

King Saud University

College of medicine



US of liver and gall stone

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outline:

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

Introduction to US



History OF US

- ▶ Piezoelectricity discovered by the Curies in 1880 using natural quartz.
- ▶ Piezoelectric Effect is the ability of certain materials to generate an electric charge in response to applied mechanical stress.
- ▶ (US) SONAR was first used in 1940's war-time
- ▶ Diagnostic Medical applications in use since late 1950's

Definition:

- ▶ a diagnostic technique in which high-frequency sound waves 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 - 15 MHz

US machine

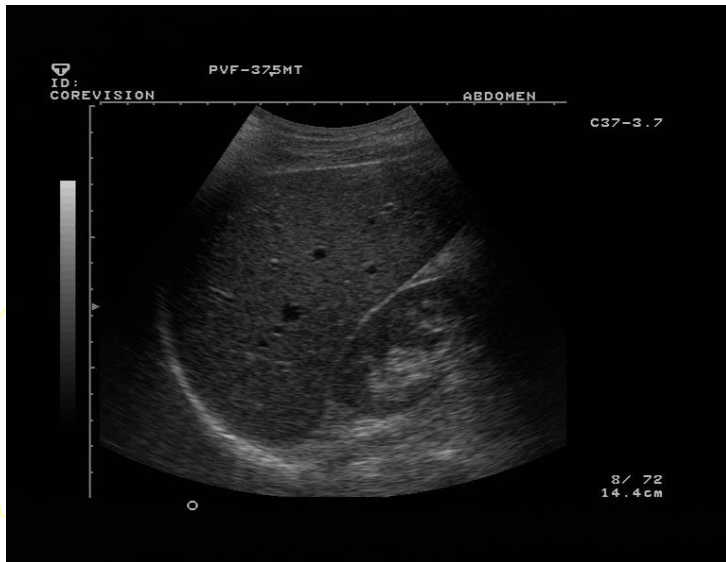


MACHINE

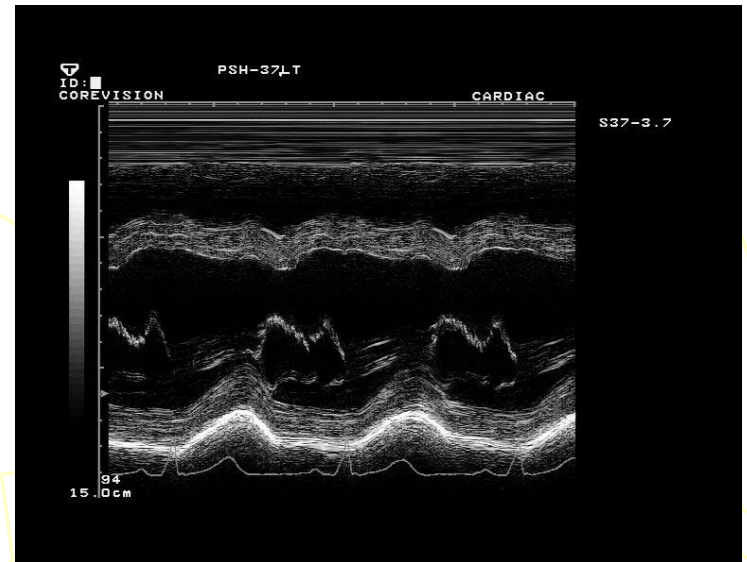


PROBES

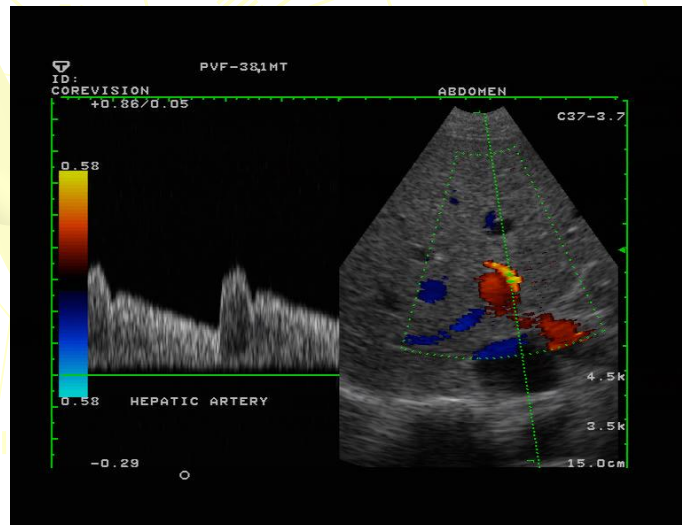
B- MODE.



M- MODE.



DUPLEX



COLOR DOPPLER



US uses:

▶ Cardiology

Echocardiography is an essential tool in cardiology, vavular heart disease.

▶ Emergency Medicine:

for Trauma patient and acute abdomen.

▶ Gastroenterology:

In abdominal sonography, the solid organs of the abdomen such as the pancreas, aorta, inferior vena cava, liver, gall bladder, bile ducts, kidneys, spleen and appendix.

▶ Gynecology:

to assess female pelvic organs, uterus ovaries

▶ Neonatology:

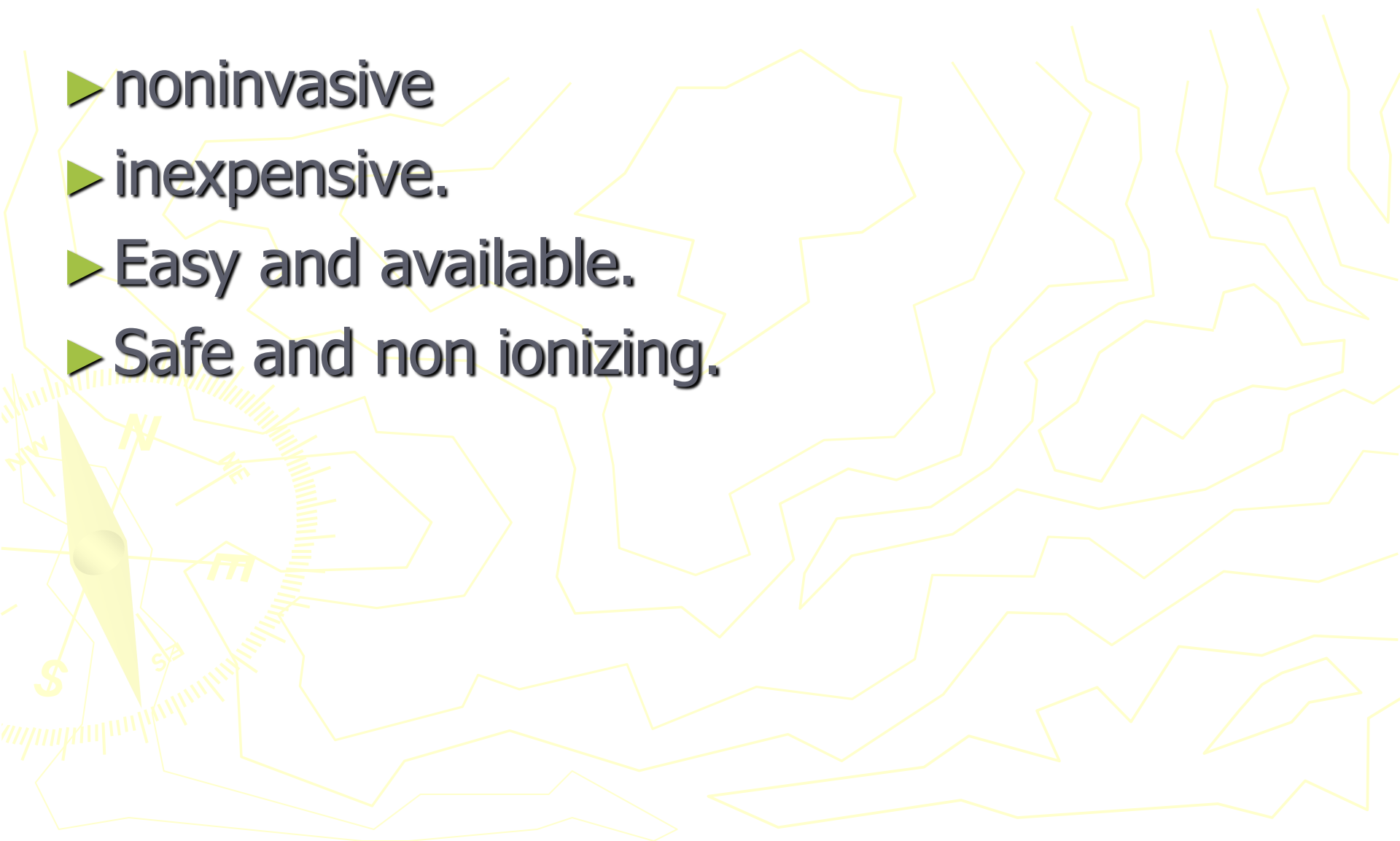
for basic assessment of intracerebral structural abnormalities, bleeds, ventriculomegaly or hydrocephalus.

Cont.

- ▶ Neurology
- ▶ for assessing blood flow and stenoses in the carotid arteries (Carotid ultrasonography)
- ▶ Obstetrics:
- ▶ sonography is commonly used during pregnancy to check on the development of the fetus.
- ▶ Urology:
- ▶ to study a patient's bladder, prostate or testes.
- ▶ Musculoskeletal
- ▶ For assessing tendons, muscles, nerves, ligaments, soft tissue masses, and bone surfaces
- ▶ vascular system:
- ▶ To assess patency and possible obstruction of arteries Arterial doppler, diagnose DVT venous doppler and determine extent and severity of venous insufficiency

Advantages of US

- ▶ **noninvasive**
- ▶ **inexpensive.**
- ▶ **Easy and available.**
- ▶ **Safe and non ionizing.**



Disadvantages of US

- ▶ **Inability to penetrate gas or bone.**
- ▶ **Operator dependant.**
- ▶ **Less sensitive in some situations.**



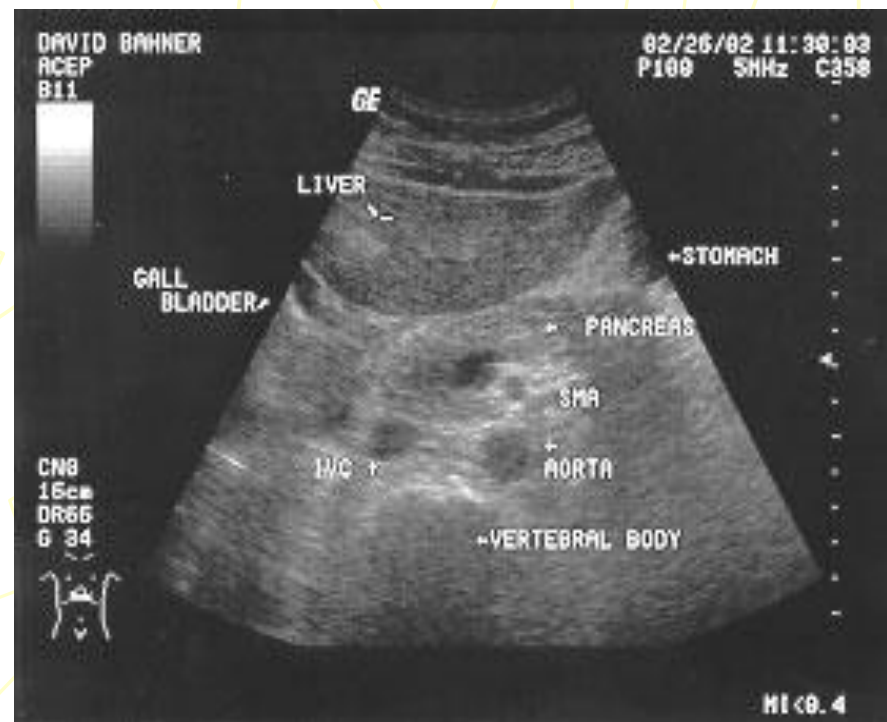
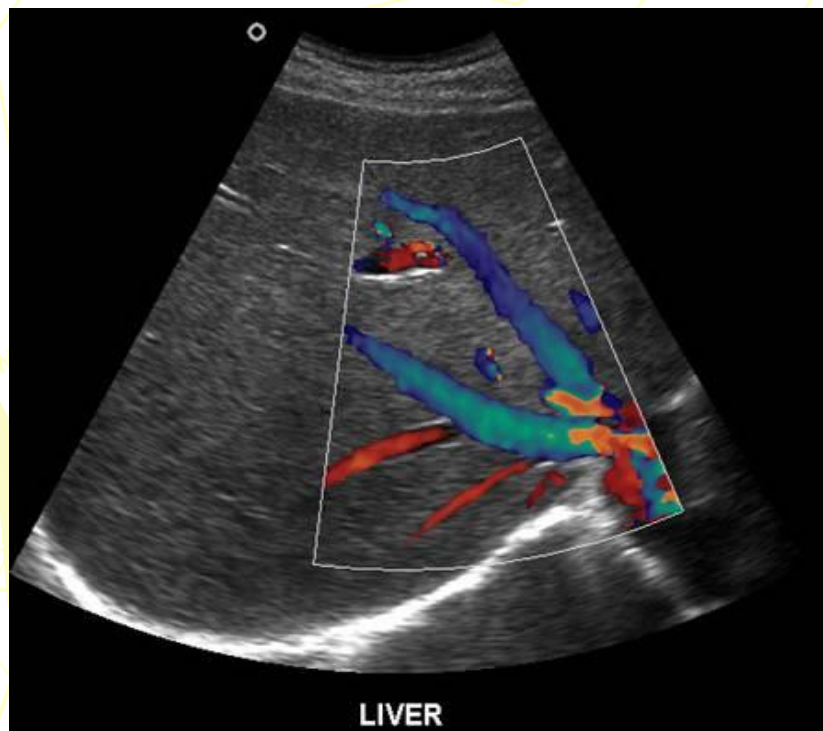
Indications of liver and gall bladder US

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

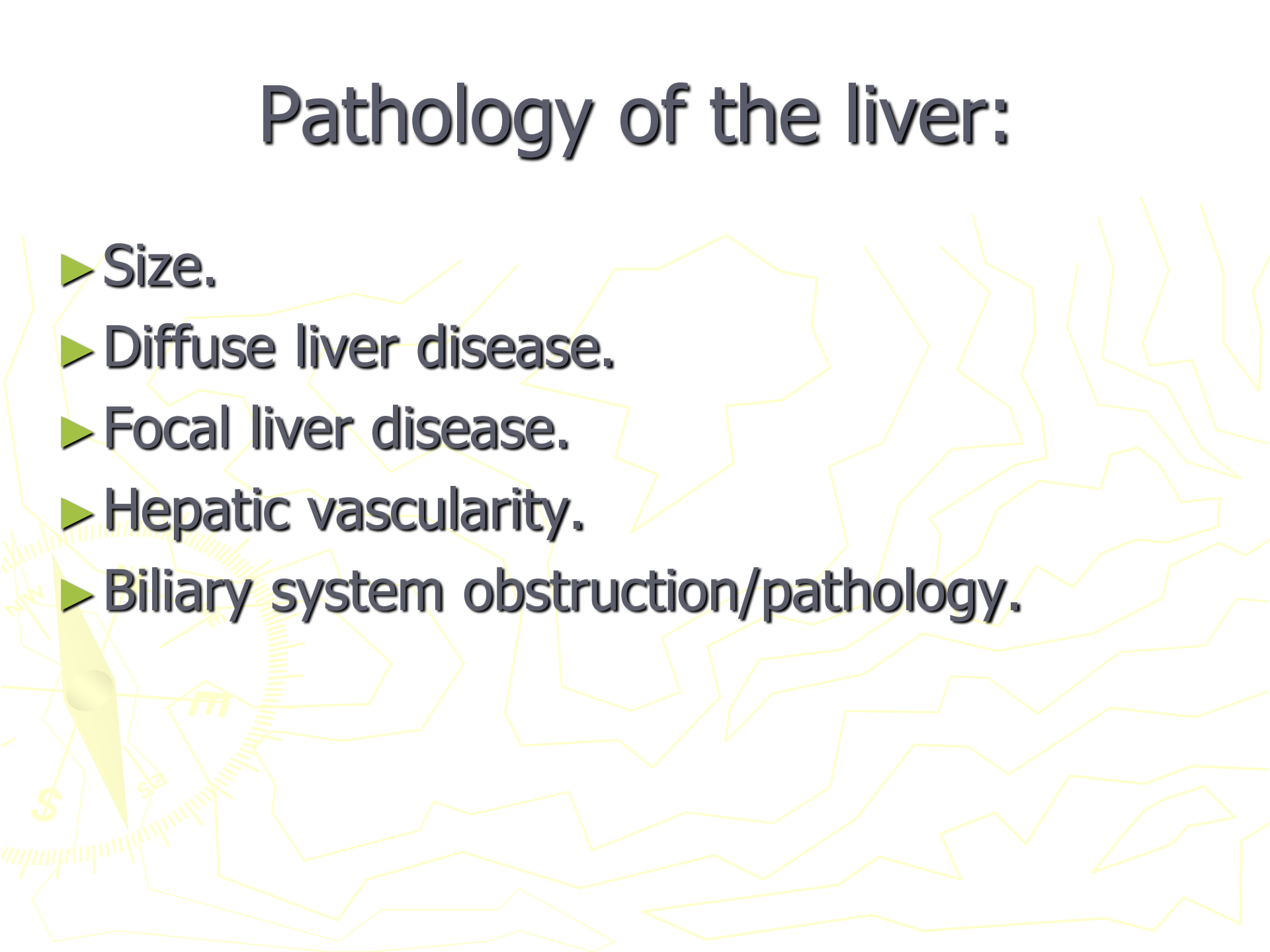
Normal anatomy and radiological appearance



Cont.



Pathology of the liver:

- ▶ **Size.**
 - ▶ **Diffuse liver disease.**
 - ▶ **Focal liver disease.**
 - ▶ **Hepatic vascularity.**
 - ▶ **Biliary system obstruction/pathology.**
- 
- The background features a complex pattern of thin, yellow, irregular lines that resemble a topographic map or a network of paths. In the lower-left corner, there is a stylized compass rose with a yellow needle pointing towards the upper-left. The compass rose includes directional markers for 'NW' and 'SE', and a yellow dollar sign (\$) is positioned near the needle's base.

Size abnormality

- ▶ Normal liver size:
15 cm at MCL.
- ▶ Hepatomegaly:
 - Infective eg viral hepatitis.
 - Neoplastic eg. Metastasis.
 - Degenerative eg. early cirrhosis.
 - Raised venous pressure eg. Congestive cardiac failure.
 - Storage disorder eg. Amyloidosis.
 - Myeloproliferative disorder eg. Polycythaemia rubra vera.



Cont.

- ▶ Small shrunken liver:
- ▶ Late cirrhosis:
- ▶ Shrunken liver with irregular outline
- ▶ Ascitis
- ▶ Portal hypertension.
- ▶ +/- focal lesion.



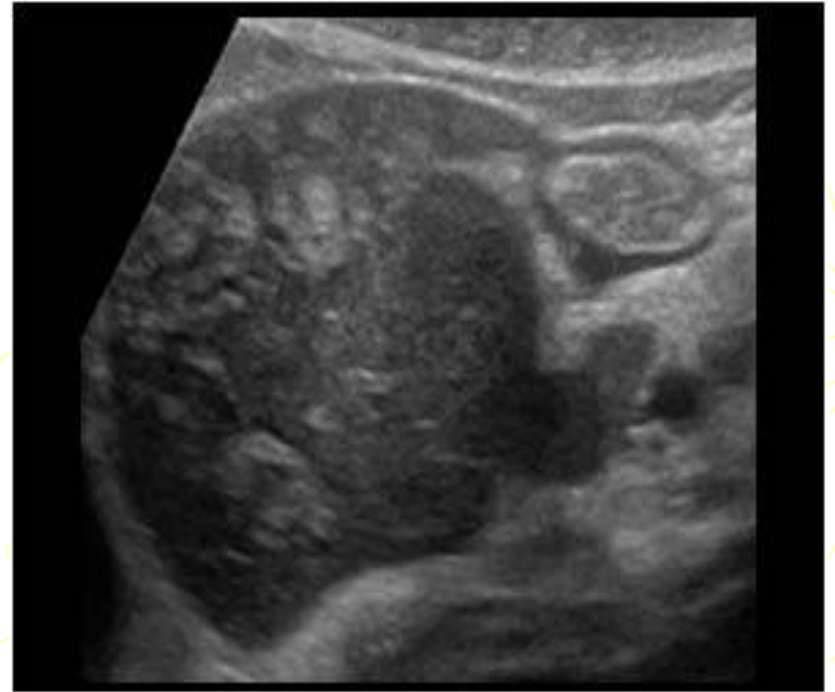
Diffuse abnormality

- ▶ Diffuse increase parenchymal echogenicity (whiter than normal)
- ▶ Diffuse fatty infiltration.
- ▶ Other infiltrative:
 - Malignant
 - Infectious
 - Glycogen storage disease



Cont.

- ▶ 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

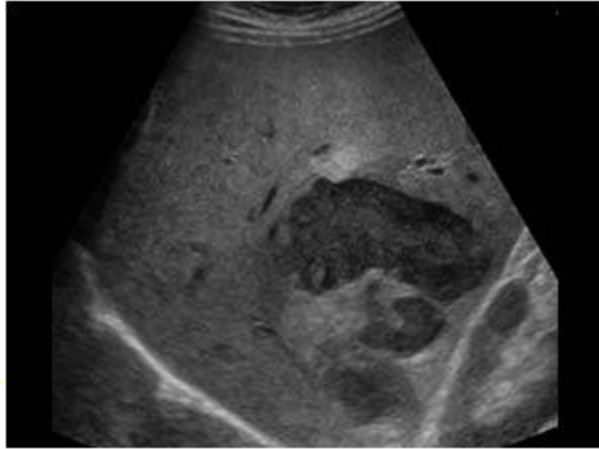
- ▶ hydated cyst.

- Congenital:

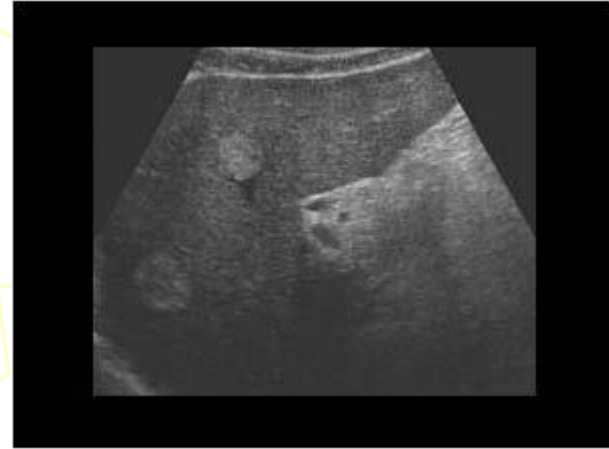
- ▶ Hepatic cyst.

Cont.

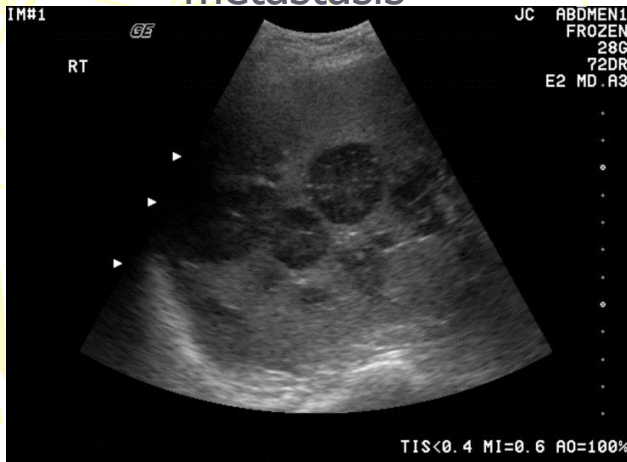
Liver abscess



hemangiomas



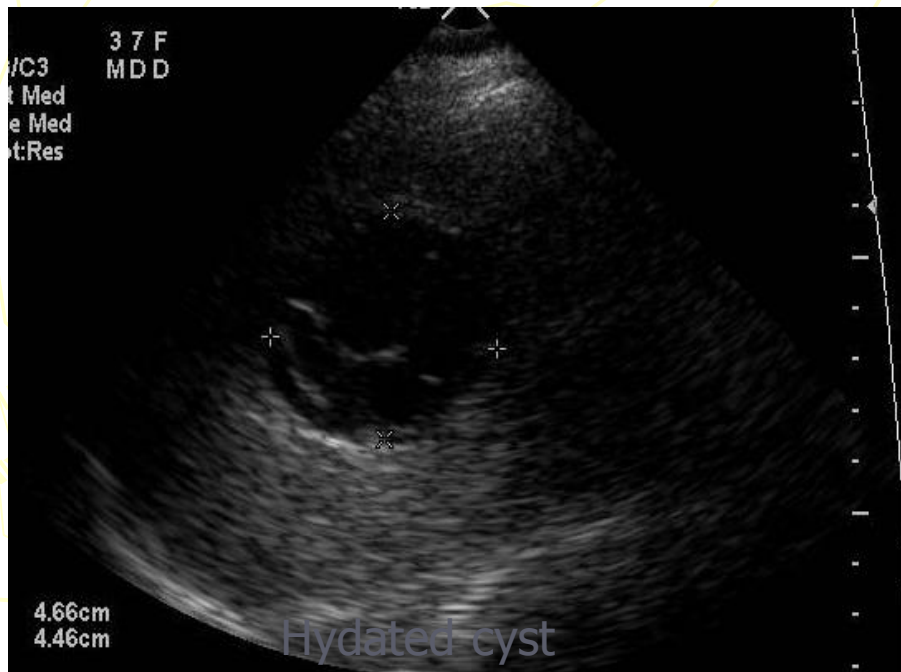
metastasis



HCC



Cont.



Vascular abnormality

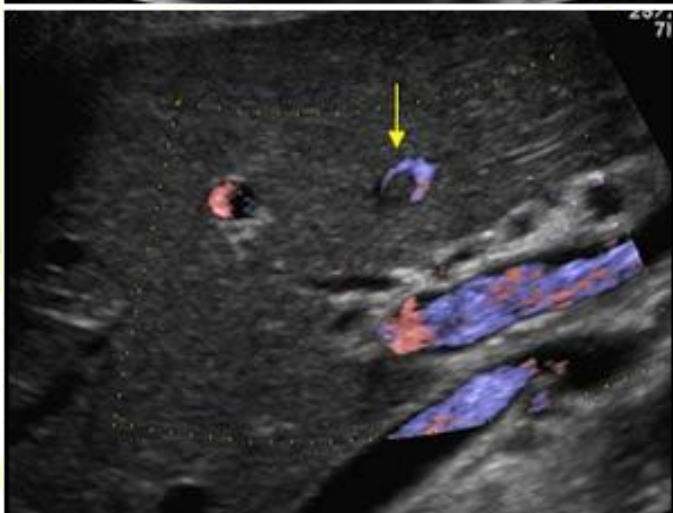
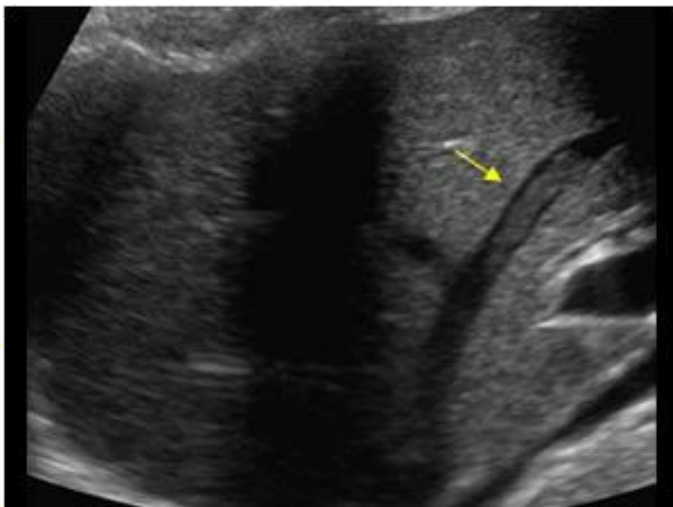
□ Portal venous system:

- ▶ thrombosis.
- ▶ Portal hypertension.

□ Hepatic venous system:

- ▶ Thrombosis
- ▶ (budd chiari syndrome).

Cont.



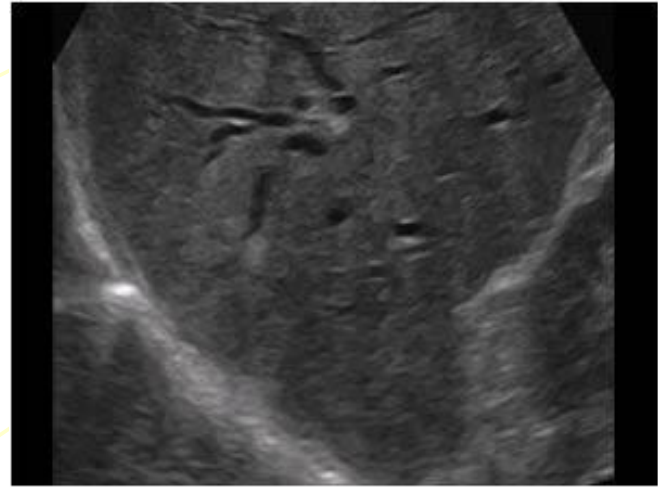
Hepatic vein thrombosis



PV thrombosis

Biliary abnormality

- ▶ Intra-hepatic biliary radicals.
Less than 3mm
- ▶ Extra-hepatic “CBD”
Less than 8mm
- ▶ 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.

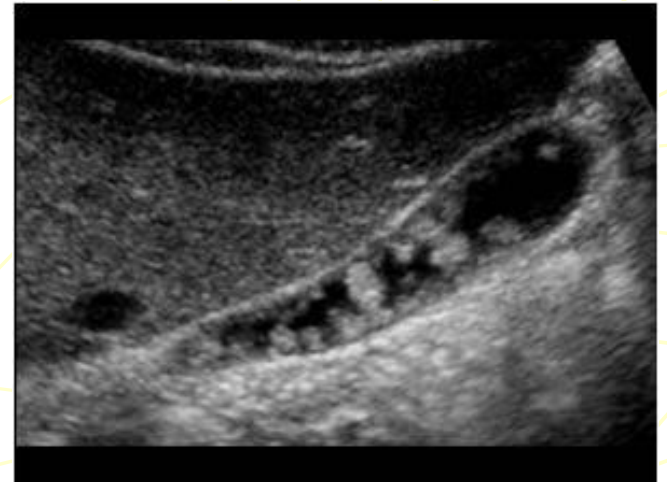


Intra-luminal pathology

► Gall stone:
Acoustic shadowing

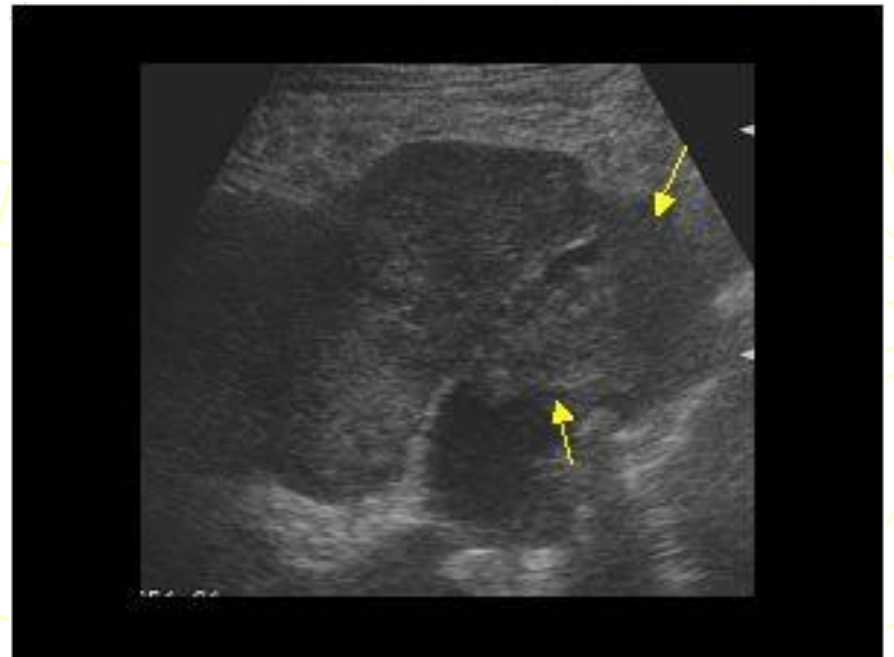


► Polyps
No acoustic shadowing.



Cont.

- ▶ **Intraluminal:**
Mass lesion
+ - invasion
Gall bladder carcinoma.



Mural pathology

□ Mural thickening:

➤ Primary:
Cholecystitis.

➤ Secondary:

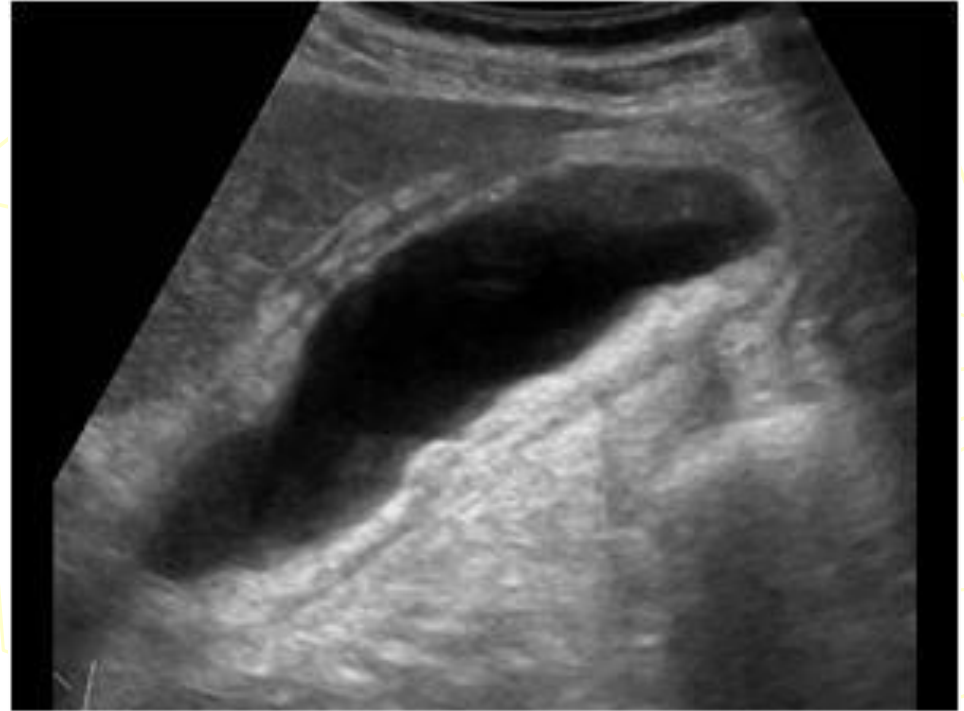
✓ Cardiac failure.

✓ Cirrhosis.

✓ ascitis

✓ Hypoalbuminaemia

✓ Renal failure.



Common pathological cases



Case one

▶ Middle age women presented to ED with fever, RUQ pain

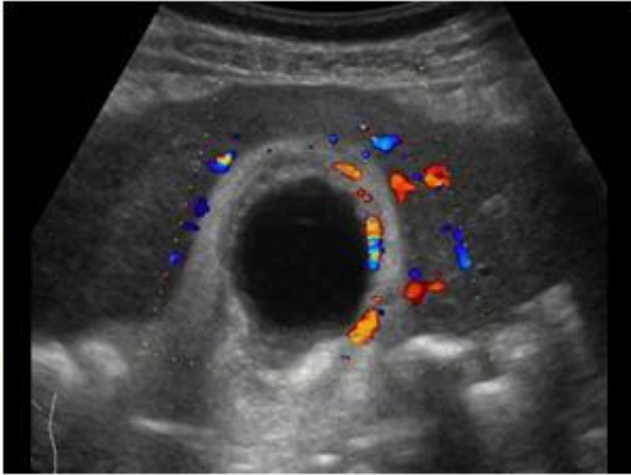
▶ On exam

She looks ill, febrile and on pain

Abdomen: RUQ tenderness

▶ Lab high LFTs & WBC.

Cont.



- ▶ Thickening of GB wall $>3\text{mm}$.
- ▶ Distended GB
- ▶ Pericholecystic fluid.
- ▶ Hyperemia.
- ▶ Gall stone
- ▶ Acute calcular cholecystitis.

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:
obese lady well not distressed, febrile or jaundiced.
- ▶ Lab LFTs normal.

Cont.

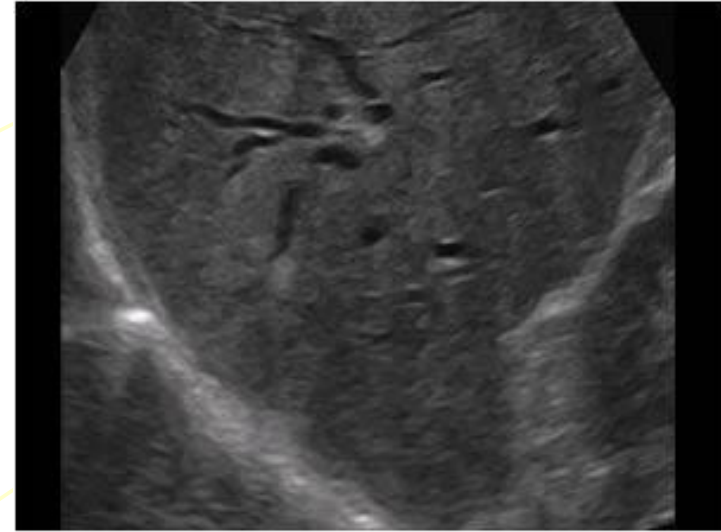


- ▶ Multiple oval shaped echogenic structures seen within GB causing acoustic shadowing
- ▶ GB stones

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.

Cont.

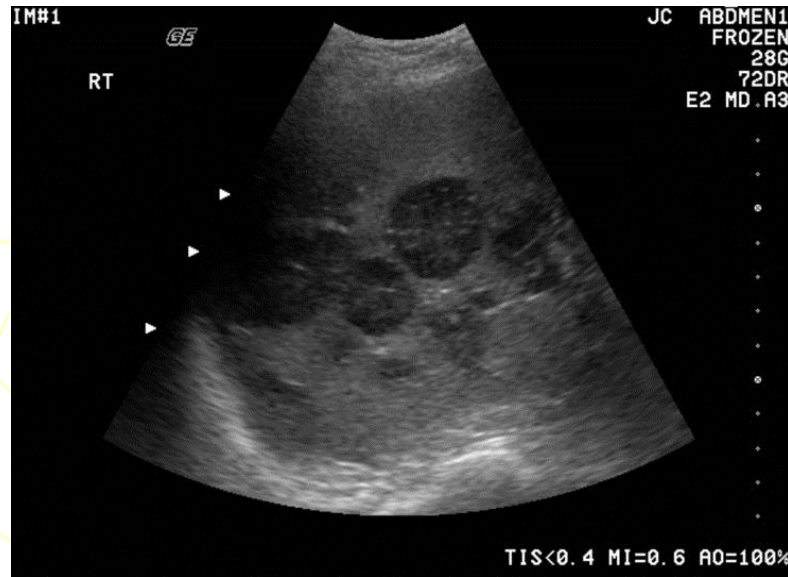


- ▶ Dilated intra-hepatic and extra-hepatic biliary system
- ▶ Echogenic structure seen within CBD
- ▶ CBD stone causing biliary obstruction.

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.

Cont.

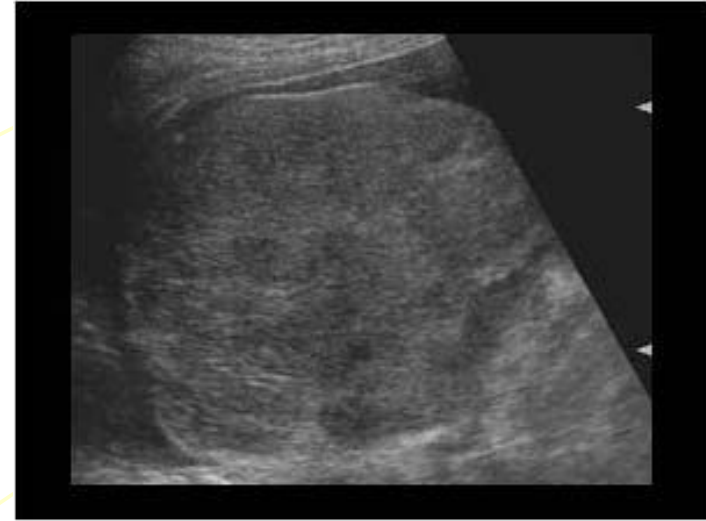


- ▶ Multiple hypoechoic focal hepatic lesions
- ▶ Metastatic liver lesions.

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.

Cont.

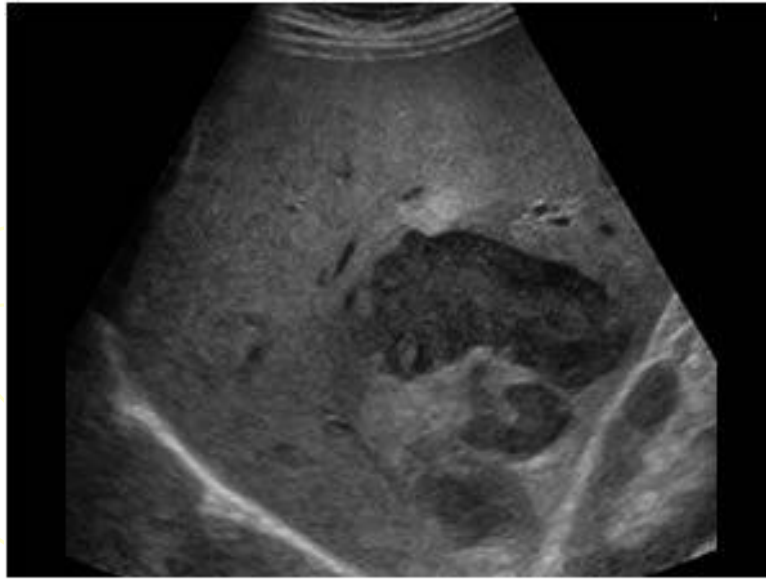


- ▶ Shrunken liver with irregular outline.
- ▶ Heterogeneous appearance.
- ▶ Focal hypoechoic lesion.
- ▶ Cirrhotic liver with HCC.

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.

Cont.



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



thank you

Radiology:
The Eye of
Medicine