

King Saud University

College of medicine

Ultrasound of Liver and Gallstones

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Outline

- ▶ Introduction to Ultrasound (US).
- ▶ Indications of liver and Gallbladder US.
- ▶ Normal anatomy and radiological appearance.
- ▶ Pathology of liver and Gallbladder.
- ▶ 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 of US

- ▶ 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

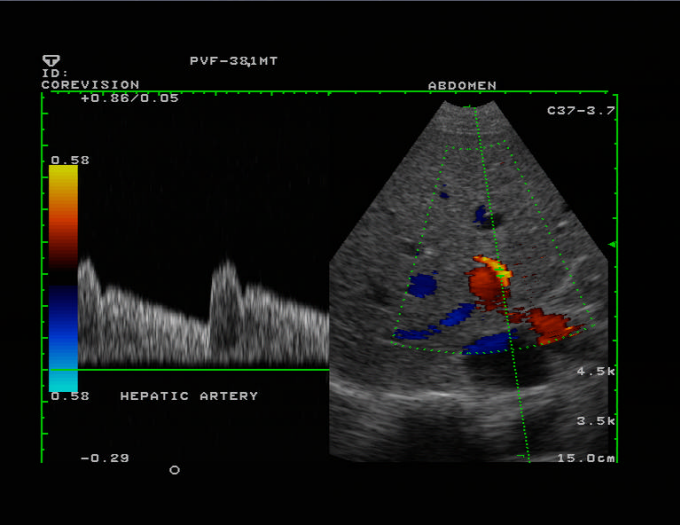
B- MODE



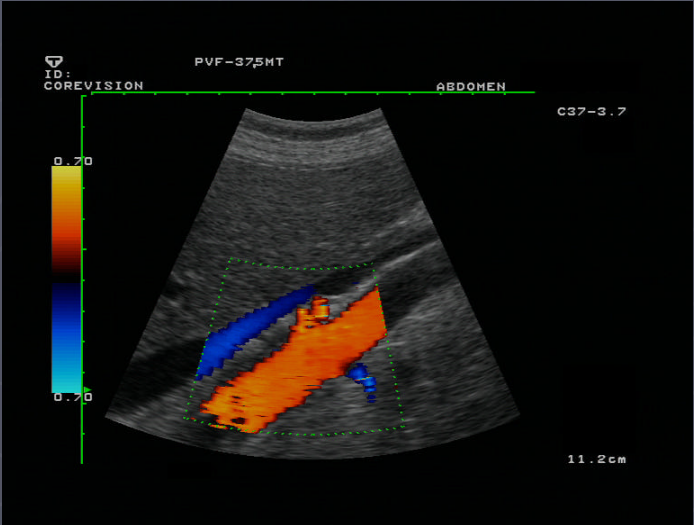
M- MODE



DUPLEX



COLOR DOPPLER



US Uses

▶ Cardiology:

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

▶ Emergency Medicine:

For Trauma patient and acute abdomen.

▶ Gastroenterology:

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

▶ Gynecology:

To assess female pelvic organs, uterus and ovaries.

▶ Obstetrics:

Commonly used during pregnancy for dating, anatomical survey and to assess fetal growth.

US Uses

▶ Neurology:

To assess carotid arteries blood flow and stenosis (Carotid ultrasonography)

▶ Neonatology:

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

▶ Urology:

To study patient's bladder, prostate or testes.

▶ Musculoskeletal:

For assessing tendons, muscles, nerves, ligaments, soft tissue masses, and bone surfaces.

▶ Vascular system:

To assess patency vs occlusion of arteries (Arterial Doppler), veins (Venous Doppler) and determine the extent and severity of venous insufficiency.

Advantages and Disadvantages of US

► Advantages:

- Noninvasive.
- Inexpensive.
- Easy and available.
- Safe and non ionizing.

► Disadvantages:

- Inability to penetrate gas or bone.
- Operator dependent.
- Less sensitive in some situations.

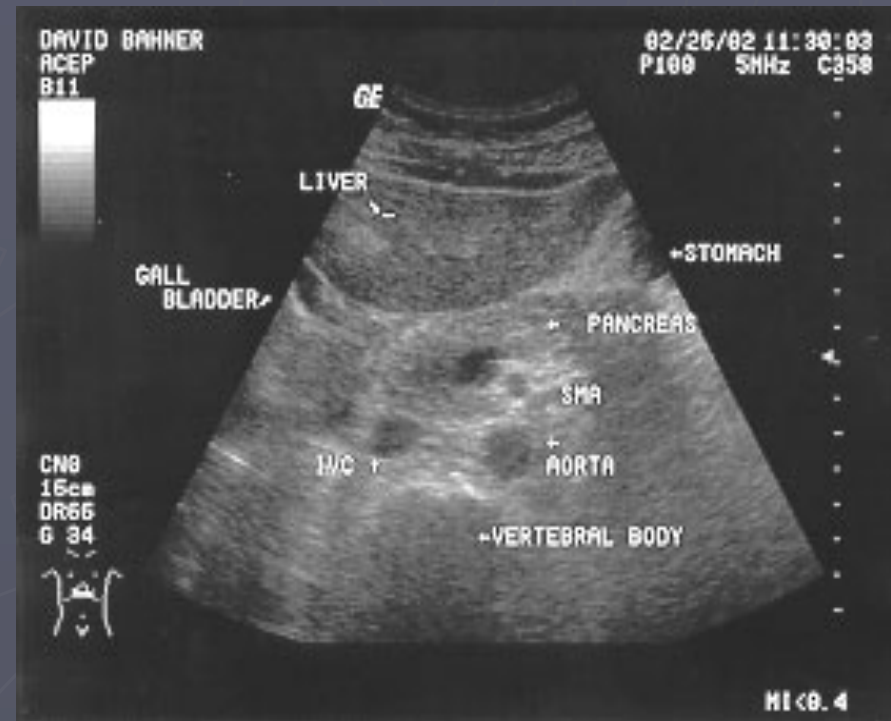
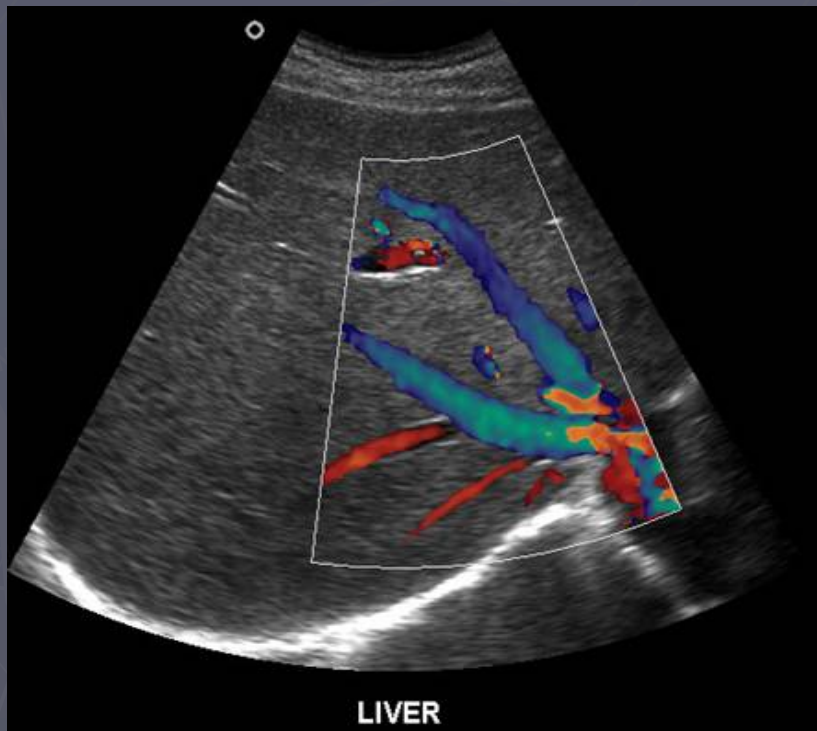
Indications of Liver and Gallbladder US

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

Normal Anatomy and Radiological Appearance



Normal Anatomy and Radiological Appearance



Pathologies of the Liver

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

Size Abnormalities

- ▶ 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.



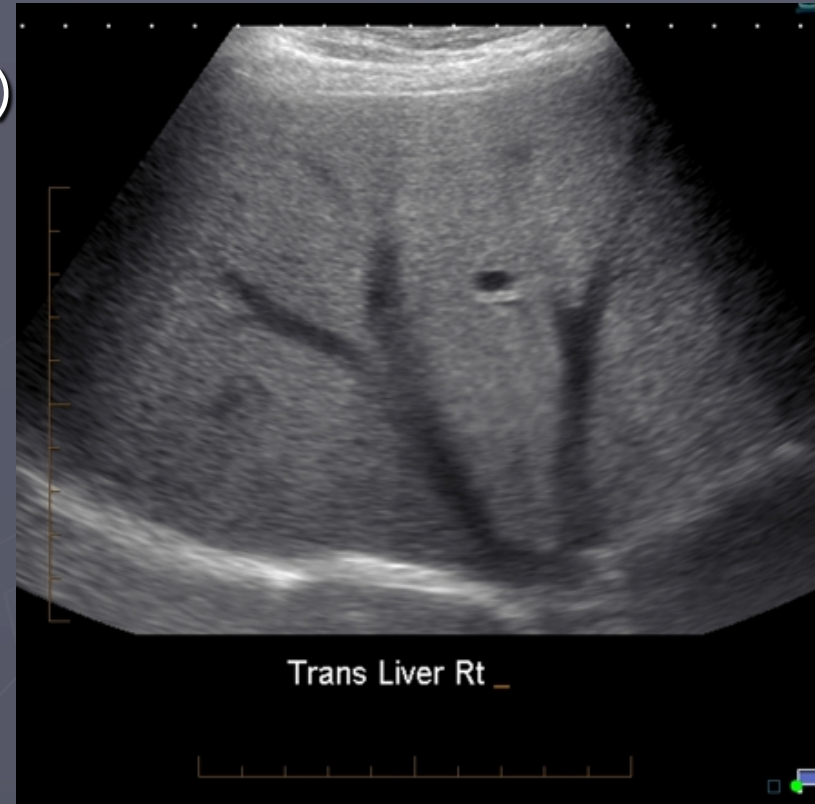
Size Abnormalities

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



Diffuse/ Infiltrative Abnormalities

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



Diffuse/ Infiltrative Abnormalities

- ▶ Decreased parenchymal echogenicity (darker than normal)
 - Acute hepatitis
 - Other:
 - ▶ Malignant infiltration

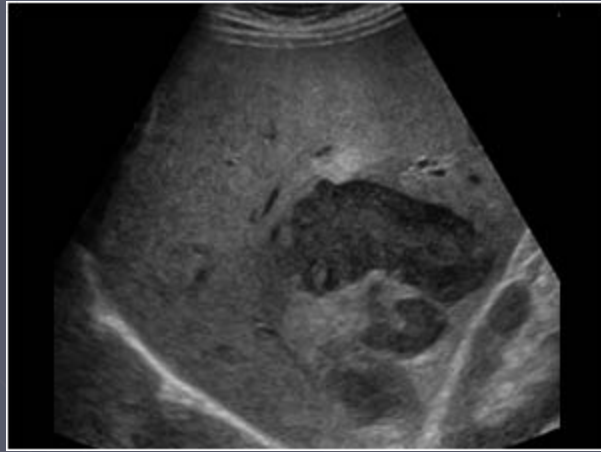


Focal Liver Lesions

- ▶ Benign tumor:
 - Hemangioma.
- ▶ Malignant tumor:
 - Primary: eg. Hepatocellular carcinoma (HCC).
 - Secondary metastasis: eg. Colon or breast cancer.
- ▶ Infective:
 - Abscess.
 - Hydatid cyst.
- ▶ Congenital:
 - Hepatic cysts.

Focal Liver Lesions

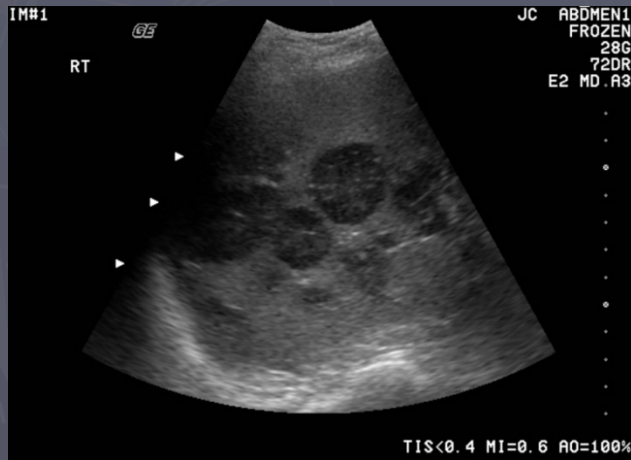
Liver abscess



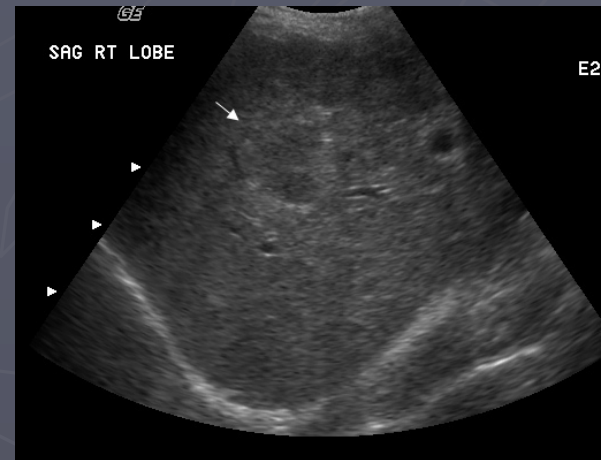
Hemangiomas



Metastasis



HCC



Focal Liver Lesions

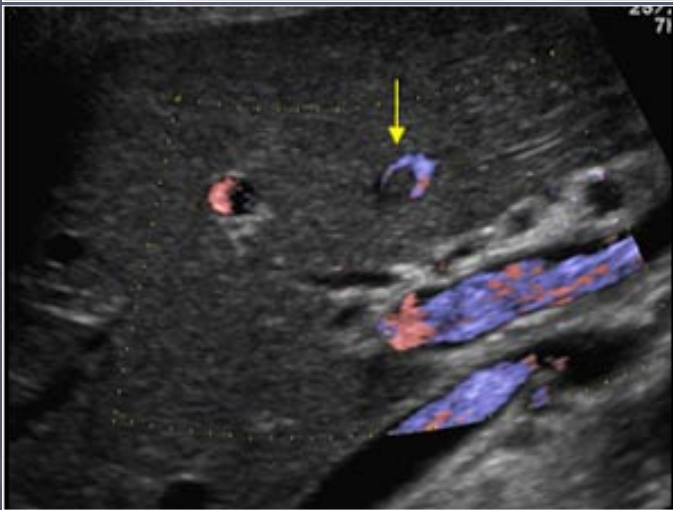
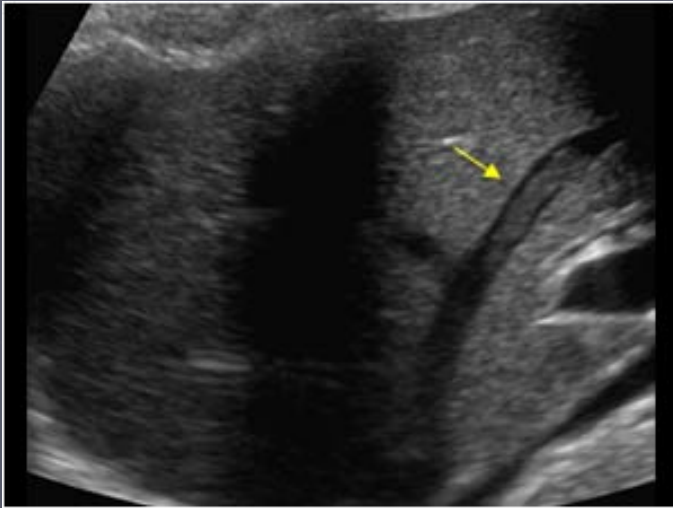


Vascular Abnormalities

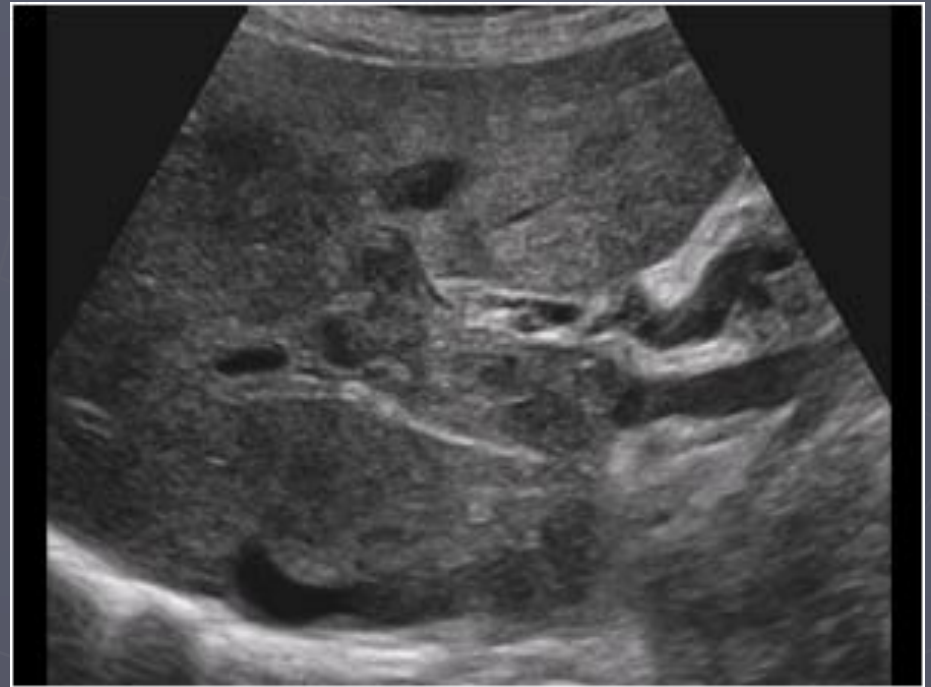
- ▶ Portal venous system:
 - Thrombosis.
 - Portal hypertension.

- ▶ Hepatic venous system:
 - Thrombosis.
 - Budd-chiari syndrome.

Vascular Abnormalities



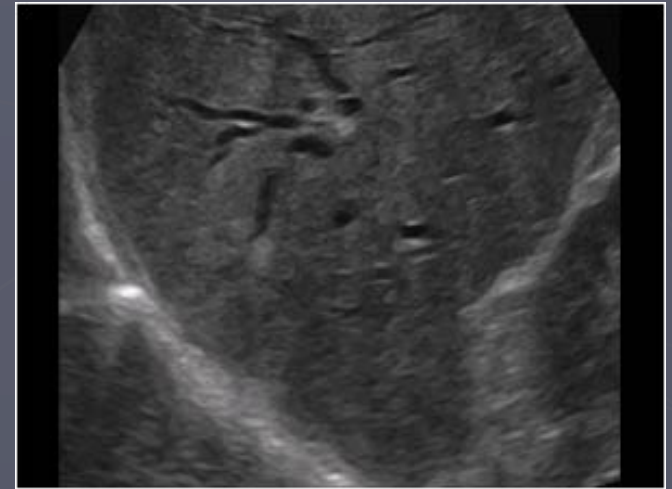
Hepatic vein thrombosis



PV thrombosis

Biliary System Abnormalities

- ▶ Normal Intra-hepatic biliary radicals:
<3mm
- ▶ Normal Extra-hepatic “CBD”: <8 mm
- ▶ Causes of dilatation & obstruction:
 - Intra-luminal:
 - ▶ Stone & mass.
 - Mural:
 - ▶ Stricture (benign & malignant)
 - Extrinsic:
 - ▶ Compression mass & Lymph node



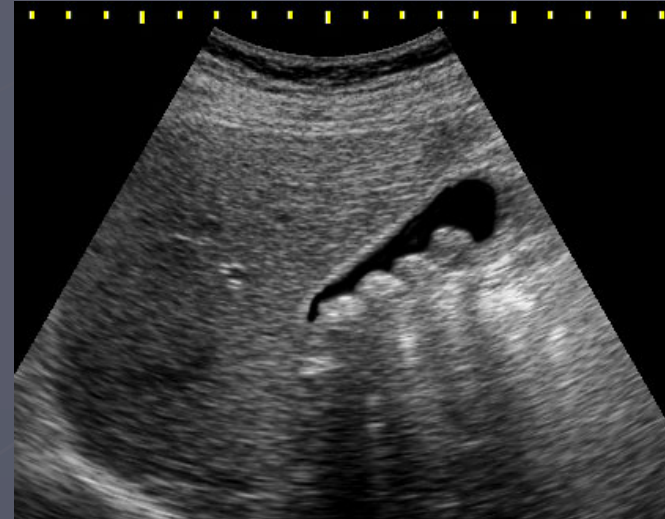
Pathologies of Gallbladder

- ▶ Intra-luminal pathologies.
- ▶ Mural pathologies.

Intra-luminal pathologies

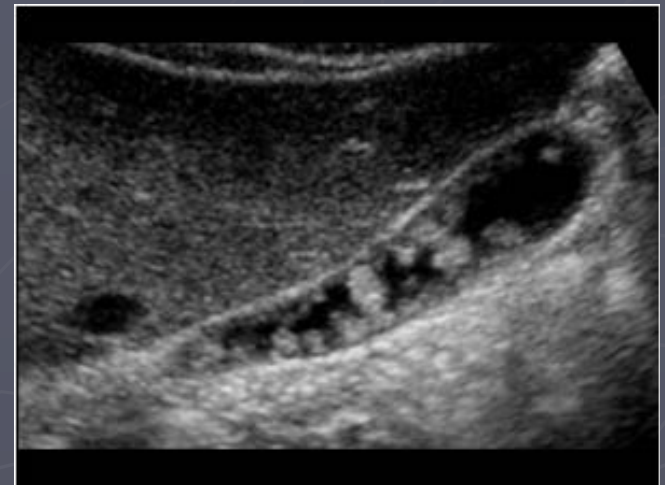
▶ Gallstones:

- Posterior acoustic shadowing
- Mobile/non-mobile



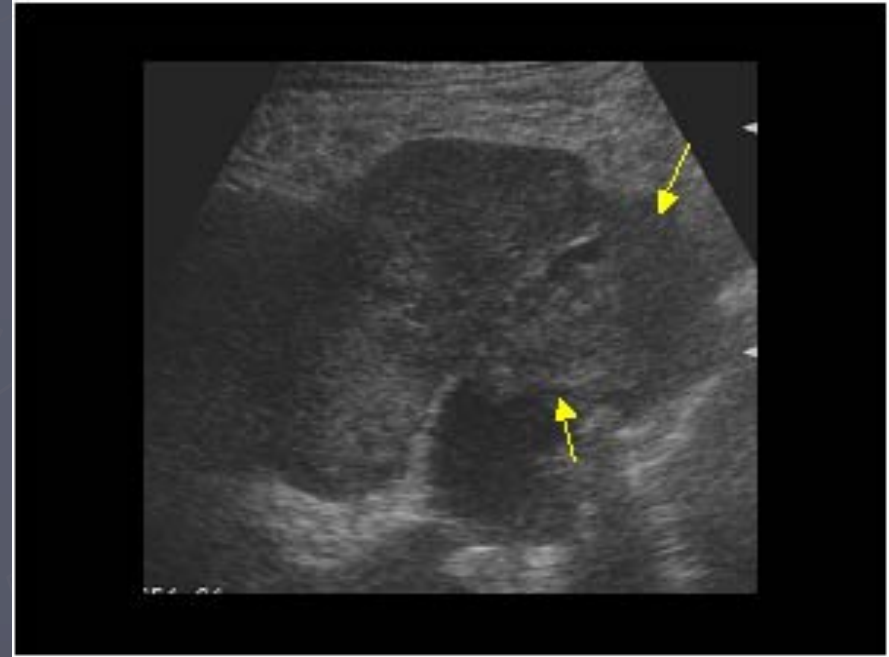
▶ Polyps

- No acoustic shadowing
- Non-mobile



Intra-luminal pathologies

- ▶ Mass, +/- invasion
 - Gall bladder carcinoma.



Mural pathologies

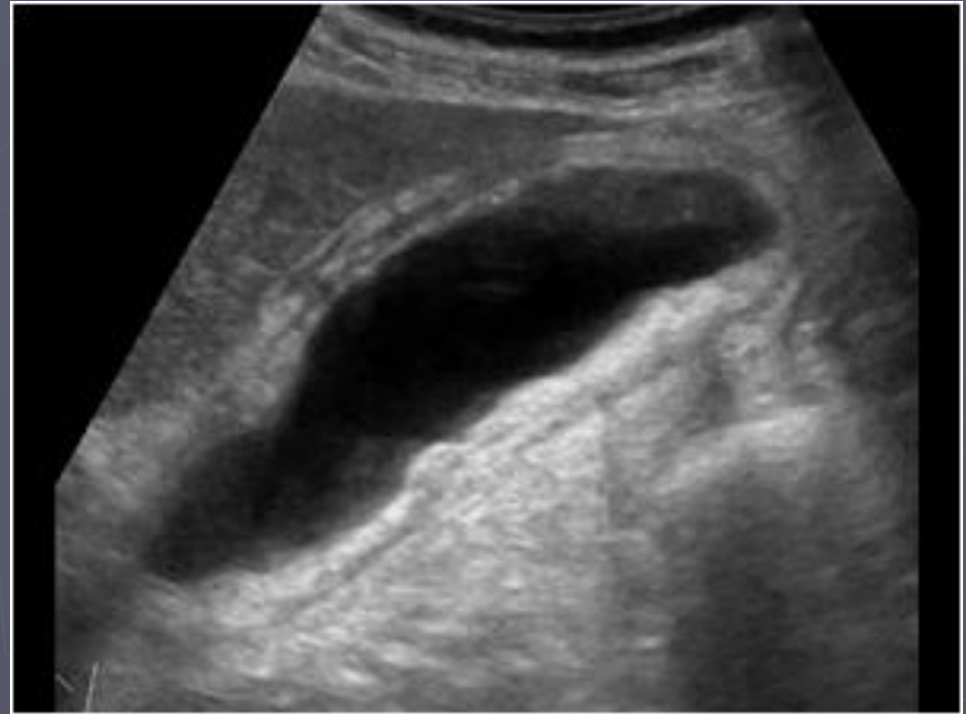
▶ Mural thickening:

■ Primary:

- ▶ Cholecystitis

■ Secondary:

- ▶ Cardiac failure
- ▶ Cirrhosis
- ▶ Ascites
- ▶ Hypoalbuminaemia
- ▶ Renal failure



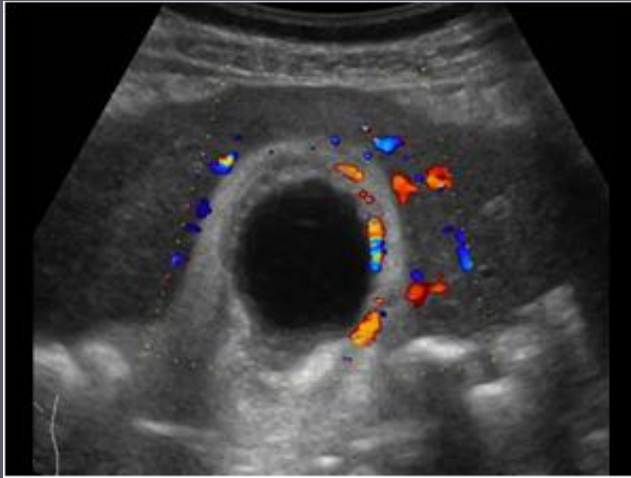
Common Pathological Cases



Case One

- ▶ Middle age women presented to ED with fever, and RUQ pain.
- ▶ On exam:
 - She looks ill, febrile and in pain
 - Abdomen: RUQ tenderness .
- ▶ Labs:
 - High LFTs & WBC.

Case One



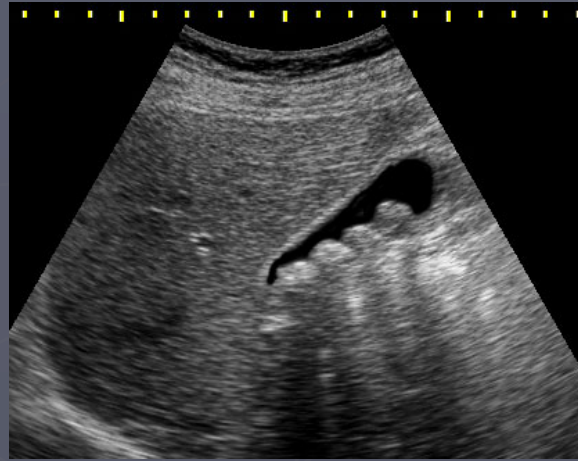
- ▶ Thickening of GB wall $>3\text{mm}$
- ▶ Distended GB
- ▶ Pericholecystic fluid
- ▶ Hyperemia
- ▶ Gallstone

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 and aggravated by fatty meal.
- ▶ On exam:
 - Obese lady. Looks well. Not distressed, febrile or jaundiced.
- ▶ Labs:
 - LFTs normal.

Case Two



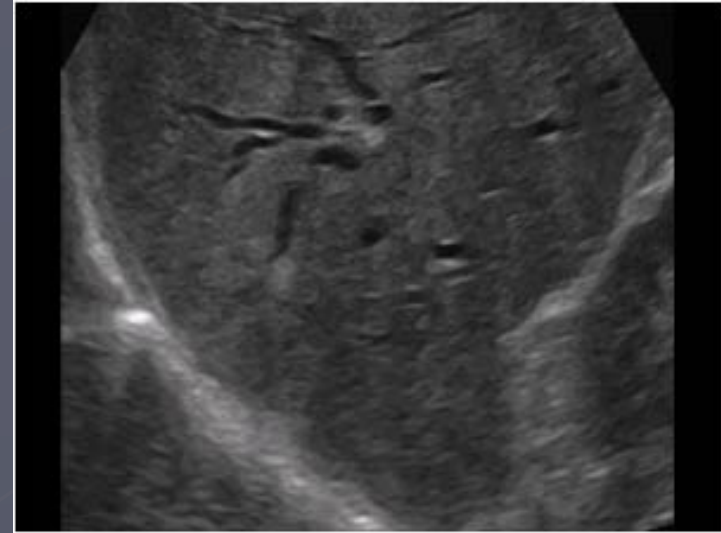
- ▶ Multiple oval shaped echogenic structures seen within GB, causing posterior acoustic shadowing

Gallbladder Stones (Cholelithiasis)

Case Three

- ▶ Middle aged man, presented to ER with severe RUQ pain and yellowish discoloration of skin and sclera.
- ▶ On exam:
 - He looks ill, jaundiced and in pain but not febrile.
- ▶ Labs:
 - High LFTs.

Case Three



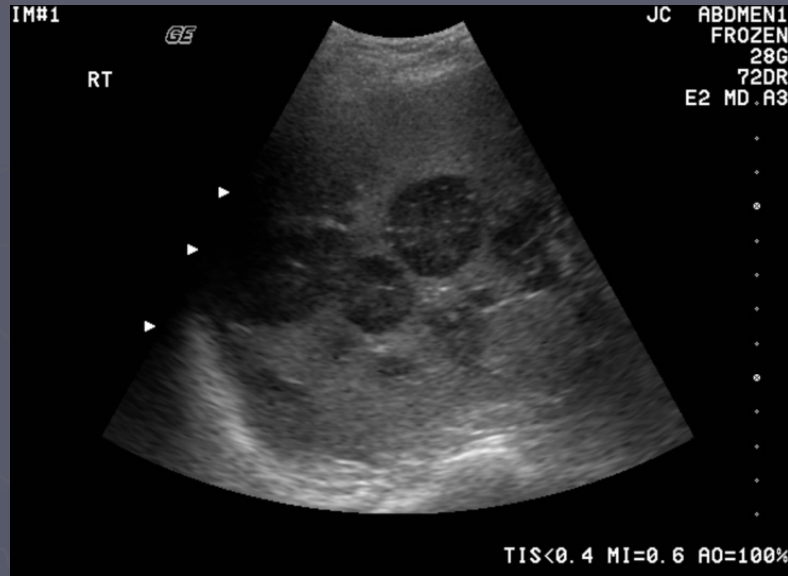
- ▶ Dilated intra-hepatic and extra-hepatic biliary system
- ▶ Echogenic structure seen within CBD

CBD Stone Causing Upstream Biliary Obstruction
(Cholelithiasis)

Case Four

- ▶ Elderly man recently diagnosed with colonic cancer. Presented to primary health care clinic with vague upper abdominal pain.
- ▶ On exam:
 - He was thin & ill looking but not febrile or jaundiced.
 - Mild abdominal tenderness. Enlarged liver with irregular outline.
- ▶ Labs:
 - Mildly elevated LFTs.

Case Four



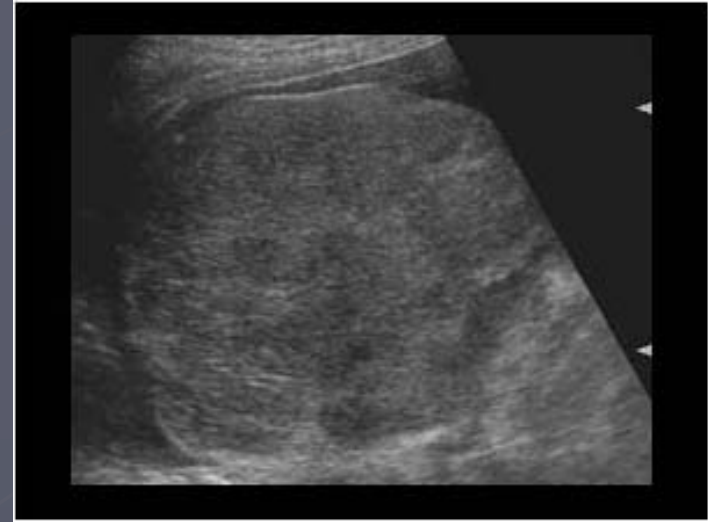
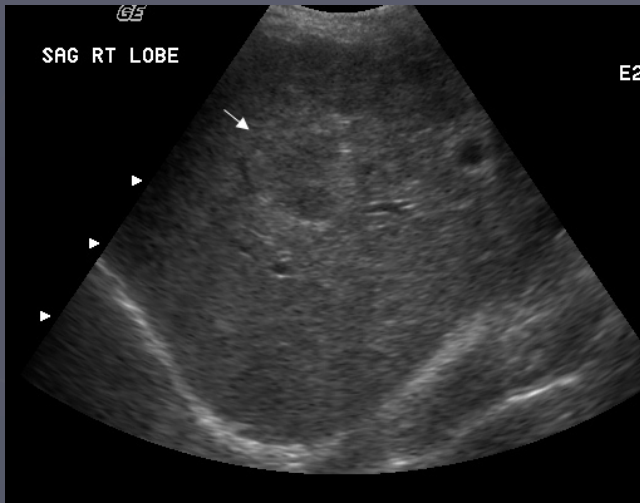
- ▶ Multiple hypoechoic focal hepatic lesions

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 looking, slim, mildly jaundice but not febrile.
 - Abdomen: Bulging flanks, dilated tortuous vessels around umbilicus. Mild diffuse abdominal tenderness.
- ▶ Labs:
 - High LFTs.

Case Five



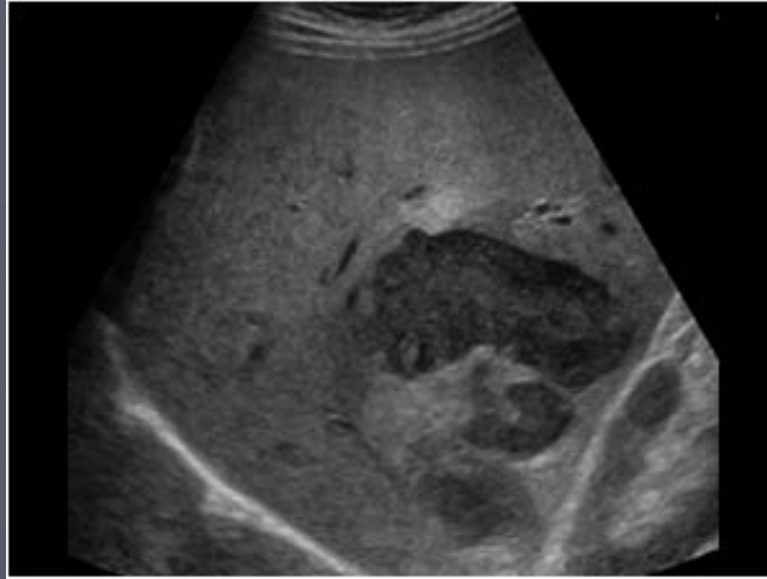
- ▶ Shrunken liver with irregular outline
- ▶ Heterogeneous appearance
- ▶ Focal hypoechoic lesion

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.
- ▶ Labs:
 - High LFTs & WBC.

Case Six



- ▶ Focal hypoechoic liver lesion with ill defined outline

Liver Abscess



thankyou

Radiology:
The Eye of
Medicine