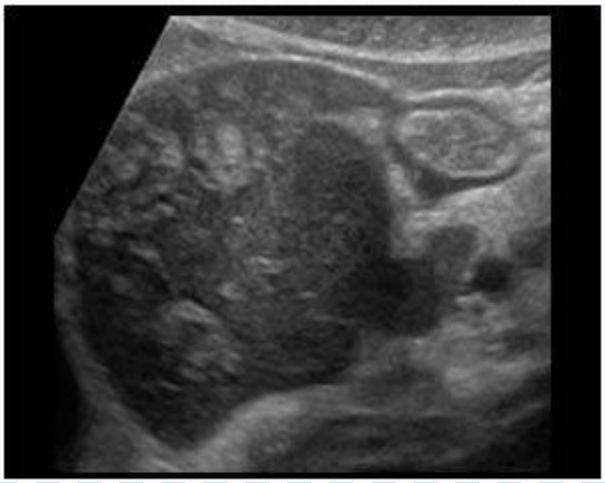
- Malignant.
- Infectious.
- Glycogen storage disease.

- Diffuse decrease in parenchymal echogensity (darker than normal) (hypoechoic).

- Acute hepatitis.

- **Other:**

- Malignant infiltration.



Focal liver lesions:

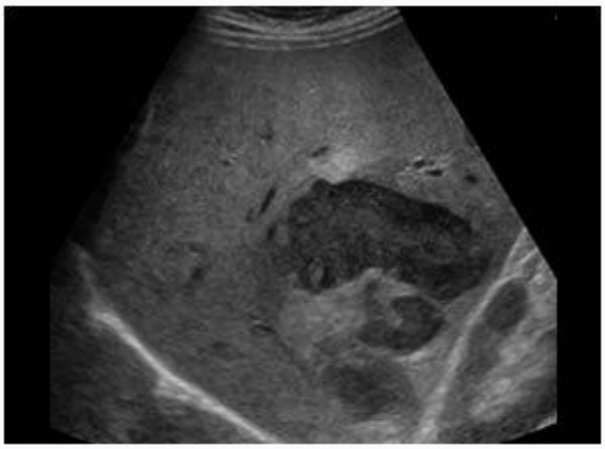
- **Benign tumor:** Hemangioma*.
- **Malignant tumors**:

a) Primary, e.g. Hepatocellular carcinoma HCC.
b) Secondary, metastasis e.g. Colon, breast.

- **Infective:**

a) Abscess.
b) Hydated cyst..

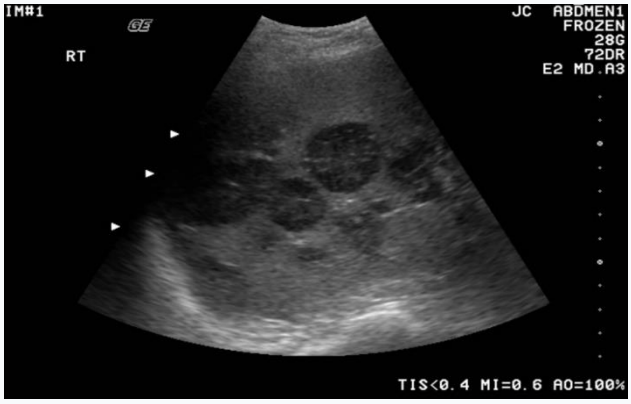
- **Congenital:** Hepatic cyst.



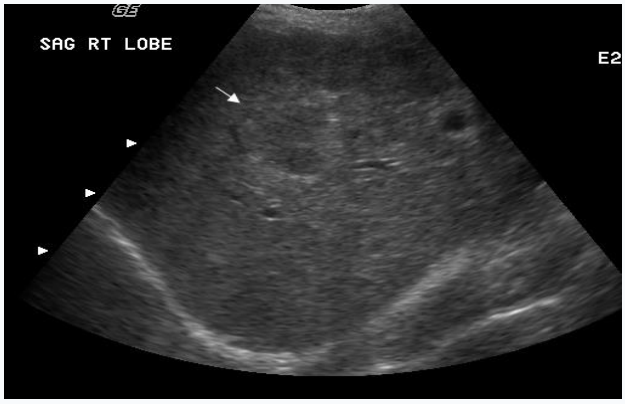
Liver abscess

Hemangiomas

* A benign tumor formed by a collection of excess blood vessels, and it may be visible through the skin as a birthmark, known colloquially as a “strawberry mark”.



Metastasis*



HCC

Hydatid cyst

Liver cyst

* It could occur hypoechoic or hyperechoic depending on the primary tumor.

Vascular abnormality

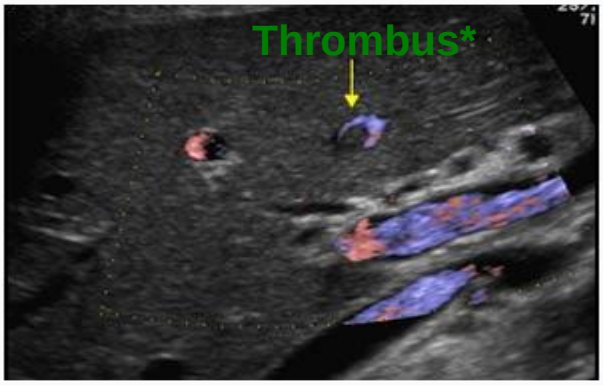
- **Portal venous system (using duplex):**

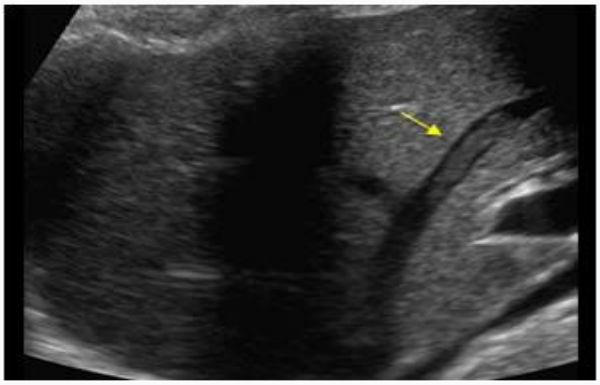
- Thrombosis.
- Portal hypertension.

- **Hepatic venous system:**

- Thrombosis.*
- (Budd Chiari syndrome).

PV thrombosis





Hepatic vein thrombosis

Budd -Chiari syndrome EXTRA

Budd–Chiari syndrome is a very rare condition, affecting 1 in a million adults. The condition is caused by occlusion of the hepatic veins that drain the liver. It presents with the classical triad of abdominal pain, ascites, and liver enlargement.

* To measure the pressure & diameter of the thrombus.
** Felling defect.

Biliary abnormality

- **Intra-hepatic biliary radicals**:

Less than 3mm.

- **Extra-hepatic "CBD":**

Less than 8mm More than this is considered dilatation.

- **Causes of dilatation & obstruction:**

- Intra-luminal:

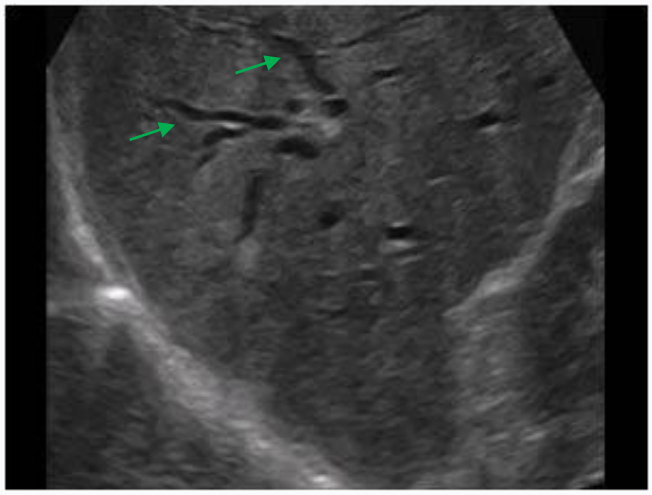
Stone & mass.

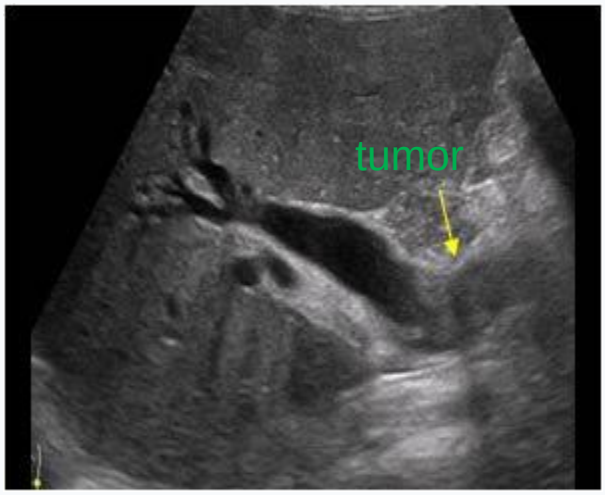
- Mural:

stricture (benign & malignant).

- Extrinsic:

Compression mass & Lymph node.





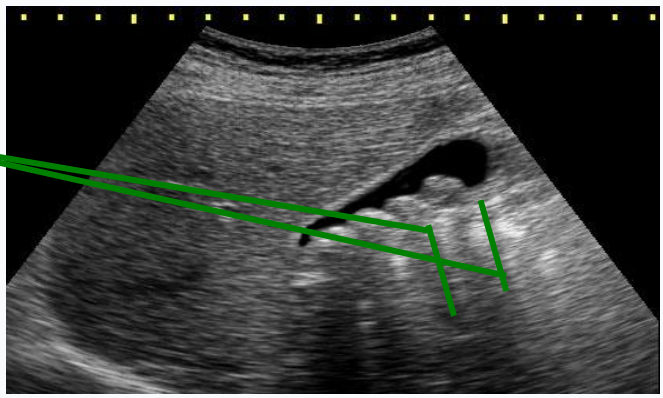
Pathology of gall bladder:

- Intra-luminal pathology.
- Mural pathology.

Intra-luminal pathology

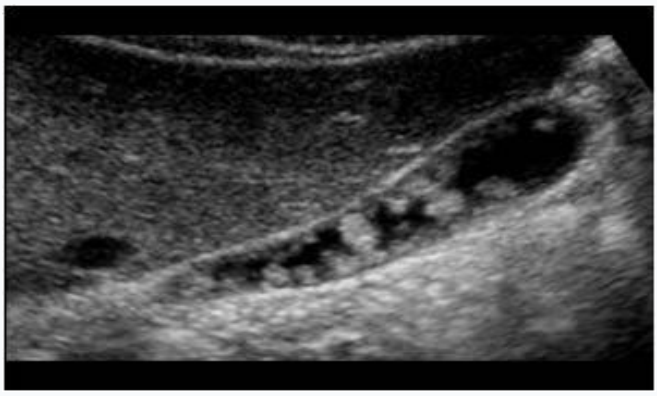
- **Gall stone*:**

Acoustic shadowing.
The black cyst is the gall bladder.



- **Polyps**

No acoustic shadowing.

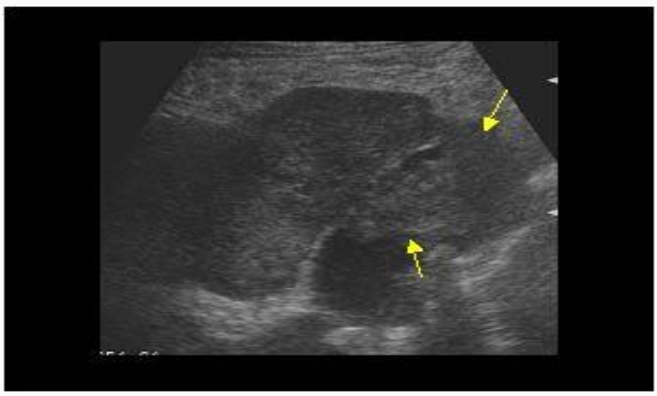


- **Intraluminal:**

Mass lesion.

+/- invasion.

Gall bladder carcinoma.



* The most common pathology diagnosed by US.

Why do we see acoustic shadowing? Because the waves will not penetrate the hard stones and will be reflected as a shadow.

Mural pathology

Mural thickening:

- **Primary:**
  Cholecystitis.

- **Secondary:**

- Cardiac failure.

- Cirrhosis.

- Ascites

- Hypoalbuminaemia

- Renal failure.

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 We should do US because RUQ and fever
- Lab high LFTs & WBC.

Thick wall

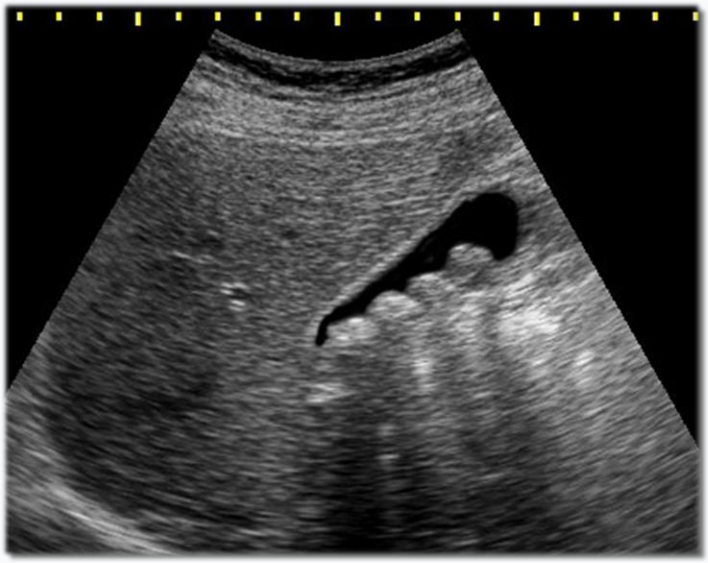
Thickening

- Thickening of GB wall >3mm.
- Distended GB
- Pericholecystic fluid.
- Hyperemia.
- Gall stone
- **Diagnosis: Acute calcular cholecystitis.**
- Differential diagnosis: Hepatitis.

Case Two

Middle age women presented to surgical out patient 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:** Gall stone Or fatty liver if the lady obese
- obese lady well not distressed, febrile or jaundiced.
- Lab LFTs normal.



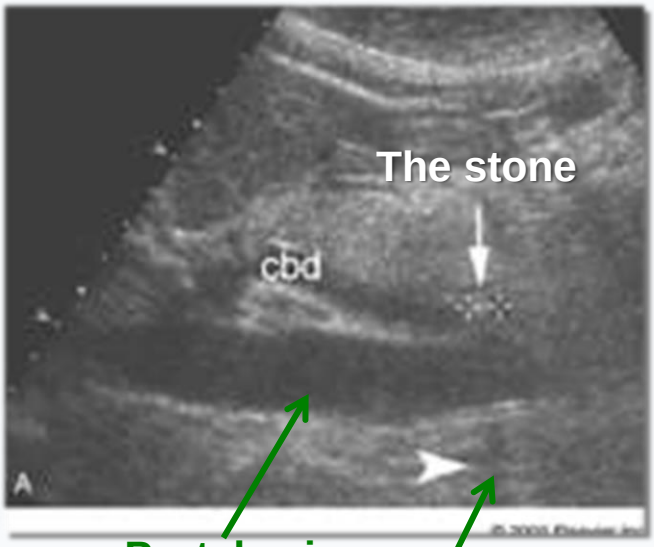
Gall stone
Acoustic shadow

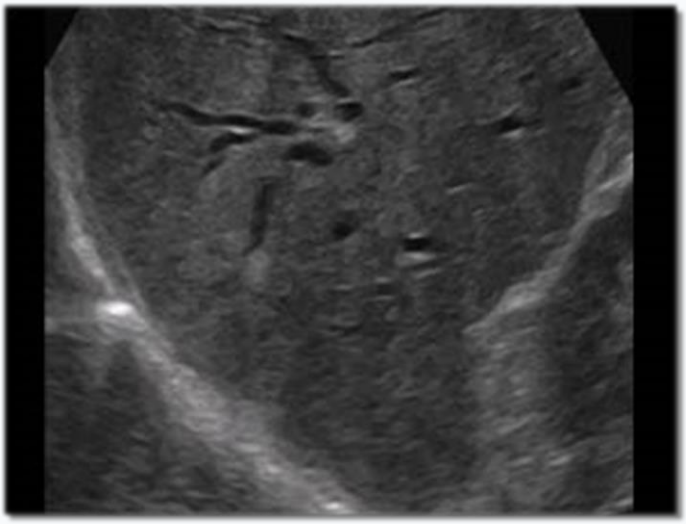
- Multiple oval shaped echogenic structures seen within GB causing acoustic shadowing.
- **Diagnosis: GB stones.**

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 intra-hepatic and extra-hepatic biliary system.
- Echogenic structure seen within CBD stone.
- **Diagnosis: CBD* stone causing biliary obstruction.**

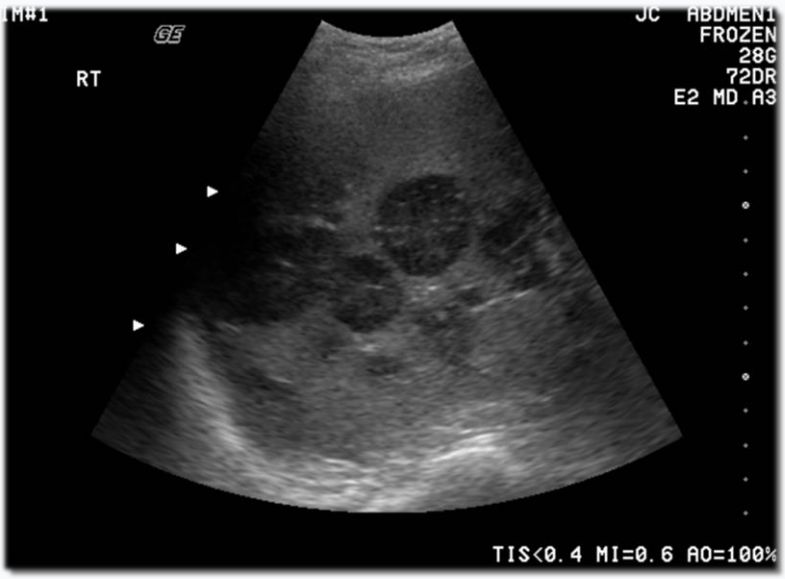
Radiology

* CBD: common bile duct.

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

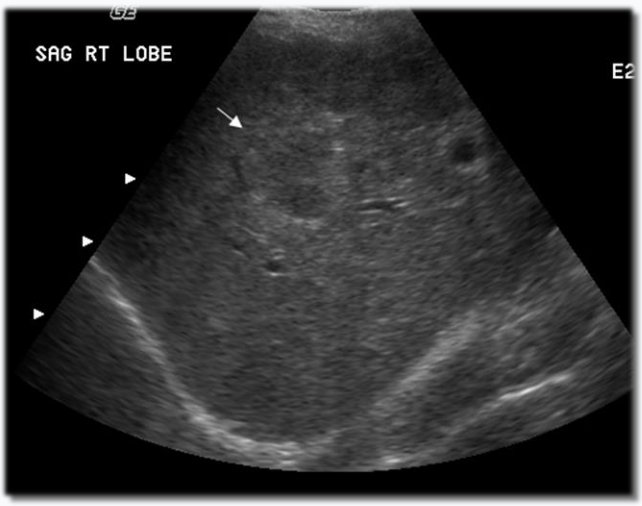


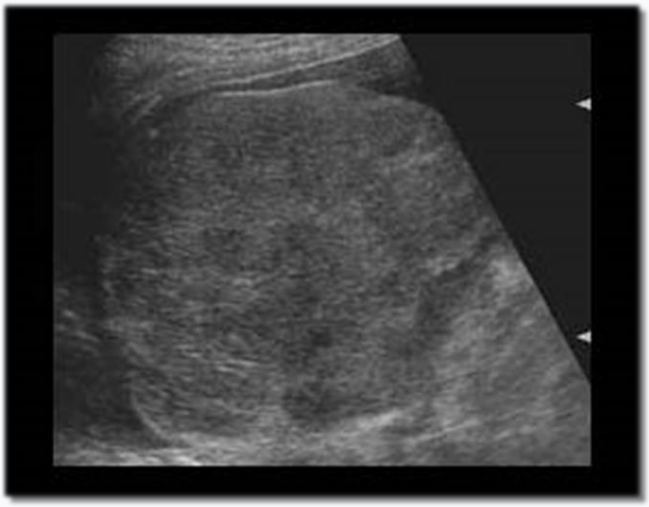
- Multiple hypoechoic focal hepatic lesions.
- **Diagnosis: Metastatic liver lesions.**

Case Five

Middle age man known case of HCV+ for 10 years presented to GI out patient 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.



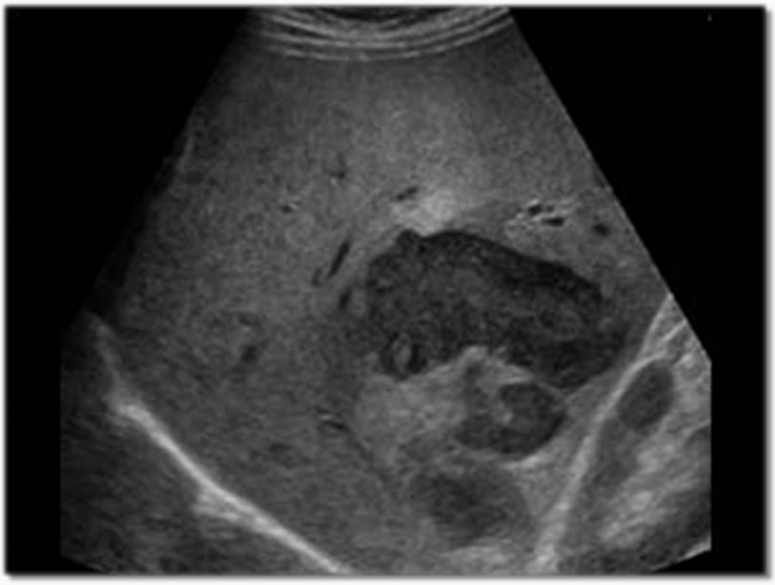


- Shrunken liver with irregular outline.
- Heterogeneous appearance.
- Focal hypoechoic lesion.
- **Diagnosis: Cirrhotic liver with HCC** Hepatocellular carcinoma.

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.
- **Diagnosis: Liver abscess.**

Summary

Ultrasound	
Advantages	**Disadvantages**
1-safe and **non-ionizing** 2-easy and available 3- inexpensive 4-noninvasive	1- **operator dependent** 2- inability to penetrate gas or bone
Liver abnormalities	
Hepatomegaly	**Shrunken liver**
1- early cirrhosis 2- fatty infiltration in liver 3- hepatitis 4- heart failure	1- Late cirrhosis 2- Ascites 3- Portal hypertension
Biliary system	
Intra- hepatic : Lesser than **3mm**	Extra – Hepatic "common bile duct": Lesser than **8mm**
Gall bladder pathology	
1-	- Polyp : No acoustic shadowing	- Gall stone : Acoustic shadowing
2-	- Acute cholecystitis > wall thickening off gall bladder	

Thanks to our friend (Elham Alobaid) for sharing us her summary.

Thank you for checking our work =)!

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References

Males' and females' slides

Feedback!

Editing file

Test yourself

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