



Lecture 2

Ultrasound of the Liver & Gallbladder



RADIOLOGY
TEAM 435

Color code:

- **Important.**
- **Doctors notes.**
- Extra explanation.

Please check this [link](#) frequently for any additions or corrections.

Reference:

- Male slides only.
- Medscape.

Outline :

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

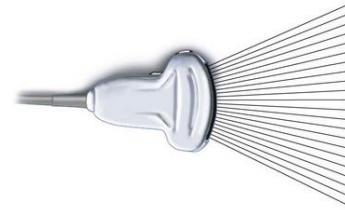
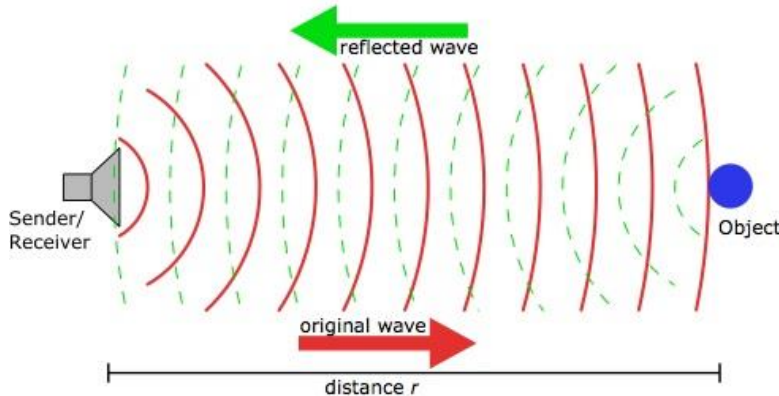
Ultrasound

- A diagnostic technique in which **high-frequency sound waves** penetrate the body 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**.
- Diagnostic Medical applications in use since late 1950's.



الانتراساوند او التصوير بالموجات الفوق الصوتيه
عبارة عن موجات صوتية عالية التردد (اكثر من
20000 هيرتز) والانسان يسمع 20-20000 هيرتز
فقط فعشان كذا سموه بالموجات الفوق صوتية.

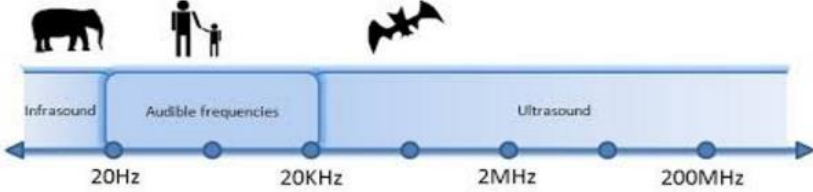
كيف يطلع لنا صورة؟
ترسل الموجات الفوق صوتية الى اتجاه معين ويرتد
الصدى ويسجل بحسب زمن وصوله (مع تناسبه مع
مسافة بعده).



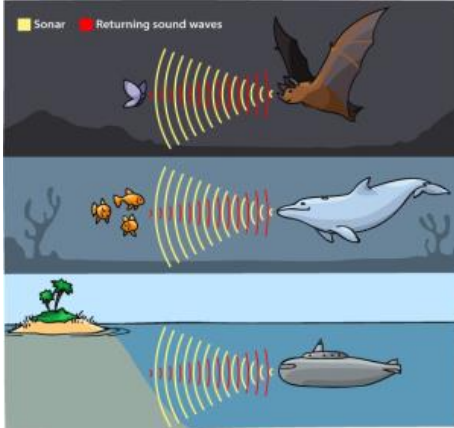
Extra 😊

Expand your horizon!

والموجات الصوتية التي تستخدم في هذا الفحص هي عبارة عن صوت مشابه للصوت العادي الذي نسمعه من حولنا، إلا أنه ذا تردد عالي لا يمكن من سماعه. فأذن الإنسان قادرة على الإستماع لمدى معين من الترددات (ما بين 20 هيرتز حتى 20000 هيرتز). أما أقل أو أكثر من ذلك فلا يستطيع الإنسان سماعه، وقد تمتلك بعض الحيوانات القدرة على سماع ما لا يستطيع سماعه كالدلافين والقطط وغيرها.



يستطيع الودواط سماع الأصوات ذات التردد العالي التي لا يمكن الإنسان من سماعها. أما الفيل فيستطيع سماع ترددات صوتية أقل من 20 هيرتز كغبرة من بقية الحيوانات. ولذلك تستطيع بعض الحيوانات الإحساس بالزلازل والبراكين قبل حدوثها لأنها تستطيع تمييز أصوات تحرك الطبقات الأرضية ذات التردد المنخفض



إستخدام الصوت في التصوير:

من أهم الخصائص التي يتميز بها الصوت هو خاصية **الصدى Echo** فالصوت عندما يصطدم بحاجز ما يرجع بإتجاه معاكس. تستغل هذه الخاصية في التصوير الطبي من خلال جهاز التصوير بالموجات فوق صوتية. ولتقريب فكرة الصدى لناخذ أمثلة من الطبيعة. يستخدم الدلفين والودواط الصدى في التنقل. فالودواط يرسل أصوات في عدة اتجاهات ويعتمد على الصدى في معرفة قرب الفريسة أو العائق. واستغل الإنسان هذه الظاهرة الكونية في بناء السفن والغواصات وأسماها بتقنية **السونار Sonar** وهي إختصار لـ **SOund Navigation And Ranging**، ولذلك أحياناً يسمى فحص الموجات فوق صوتية بالسونار.

[Click here to read more!](#)

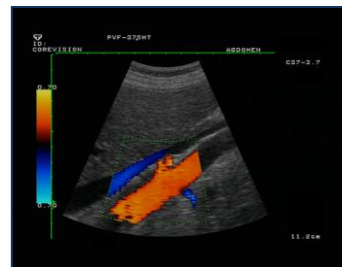
Ultrasound language:

- **Hyper-echoic** معناته انعكست كل الموجات = **White**. Like bone and solid organs.
- **Hypo-echoic** انعكس جزء من الموجات = **Light grey**. Like the liver.
- **An-echoic** ما انعكس شي = **Black**. Like fluid

Advantages	<ul style="list-style-type: none"> - Inexpensive - Easy and available - Safe and no radiation
Disadvantages	<ul style="list-style-type: none"> - Inability to penetrate gas or bone. so we can't assess the bowel and the lungs. - Operator dependent. needs a trained doctor. - Less sensitive in some situations. Like in obesity.
Indications	<p>بوجه عام اذا جاء مريض باعراض حصى مرارة او مرض بالكبد</p> <ul style="list-style-type: none"> - Right upper quadrant pain. - Jaundice. - High liver function test. - Fever work up. - Screening for metastasis. But we usually do CT for scanning the whole body!



B-mode



Color doppler



Duplex

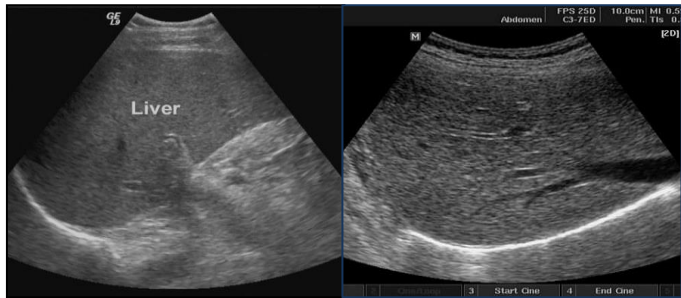
2 things in one (color doppler + wave form)
We can see the flow in the vessels.

US is the golden standard in assessing the gallbladder!!

Ultrasound Uses

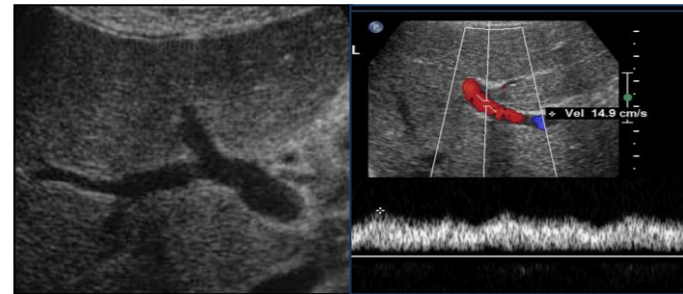
Emergency Medicine	Trauma patient and acute abdomen pain. Like in internal bleeding.
Neurology	Assessing blood flow and stenosis in the carotid arteries (Carotid ultrasonography)
Cardiology	Echocardiography is an essential tool in cardiology, valvular heart disease. We call it Echo.
vascular system	assess patency and possible obstruction of arteries Arterial Doppler, diagnose DVT venous doppler and determine extent and severity of venous insufficiency
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	Assess female pelvic organs, uterus ovaries.
Obstetrics	sonography is commonly used during pregnancy to check on the development of the fetus.
Neonatology	Basic assessment of intracerebral structural abnormalities, bleeds, ventriculomegaly or hydrocephalus. We can see through the skull because the baby's sutures are not yet fused.
Musculoskeletal	For assessing tendons, muscles, nerves, ligaments, soft tissue masses, and bone surfaces. In interventional radiology like when injecting steroids into joints in case of rheumatoid arthritis.
Urology	to study a patient's bladder, prostate or testes.

Normal Liver appearance

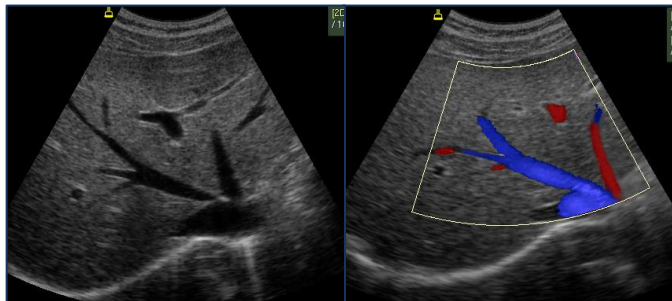


Normal liver
(B-mode)

Echo-genic with no lesions



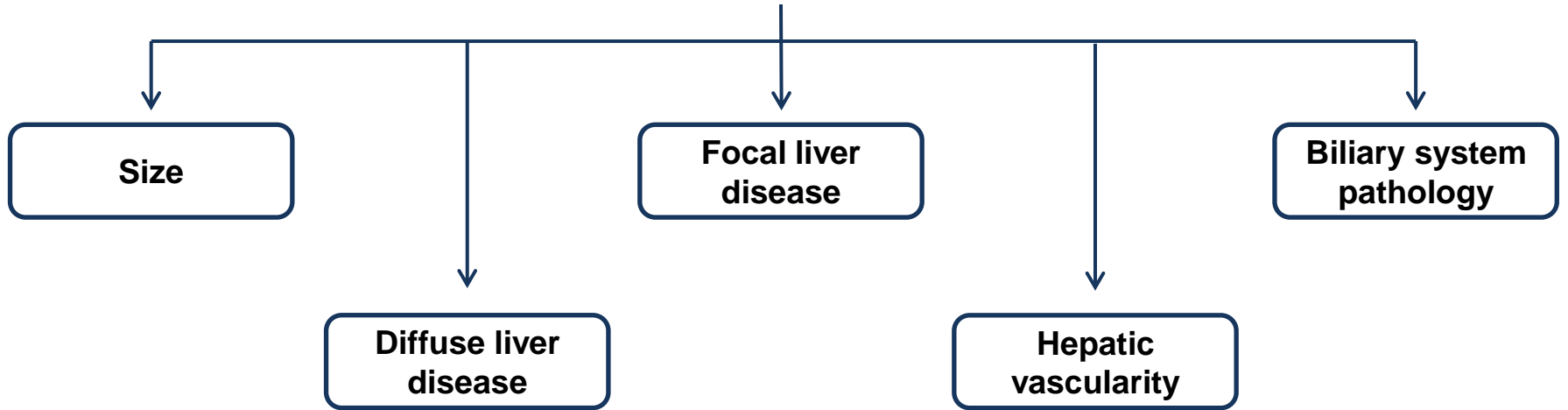
Portal vein
(duplex)



Hepatic vein
(color doppler)
Rabbit ear appearance

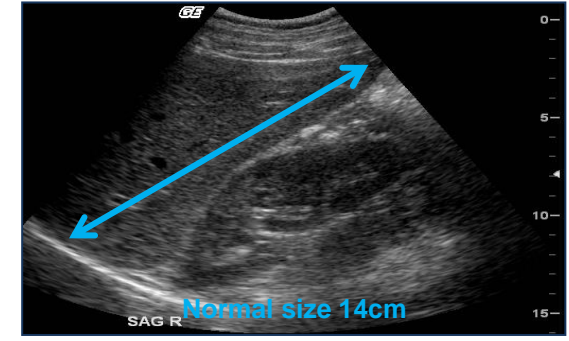
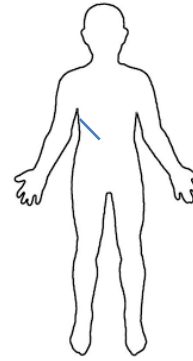


Pathology of the Liver



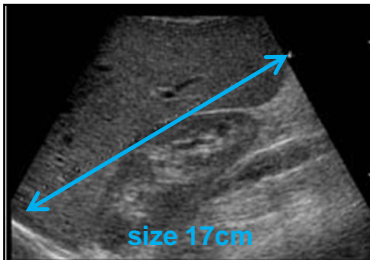
Size abnormality

Normal: **9 - 15** cm at Mid Clavicle Line (MCL)



Large liver > 15cm (Hepatomegaly)

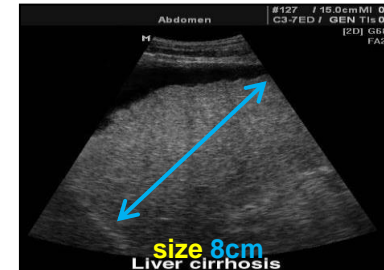
- **Infection:** eg viral hepatitis.
- **Neoplasm** (tumor): eg. Metastasis.
- **Cirrhosis:** early phase.
- **Metabolic:** Amyloidosis /fat.
- **Drugs/toxins:** alcohol.
- **Others:** Budd Chiari syndrome. An occlusion of the hepatic vein.



Small liver < 9cm (Shrunken)

- **Late cirrhosis:**
 - Shrunken size.
 - Irregular outline.
 - Ascites.
 - Portal hypertension.

In early stage of cirrhosis the livers size will increase (like in any inflammatory case) and in the late stages it'll shrink.



Diffuse abnormality

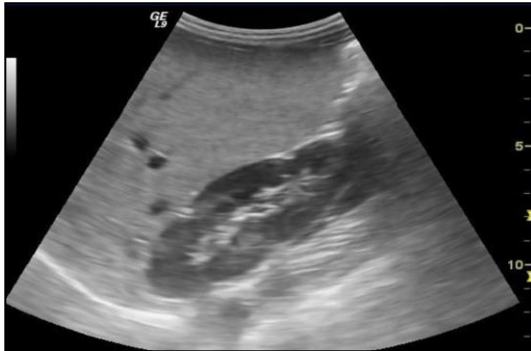


Normal

More than normal (more white)

Diffuse fatty infiltration.

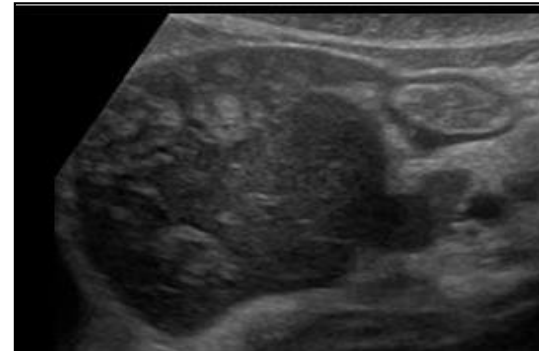
More echoic than the liver (hyper-echoic)



Less than normal (more black)

infection: Acute hepatitis.

Less echoic than the liver (hypo-echoic)

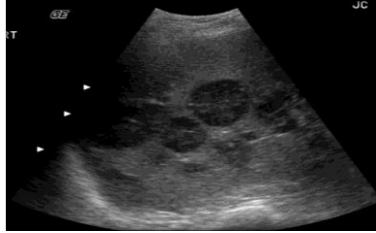


Focal liver lesion

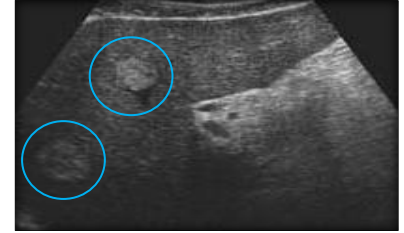
- **Benign tumor:**
 - Hemangioma.
- **Malignant tumor:**
 - **Primary** eg: Hepatocellular carcinoma.
 - **Secondary metastasis** eg: Colon & breast.
- **Infective:**
 - Abscess.
 - Hydated cyst.
- **Congenital:**
 - Hepatic cyst.



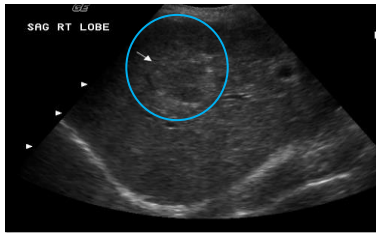
Normal



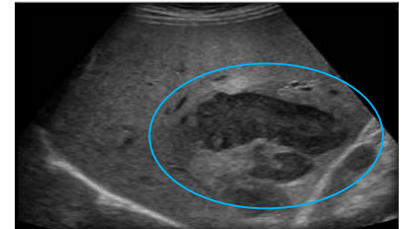
Metastasis



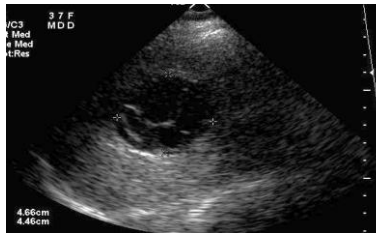
Hemangiomas



HCC



Liver Abscess



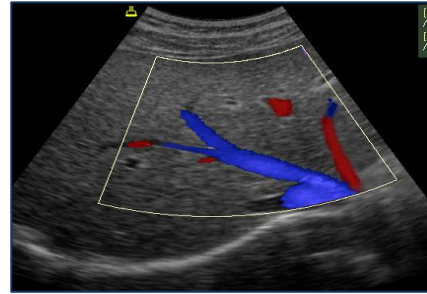
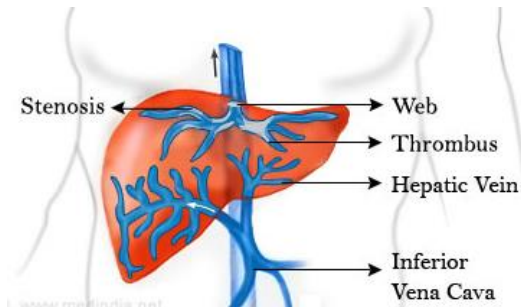
Hydated Cyst



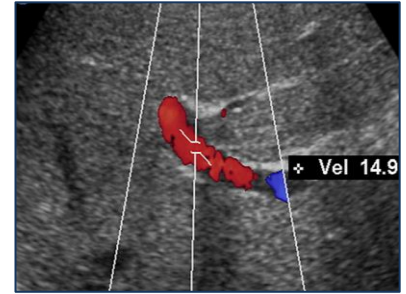
Multiple Hepatic Cyst

Vascular abnormality

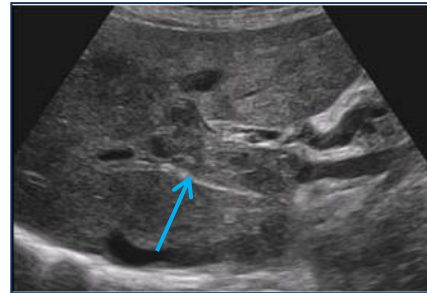
- **Portal venous system:**
 - Thrombosis.
 - Portal hypertension.
- **Hepatic venous system:**
 - Thrombosis.
 - **Budd Chiari syndrome.** is an uncommon condition induced by thrombotic or non-thrombotic obstruction of the hepatic venous outflow and is characterized by hepatomegaly, ascites, and abdominal pain.



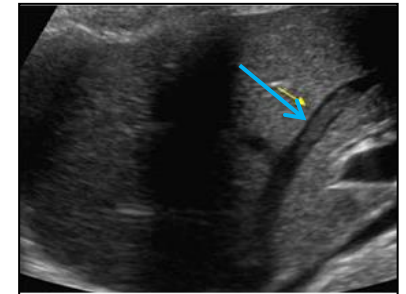
Normal



Normal



PV Thrombosis



Hepatic Vein Thrombosis
The thrombus in the vessel is hyper-echoic > it should be black

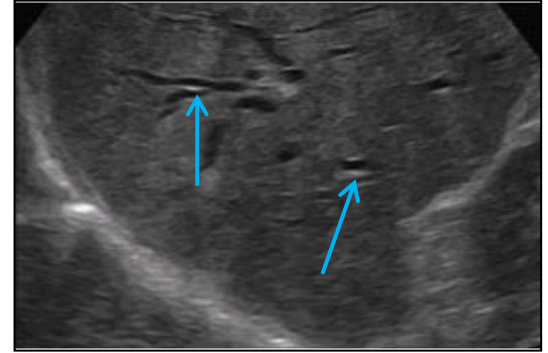
Biliary abnormality

Intra-hepatic biliary radicals. —→ Less than 3mm.

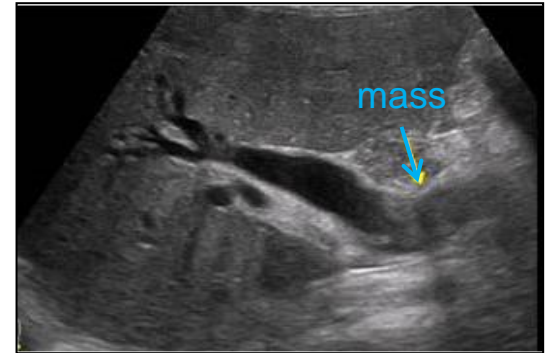
Extra-hepatic “CBD”. —→ Less than 8mm.

Causes of dilatation & obstruction:

- **Intra-luminal:**
Stone & mass.
- **Mural:**
stricture (benign & malignant)
- **Extrinsic:**
Compression mass & Lymph node



Intra Hepatic Dilatation



Dilated CBD



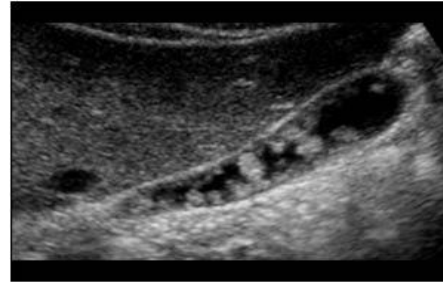
Pathology of the Gallbladder

Intra-luminal pathology.

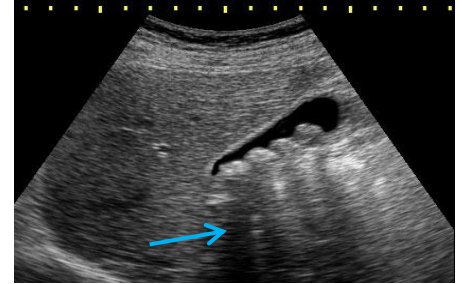
- **Gall stone** (Acoustic shadowing)
- **Polyps** (No acoustic shadowing)
- **Mass lesion.**
 - Gall bladder carcinoma.

Mural pathology.

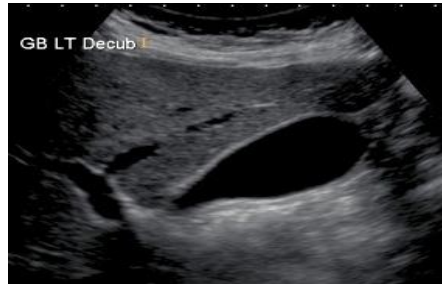
- **Primary:**
 - Cholecystitis.
- **Secondary:**
 - Cardiac failure.
 - Cirrhosis.
 - ascites.
 - Hypoalbuminemia
 - Renal failure.



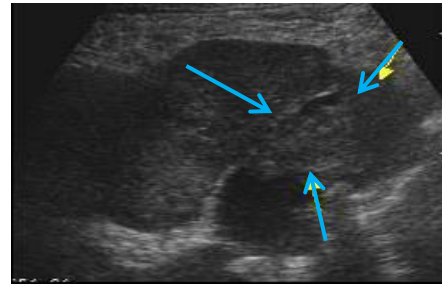
Polyps



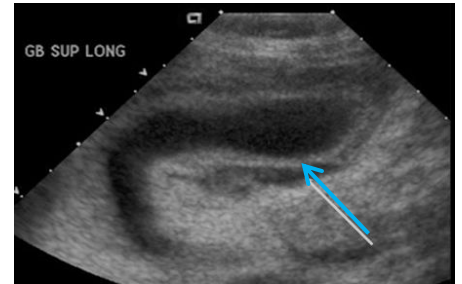
Gall Stone
Shadows of the stone are darker



Normal



Gall Bladder Carcinoma



Cholecystitis
Thick wall

Common Pathological Cases

- Case 1:** Middle age women presented to ED with fever, RUQ pain.
- On exam: she looks ill, febrile and abdomen pain (RUQ tenderness).
 - Lab high LFTs & WBC.



Acute calcular cholecystitis

Gall stone
Thickening of GB wall >3mm.
Distended GB

- Case 2:** 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.



Metastatic liver lesions.

Multiple hypoechoic focal hepatic lesions



Common Pathological Cases

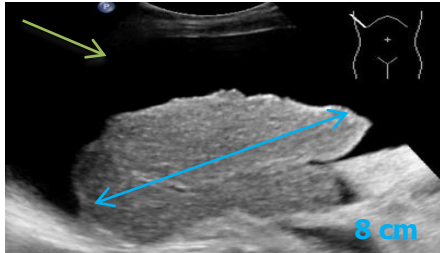
Case 3: Middle age man known case of HCV+ for 10 years presented to GI out patient clinic with history of abdominal distension. No fever.

- 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.



Liver cirrhosis

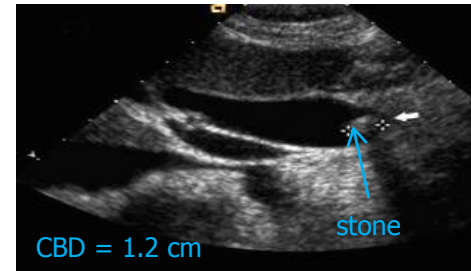
Shrunken liver with irregular outline.

Free fluid (ascites)

Case 4: Middle age woman complaining of right upper quadrant pain, dark urine and pale stool.

- On examination:

her skin and sclera are yellowish, not febrile.



CBD stone

Dilated CBD

Thanks for checking our team!

For any suggestions or questions please don't hesitate to contact us on:

Email: radiology435team@gmail.com

Twitter: [@radiology_435](https://twitter.com/radiology_435)

شكر خاص لزميلنا هشام الغفيلي.

Team members :

- **Monirah Alsalouli.**
- **Abdullah Aljunaydil.**
- **Lamia Alsaghan.**

