



431
Radiology Team

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Lecture 12: Radiology of Diseases of the GIT & Radiological Investigation of Hepatobiliary System



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Revised By: *Lama AlShwairikh*

◆ **Important**

◆ **Doctor's notes**

◆ **Team's notes**

Ultrasound



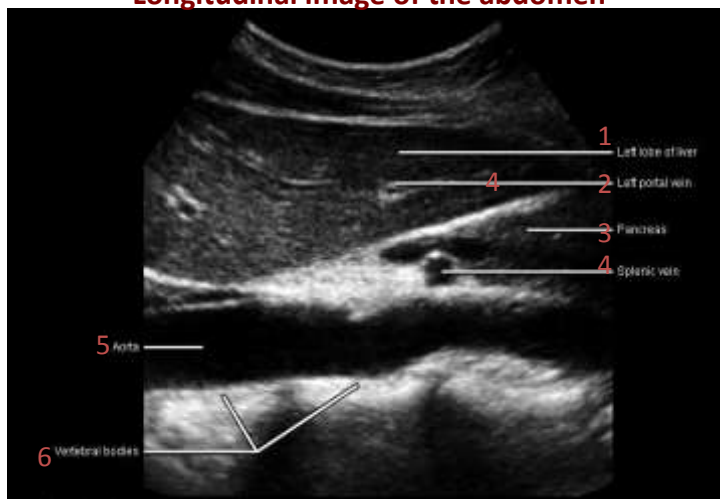
There's a separate file for images from the ppt that the doctor didn't comment on during the lecture.

- Not expensive.
- Allows comparison with the opposite side.
- No ionizing radiation.
- Performed at bedside or in the operating room.
- It is a non-invasive modality.

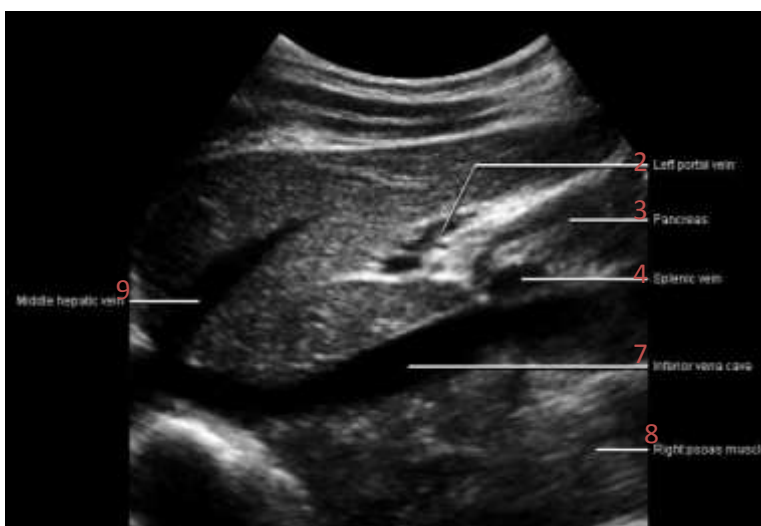
FYI: Probes are the most expensive part of the US machine



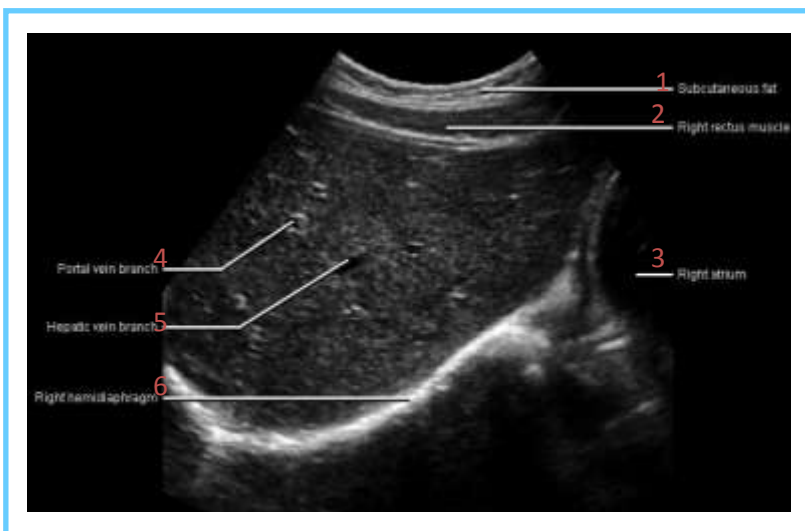
Longitudinal image of the abdomen



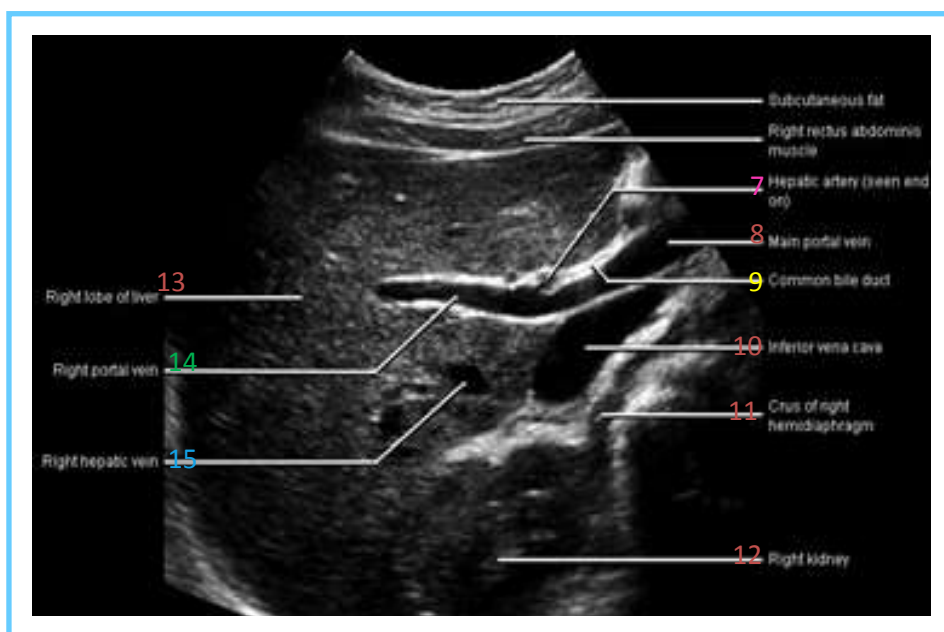
- 1) Left lobe of liver.
- 2) Left portal vein.
- 3) Pancreas.
- 4) Splenic vein.
- 5) Aorta.
- 6) Vertebral bodies.



- 7) Inferior vena cava.
- 8) Right psoas muscle.
- 9) Middle hepatic vein.



- 1) Subcutaneous fat.
- 2) Right rectus muscle.
- 3) Right atrium.
- 4) Portal vein branch.
- 5) Hepatic vein branch.
- 6) Right hemidiaphragm.



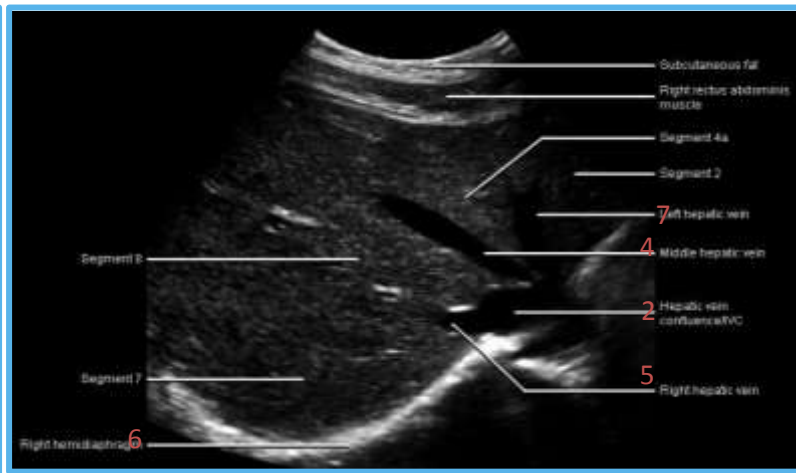
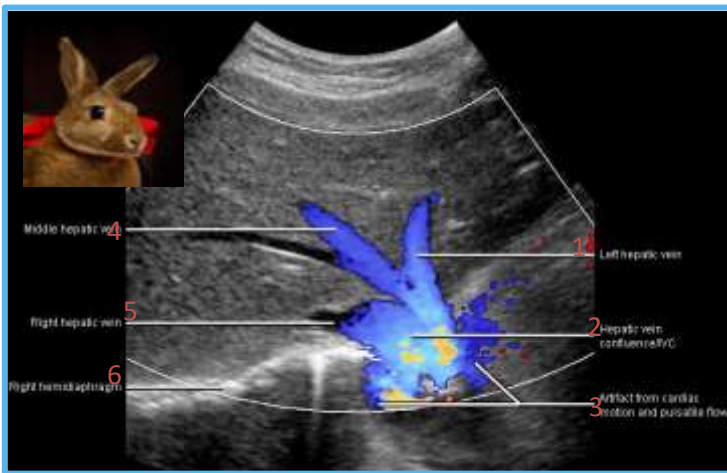
- 7) Hepatic artery.
- 8) Main portal vein.
- 9) Common bile duct.
- 10) Inferior vena cava.
- 11) Crus of right hemidiaphragm.
- 12) Right kidney.
- 13) Right lobe of liver.
- 14) Right portal vein.
- 15) Right hepatic vein.

How can we differentiate between the black dots in the liver (portal, hepatic veins, other structure)?

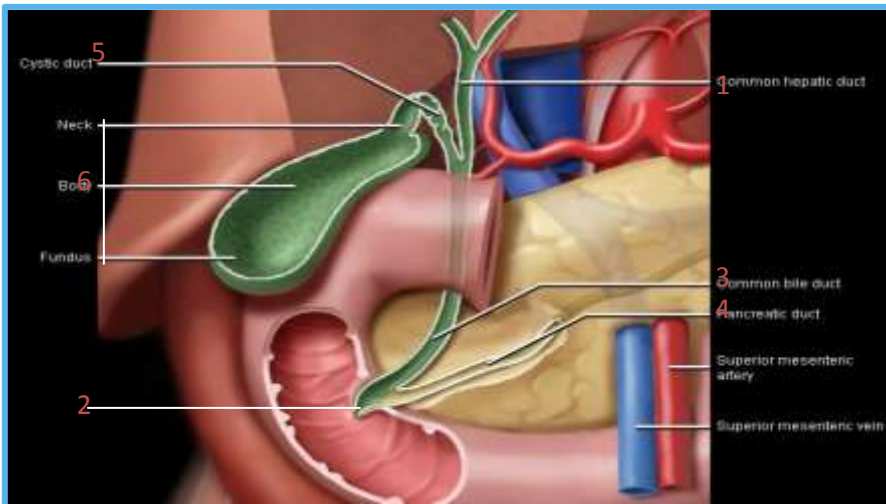
- 1- Follow it with the scan and see if it is going to the portal system or the main hepatic veins.
- 2- The **portal vein** is surrounded by an echogenic (bright) line, while the **hepatic vein** is anechoic (no bright shadow surrounding it).

The portal vein is a landmark for the **hepatic artery** and the common bile duct, when we want to see the hepatic artery or the common bile duct we put a color (to show blood flow) in the portal vein since it is the largest among them.

Anterior to the portal vein, there is a black line between two bright lines; this is the **COMMON BILE DUCT**. Normally, its diameter is less than 4 mm and it can be up to 5-6 mm in elderly and post cholecystectomy. If there's any "pathology" like obstruction, the common bile duct could appear even bigger than the portal vein.



- 1) Left hepatic vein.
- 2) Hepatic vein confluence/IVC.
- 3) Artifact from cardiac motion and pulsatile flow.
- 4) Middle hepatic vein.
- 5) Right hepatic vein.
- 6) Right hemidiaphragm.
- 7) Left hepatic vein.
- 8) Main portal vein.
- 9) Inferior vena cava.
- 10) Right lobe of liver.

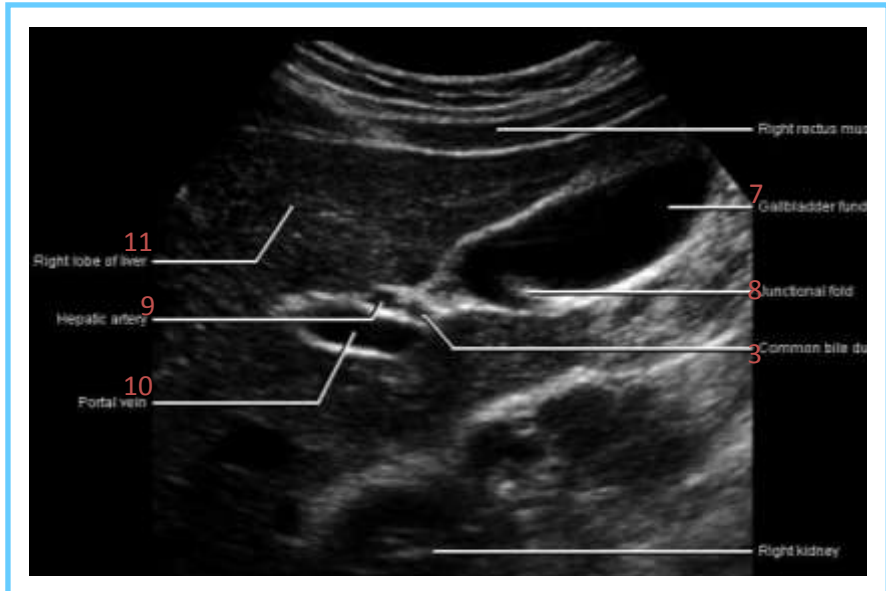


Gallbladder: anechoic structure (sac) with a bright wall.

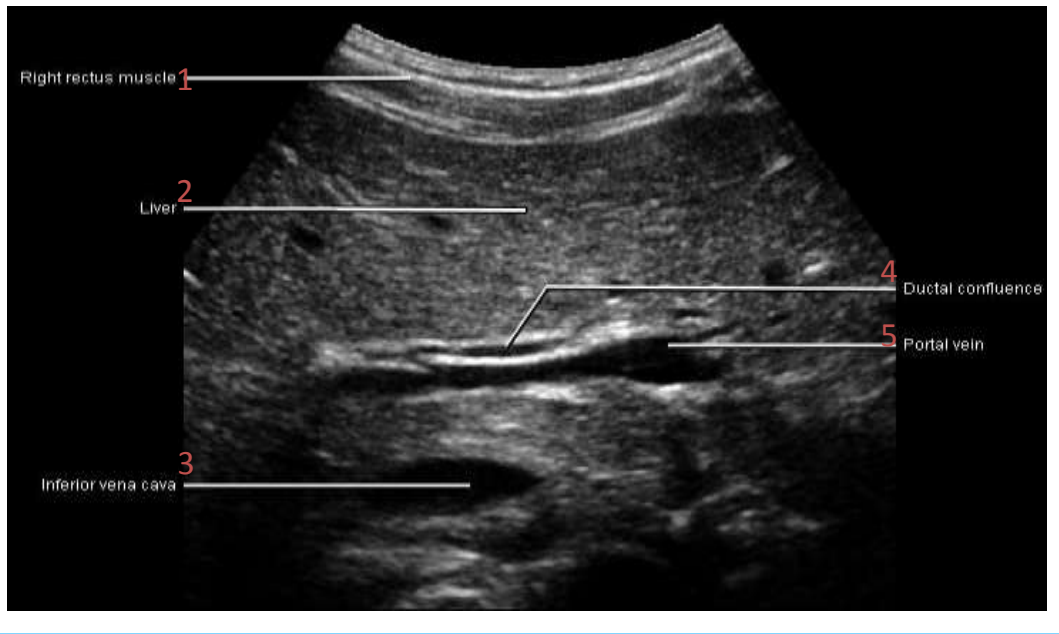
Cystic duct: drains into the common bile duct.

Portal vein: posterior to common bile duct and hepatic artery.

Junctional fold: an echogenic line inside the gallbladder which can be seen normally in some cases.



- 1) Common hepatic duct.
- 2) Ampulla of Vater.
- 3) Common bile duct.
- 4) Pancreatic duct.
- 5) Cystic duct.
- 6) Gallbladder.
- 7) Gallbladder fundus.
- 8) Junctional fold.
- 9) Hepatic artery.
- 10) Portal vein
- 11) Right lobe of liver.



- 1) Right rectus muscle.
- 2) Liver.
- 3) Inferior vena cava.
- 4) Ductal confluence.
- 5) Portal vein.

CT

Components:

X ray source, detectors and computer data processing system.

What is CT Scanning?

- CT scanning—sometimes called CAT scanning—is a noninvasive, painless medical test that helps physicians diagnose and treat medical conditions.
- CT imaging uses special x-ray equipment to produce multiple images (multi sliced) or pictures of the inside of the body and a computer to join them together in cross-sectional views of the area being studied. The images can then be examined on a computer monitor or printed.
- CT scans of internal organs, bone, soft tissue and blood vessels provide greater clarity than conventional x-ray exams.
- Modern CT scanners can scan through large sections of the body in just a few seconds. Such speed is beneficial for all patients especially children, the elderly and critically ill.

What are some common uses of the procedure Abdomen and pelvis?

This procedure is typically used to help diagnose the cause of abdominal pain and diseases of the **bowel** and colon, such as:

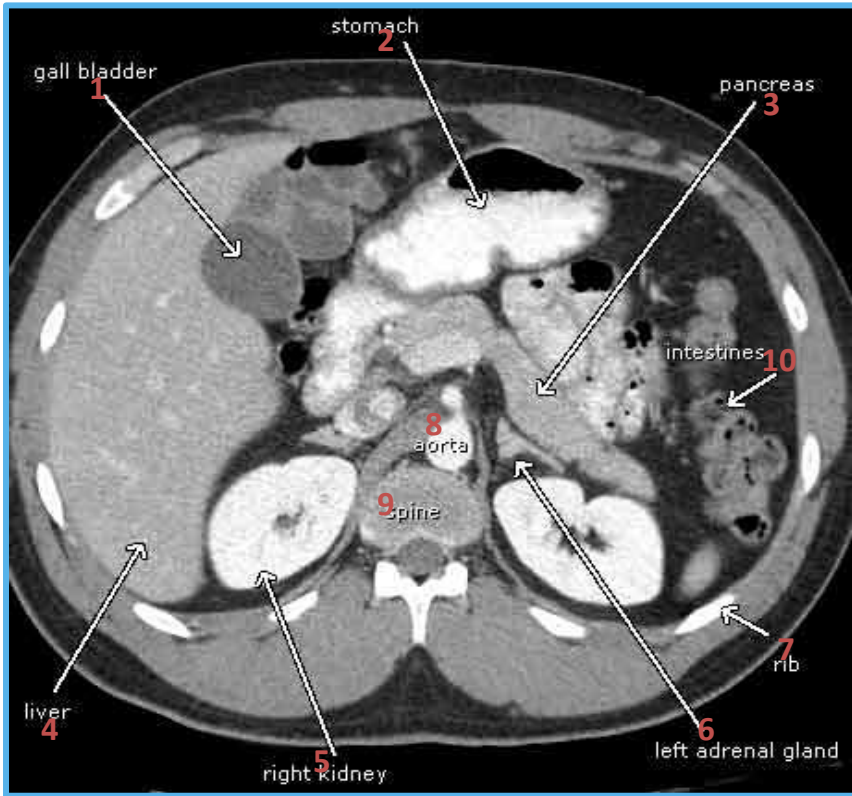
- Abscesses in the abdomen.
- Inflamed colon.
- **Cancers** of the colon, liver, pancreas and kidneys.
- **Pancreatitis.**
- **Lymphoma.**
- Staging for cancer.
- **Diverticulitis.**
- **Appendicitis.**

Advantage: Very detailed image especially for bones.

Disadvantage: Radiation (not safe in pregnancy)

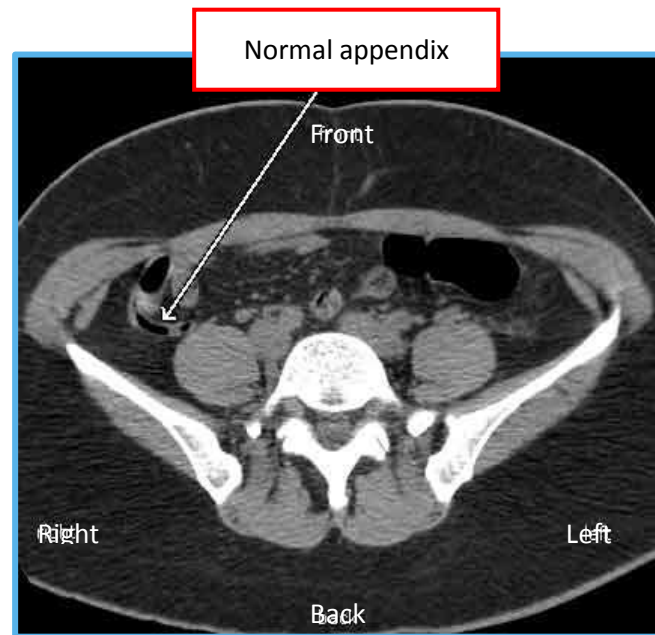
CT scanning of the abdomen/pelvis is also performed to:

- Visualize the liver, spleen, pancreas and kidneys
- Plan and properly administer radiation treatments for tumors
- Guide biopsies and other minimally invasive procedures
- CT imaging can also play a significant role in the detection, diagnosis and treatment of vascular disorders that can lead to stroke, gangrene or kidney failure.



- 1) Gall bladder.
- 2) Stomach.
- 3) Pancreas.
- 4) Liver.
- 5) Right kidney.

- 6) Left adrenal gland.
- 7) Rib.
- 8) Aorta.
- 9) Spine
- 10) Intestines.



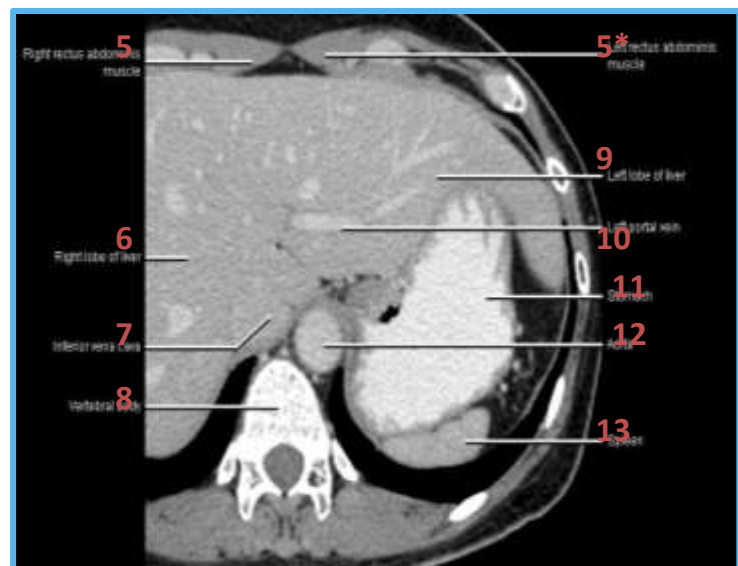
Appendix: Tubular like structure: Normally:

- 1- Filled with air or contrast
- 2- Not distended (less than 6 mm)
- 3- No thick wall (less than 3 mm)

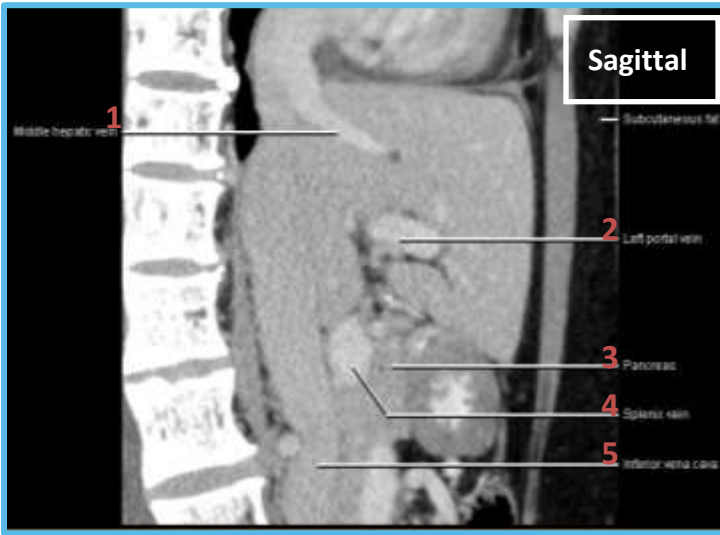
Abnormal appendix: distended, dilated, thickened and hyperdense (appendicolith)



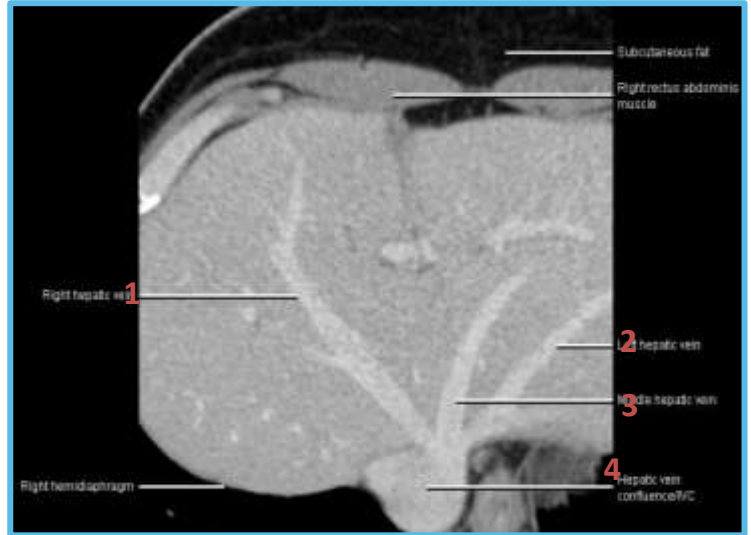
- 1) Common hepatic artery.
- 2) Celiac artery.
- 3) Pancreas.
- 4) Splenic artery.
- 5) Right rectus abdominis muscle.
- 5*) Left rectus abdominis muscle.
- 6) Right lobe of liver



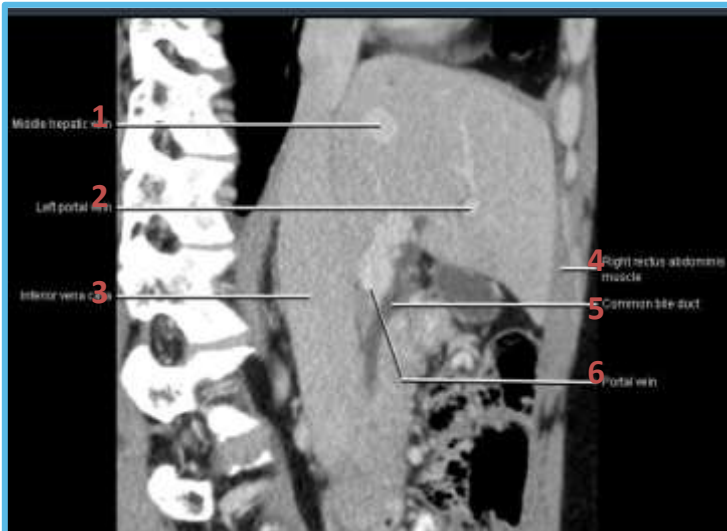
- 7) Inferior vena cava.
- 8) Vertebral body.
- 9) Left lobe of liver.
- 10) Left portal vein.
- 11) Stomach.
- 12) Aorta.
- 13) Spleen.



- 1) Middle hepatic vein.
- 2) Left portal vein.
- 3) Pancreas.
- 4) Splenic vein.
- 5) Inferior vena cava.

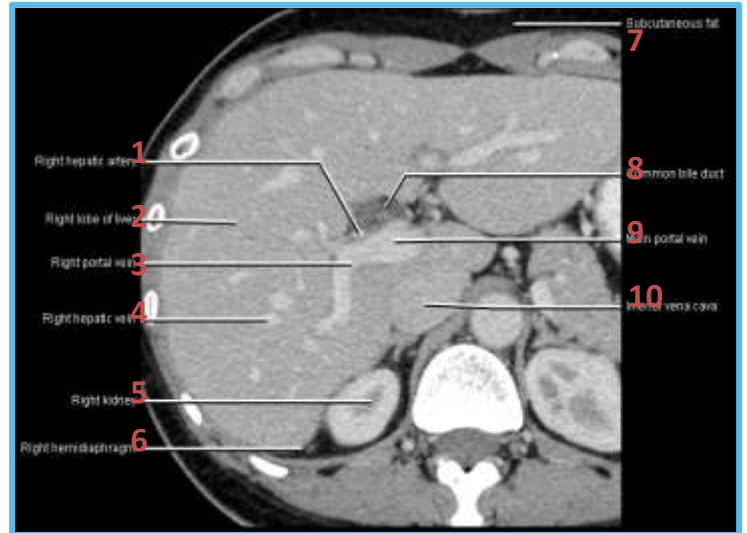


- 1) Right hepatic vein.
- 2) Left hepatic vein.
- 3) Middle hepatic vein.
- 4) Hepatic vein confluence/IVC.



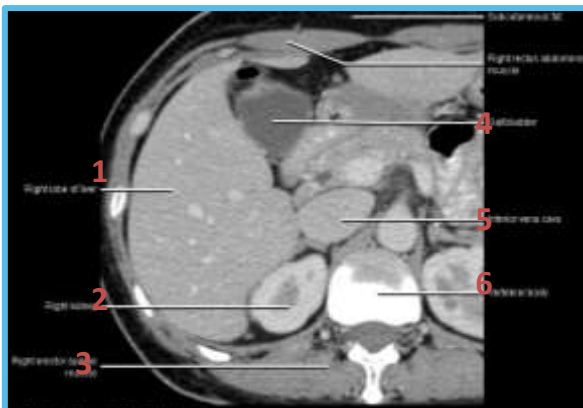
- 1) Middle hepatic vein.
- 2) Left portal vein.
- 3) Inferior vena cava.

- 4) Right rectus abdominis muscle.
- 5) Common bile duct.
- 6) Portal vein.



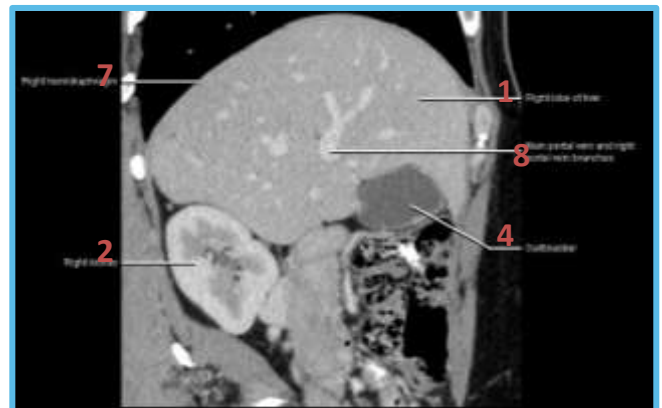
- 1) Right hepatic artery.
- 2) Right lobe of liver.
- 3) Right portal vein.
- 4) Right hepatic vein.
- 5) Right kidney.

- 6) Right hemidiaphragm.
- 7) Subcutaneous fat.
- 8) Common bile duct.
- 9) Main portal vein.
- 10) Inferior vena cava.



- 1) Right lobe of liver.
- 2) Right kidney.
- 3) Right erector spinae muscle.

- 4) Gallbladder.
- 5) Inferior vena cava.
- 6) Vertebral body.



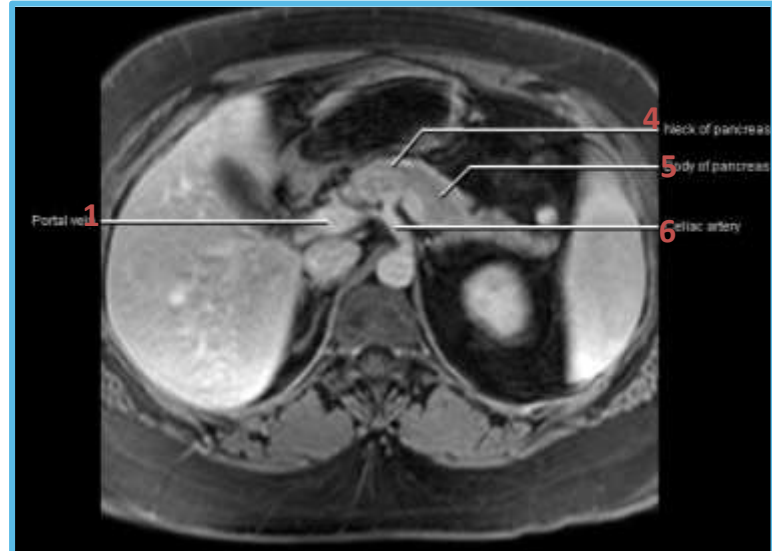
- 7) Right hemidiaphragm
- 8) Main portal vein and right portal with branches.

MRI

- Magnet
- RF coils
- Computer

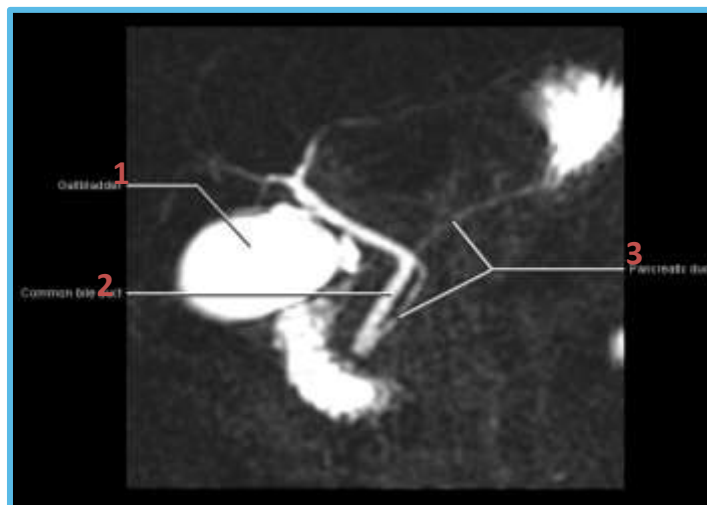


- 1) Portal vein.
- 2) Pancreas.
- 3) Splenic vein.



- 4) Neck of pancreas.
- 5) Body of pancreas.
- 6) Celiac artery.

A landmark for the pancreas is that the splenic vein is posterior to it.

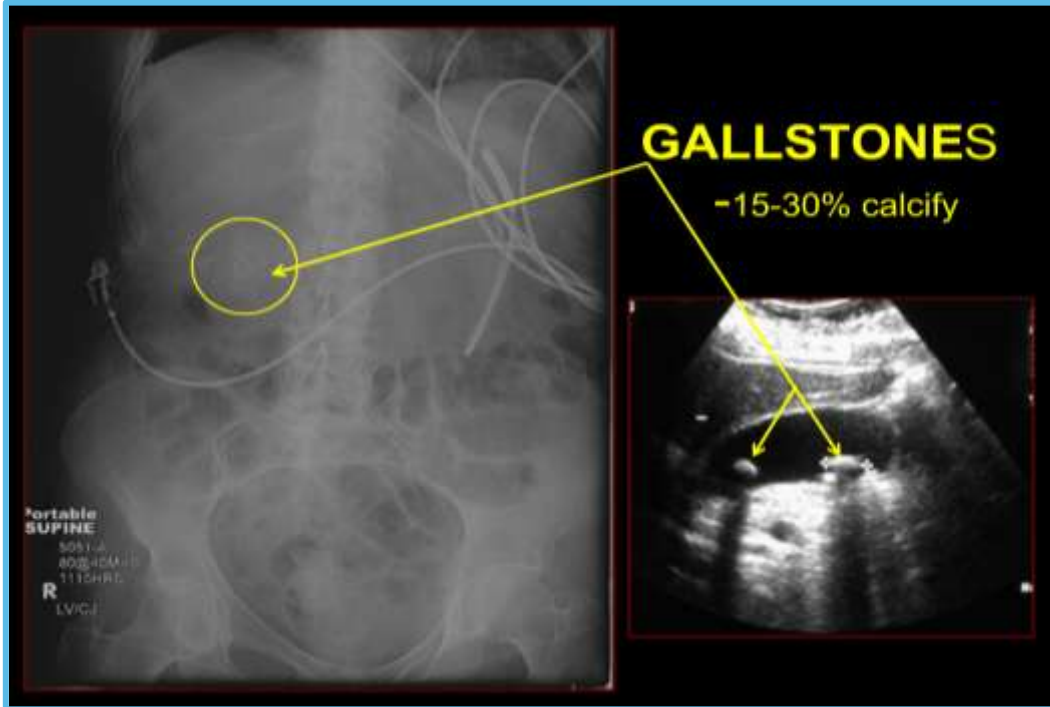


- 1) Gallbladder.
- 2) Common bile duct.
- 3) Pancreatic duct.

MRCB: we can assess biliary radicals by MRI without the need of endoscopy.

Hepatobiliary system

- Liver
- Gallbladder and bile ducts
- Pancreas
- Spleen



X-ray:

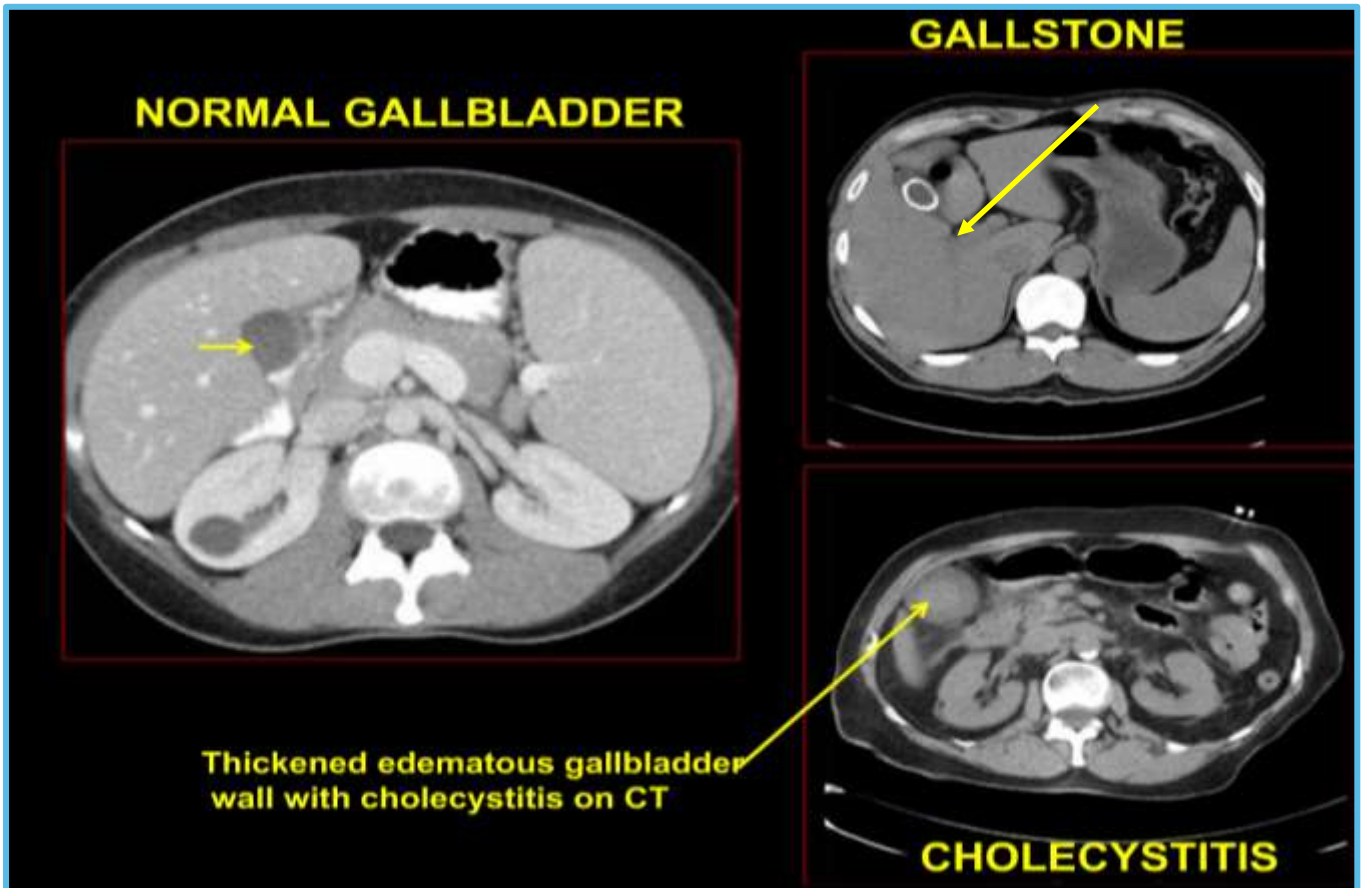
Rounded radiopaque shadows.

US:

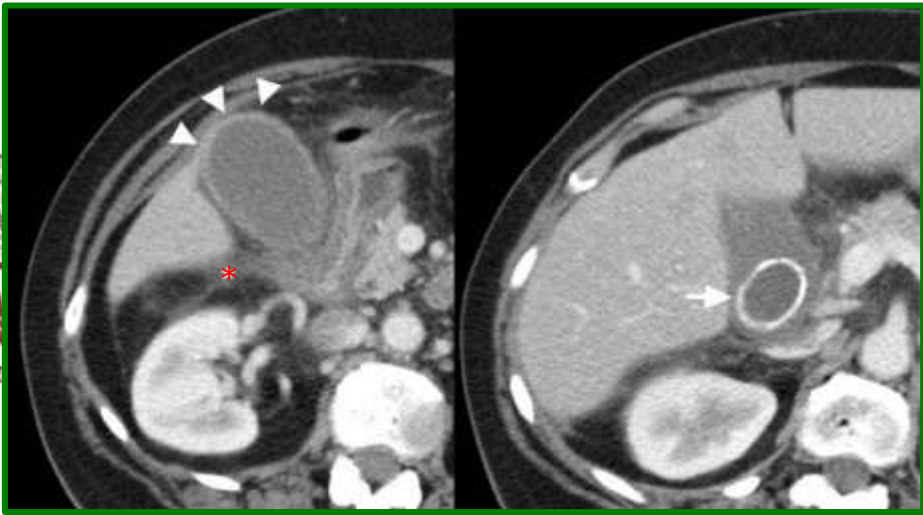
- Gallbladder filled with bile.
- Two echogenic structures inside the gallbladder.
- **Acoustic shadowing** is seen.

Gallbladder stones:

15-30% are calcified.



In Cholecystitis: stranding in the fat surrounding the gallbladder



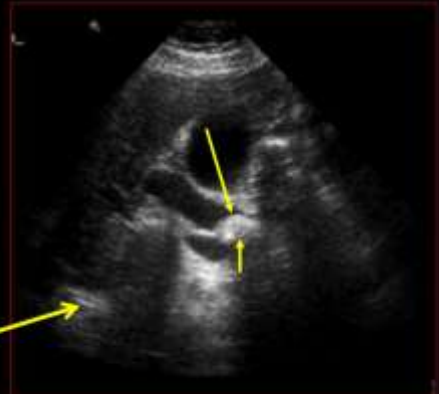
Contrast-enhanced CT shows a distended gallbladder (arrowheads) with a slightly thickened wall and subtle regional fat stranding (asterix). There is an impacted obstructing stone in the neck of the gallbladder (arrow).

CHOLECYSTITIS

With diffuse wall thickening and edema

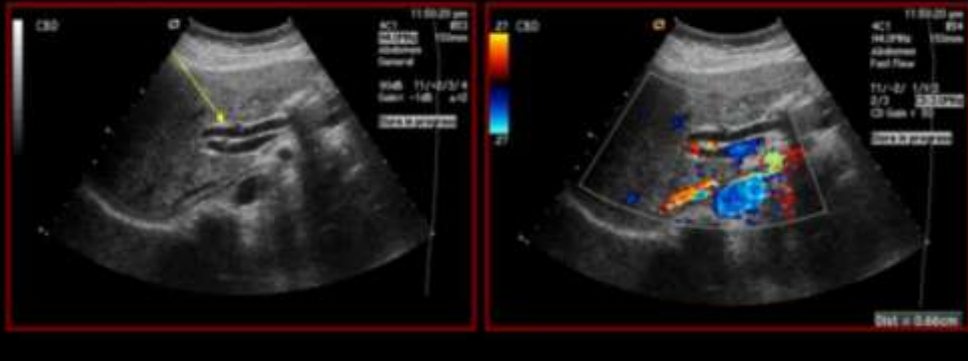


Normal bile duct

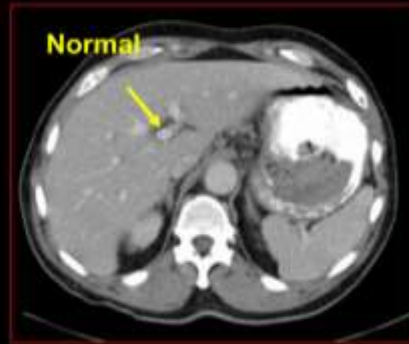


Obstructed duct due to distal calculus

Longitudinal – CBD dilated duct note Doppler signal in vessels



*Note dilated bile ducts.
(Low density branching
structures anterior to
portal veins)



Normal



DILATED BILIARY TREE

CT and ULTRASOUND



Abnormally
dilated biliary
ducts, larger
than the portal
veins.



Dilated CBD with calculi
Endoscopic retrograde
Cholangiopancreatography
ERCP

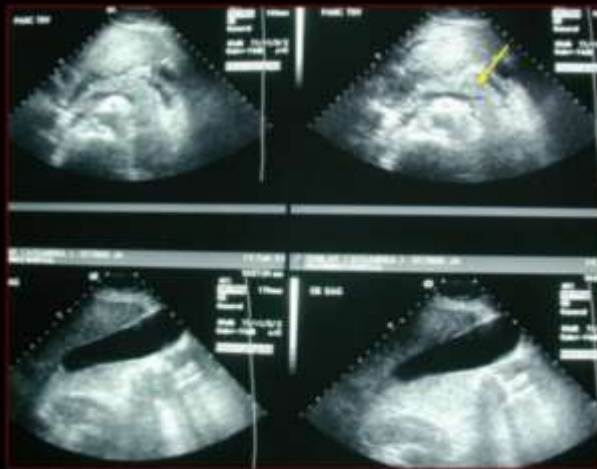
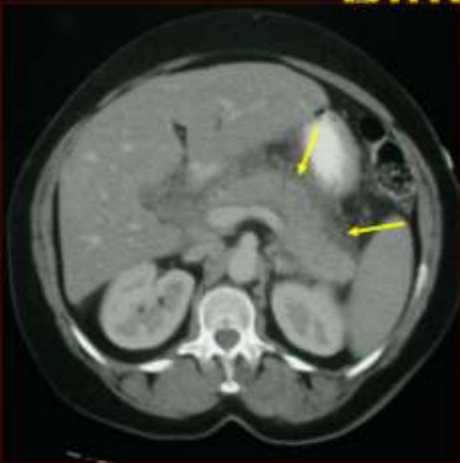
ECRP:

An endoscopic procedure done by gastroenterologists where they go through the mouth to the common bile duct and inject a contrast in it.

You see a filling defect (caused by stones, tumors, etc.)

PANCREATITIS CT AND US

Diffuse edema



On CT: (Typical picture of pancreatitis)

- 1- Thickened pancreas.
- 2- Stranding in the fat.
- 3- Gray color surrounding it.

Pancreatitis

Could be due to 1)

Biliary calculi

2)

Alcohol toxicity



Dilated pancreatic duct, surrounded by fluid (edema) and fat stranding (called dirty fat).

RETROGASTRIC FLUID COLLECTION

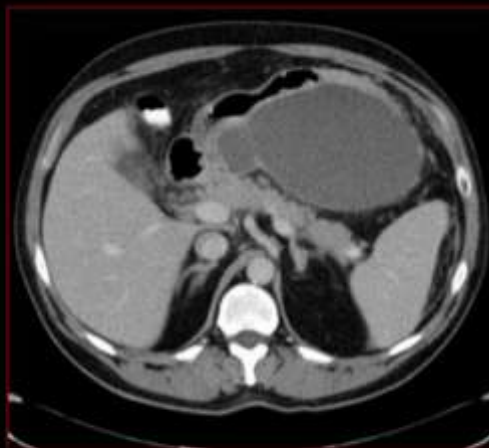
PSEUDOCYST

COMPLICATIONS

Pain

Infection

Hemorrhage-pseudoaneurysm



A pancreatic pseudocyst: retroperitoneal fluid collection that can cause pain, infection and hemorrhage-pseudoaneurysm

Chronic calcific pancreatitis



Longitudinal calcification projecting over stomach and vertebrae (Indicates chronic pancreatitis)

EMPHYSEMATOUS CHOLECYSTITIS DIABETIC PATIENTS -AIR IN WALL



CT:

Air in the wall of the gallbladder and inside it.

X-ray:

Thin dark line surrounding the gallbladder and inside it.

It is mostly seen in diabetics patients.

ACALCULOUS CHOLECYSTITIS

BILIARY STASIS- FASTING/ICU PATIENTS



US: irregular thickened wall.

Can be seen in ICU patients who are not eating by mouth (fasting) and are on IV fluids for long time.

GALLSTONE ILLEUS

Small Bowel Obstruction at IC valve due to migration of gallstones



Stones in gallbladder that travelled with time to the ileocecal junction, these stones caused obstruction in the terminal ileum; thus, the bowel loops are dilated.

Causes of acute RUQ Pain:

Acute Cholecystitis – most common.

Other differential diagnosis:

- PUD / Gastritis / Reflux.
- Acute Hepatitis / Pancreatitis.
- Right sided pneumonia.
- Choledocholithiasis.
- Liver abscess.

Imaging evaluation of RUQ pain:

- 1st: Ultrasound
- 2nd: CT / HIDA.
- 3rd: ERCP / MRCP.

Ultrasound is sensitive and specific for demonstrating:

- Gallstones.
- Biliary dilatation.
- Features of inflammatory disease.

HIDA Scan:

A hepatobiliary scan in which a radioactive chemical or tracer is injected into a vein in your arm. The name HIDA comes from an early tracer used for the scan, hydroxy iminodiacetic acid. More effective tracers are used today. Cholescintigraphy and hepatobiliary scintigraphy are other names for a HIDA scan.

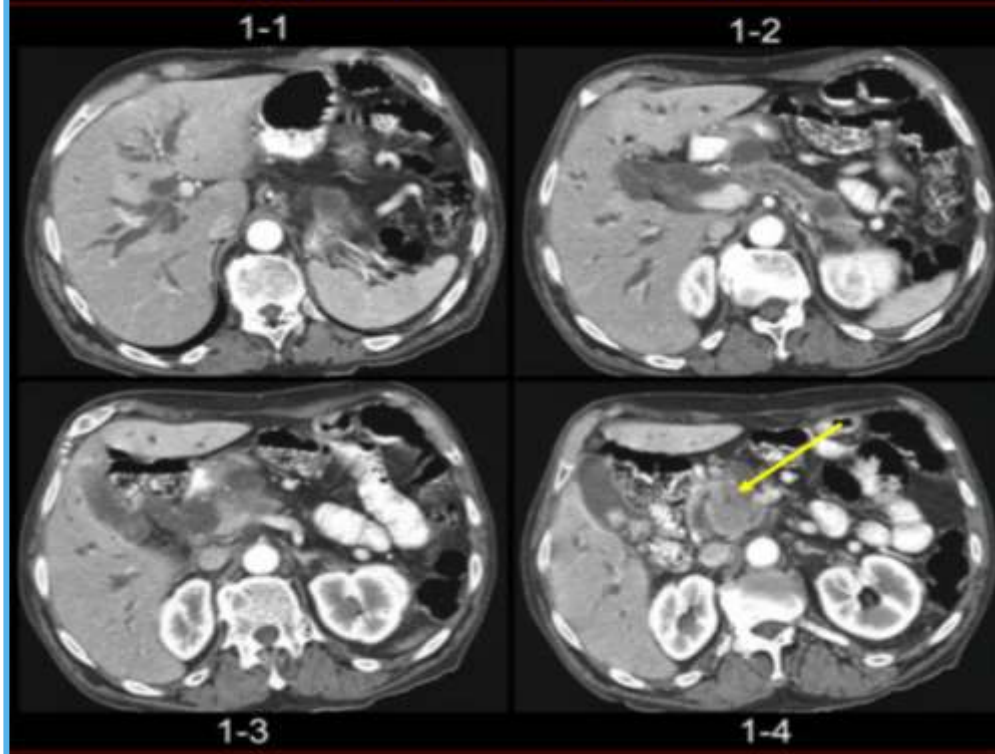
ERCP:

Endoscopic retrograde cholangiopancreatography

MRCP:

Magnetic resonance cholangiopancreatography. Currently, MRCP is used more than ERCP.

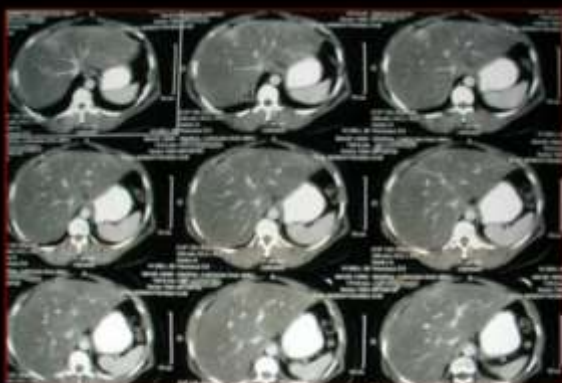
PANCREATIC CANCER obstructive jaundice



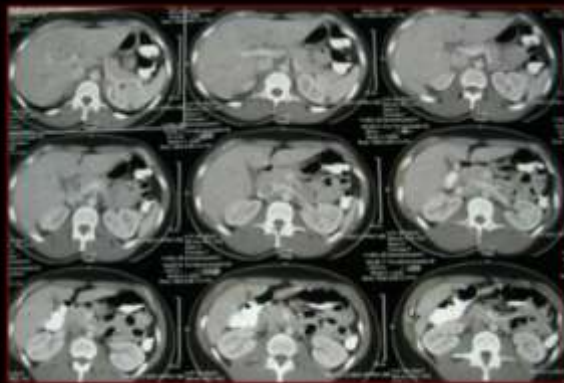
- Tumor in the head and neck of pancreas
- It has dark and bright areas (not homogenous)
- Dilated pancreatic duct.
- Compression on the common bile duct causing biliary radicals dilatation that are almost the same size as the portal vein.

HEPATIC DYSFUNCTION SGOT/SGPT

Fatty infiltration



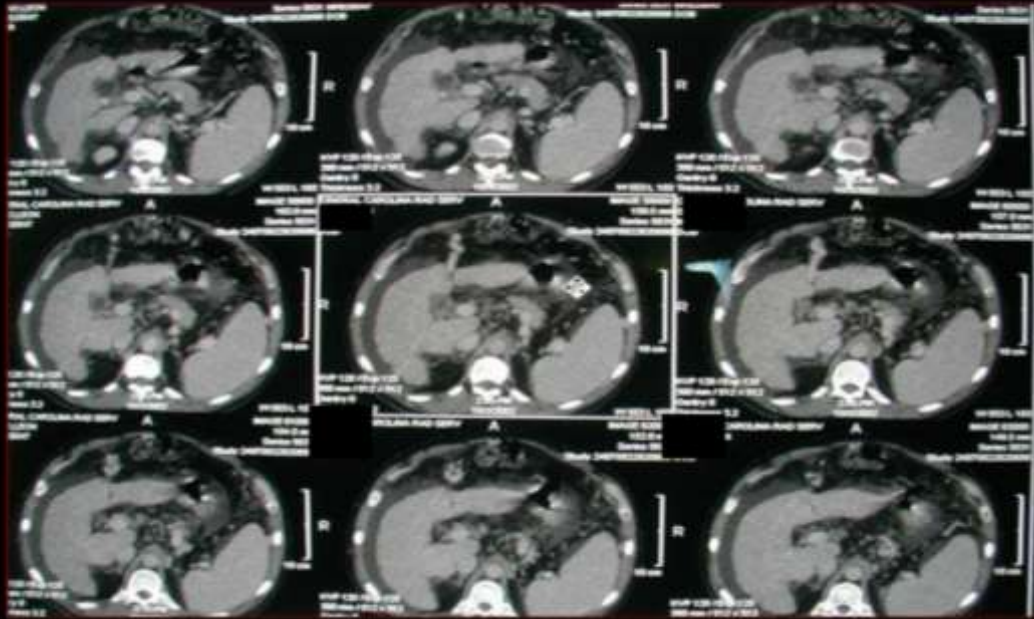
Normal liver



Normal: Liver and spleen are similar in density.

Fatty liver: more dense.

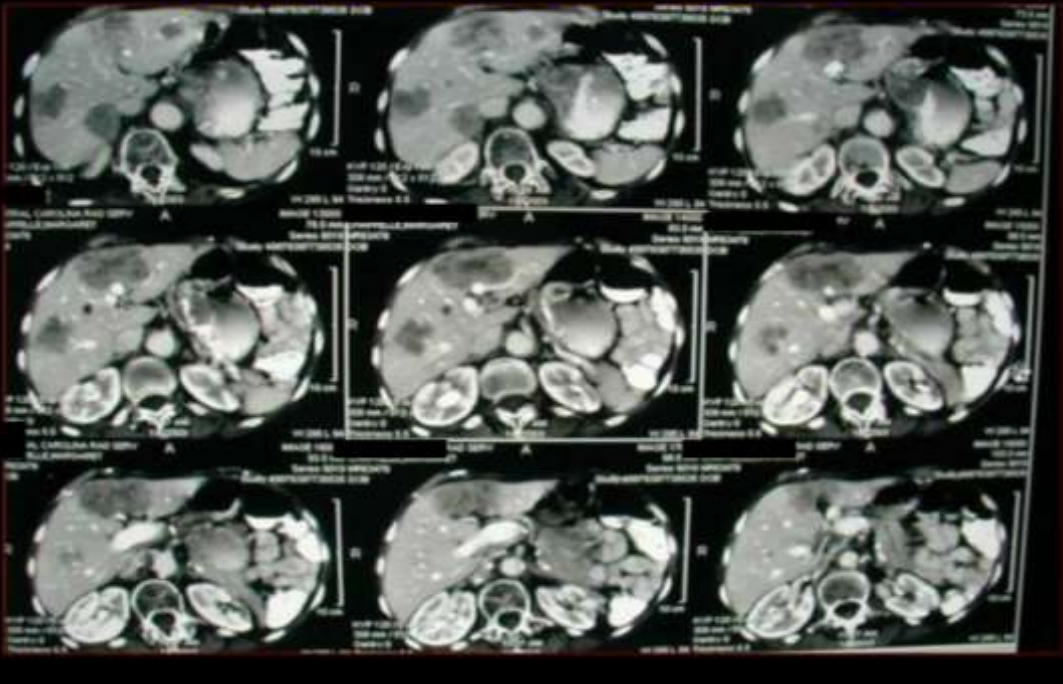
CIRRHOSIS



Early: liver enlargement, irregular wall and nodular.

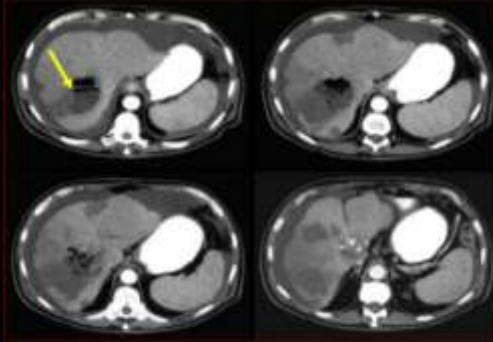
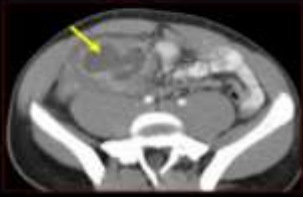
Late: size decreases, some fluid surrounding the liver (ascites), sometimes varices is seen.

METASTATIC DISEASE



Multiple areas inside the liver having different appearance than the normal structure of the liver. These lesions could be primary or secondary tumore. In this case, metastatic disease.

APPENDICITIS AND HEPATIC ABSCESS



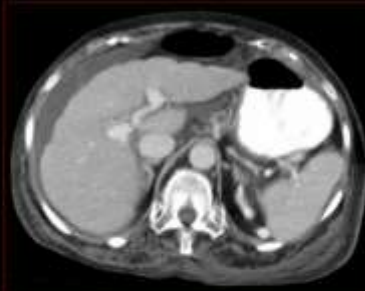
Enlarged palpable spleen



The liver with a collection of air fluid levels and hepatic abscess.

In the right iliac fossa we see a sac with thick enhanced wall, this is appendicitis. with appendicular abscess.

CIRRHOTIC LIVER



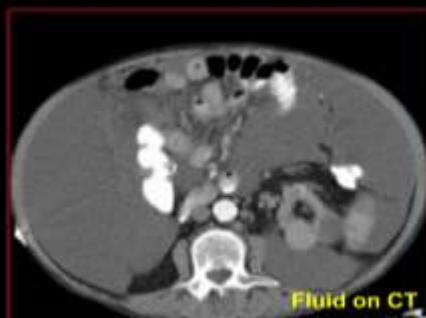
PALPABLE LIVER

PALPABLE GALLBLADDER

When it is distended



Lucent fluid at tip of liver on ultrasound



Fluid on CT

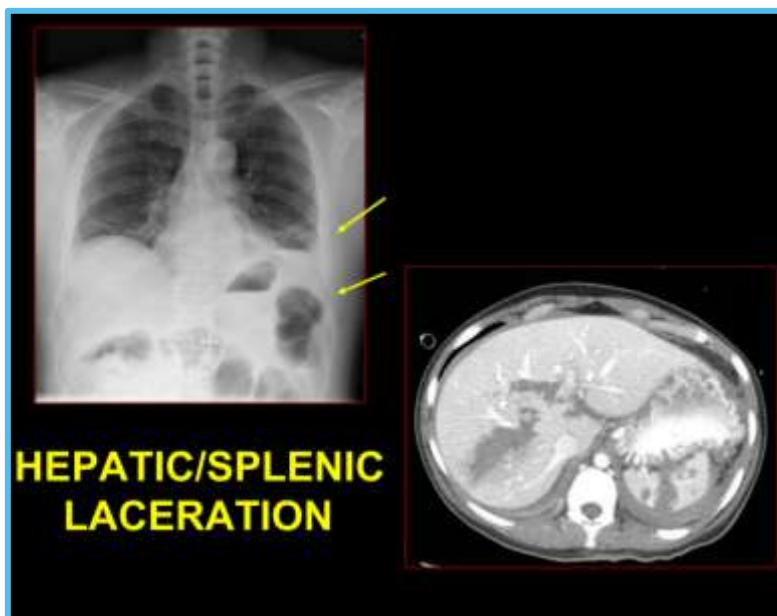
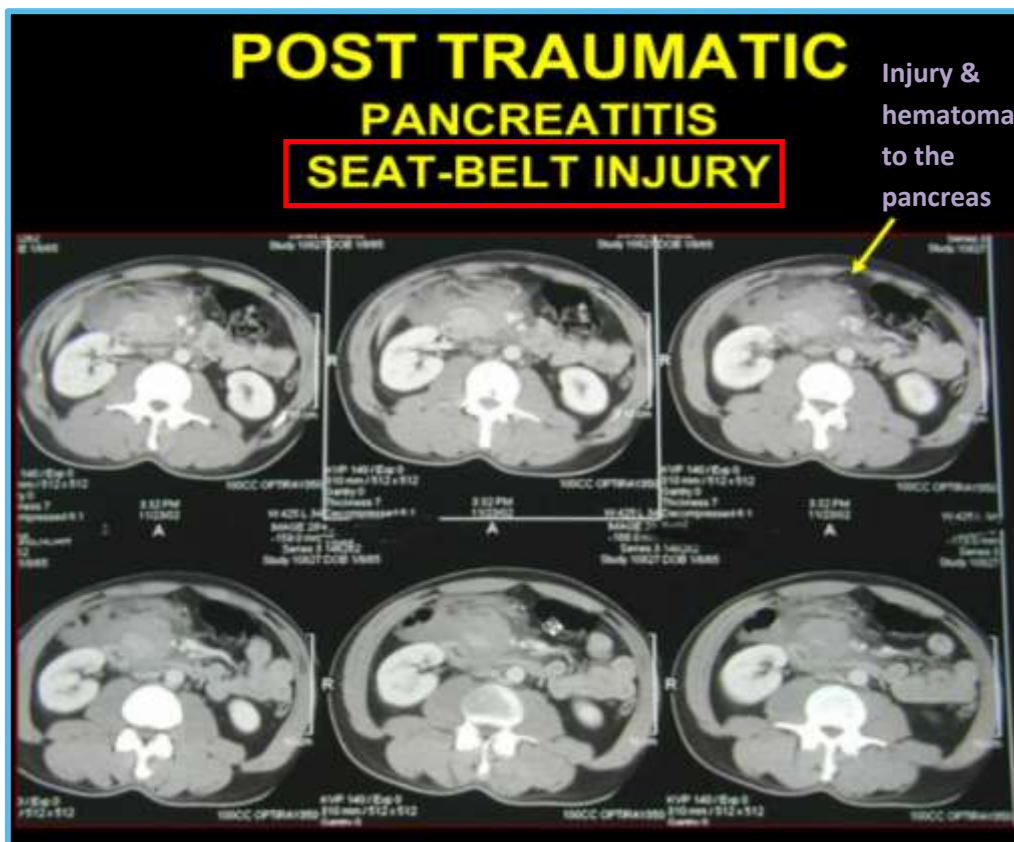
Free fluid (ascites in the abdomen) is seen on CT and US.

CT: Abdominal organs (mainly bowel loops) are localized in the center due to ascites.



Ascites displacing bowel medially on Xray

Trauma



X-RAY: Fractured ribs.

CT: Multiple lacerations of spleen and liver and hematoma surrounding them.

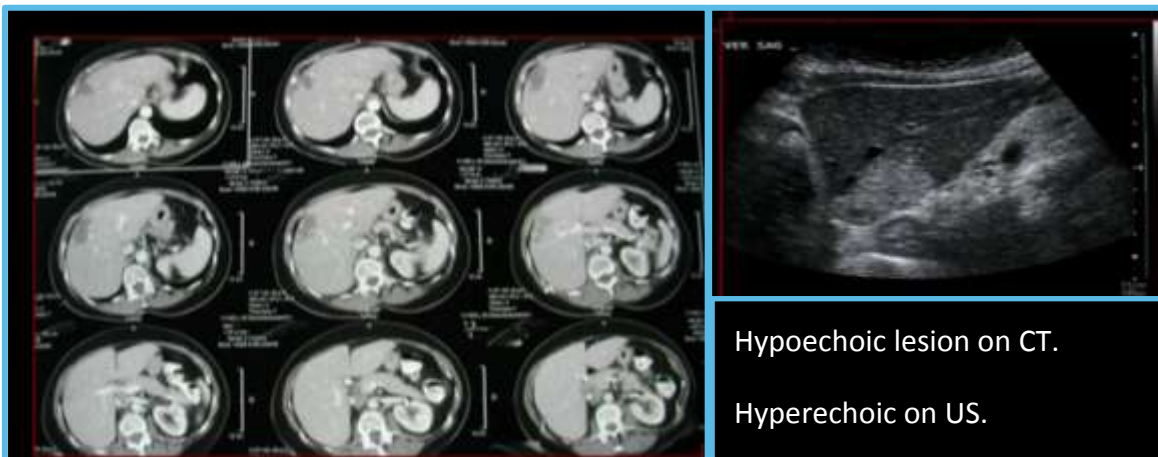
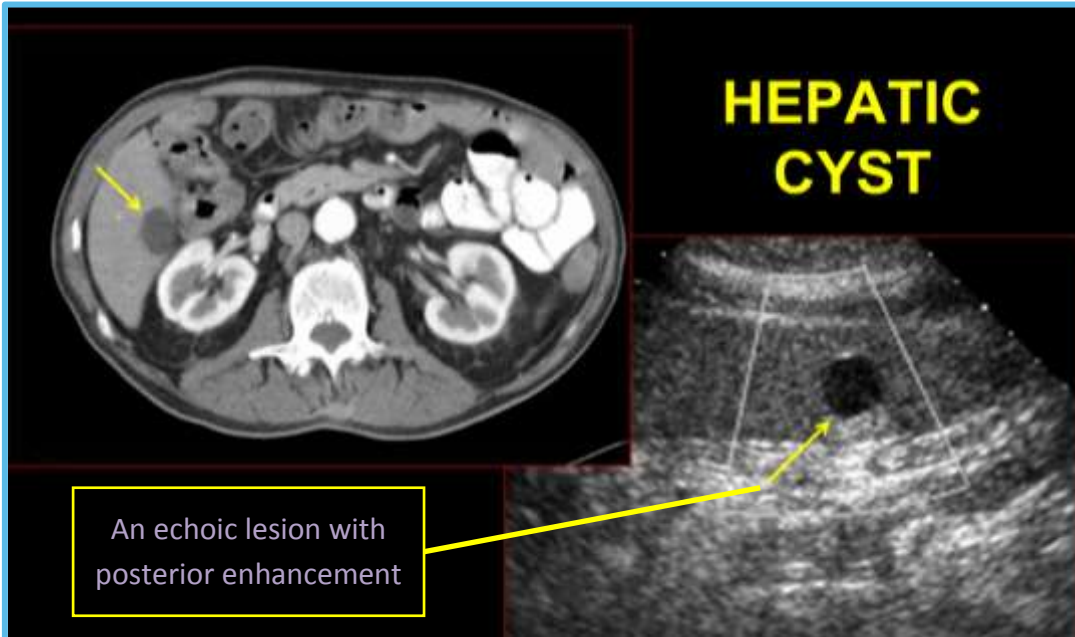


F.A.S.T Scan
(Focused Assessment with Sonography for Trauma)
Ultrasound survey for free peritoneal fluid

FAST: US in the ER to detect free abdominal fluid for traumatic unstable patients to see if there's bleeding.

Incidental findings

When you order a test to detect something and find something else



Hemangioma
Benign hepatic lesion

How can we differentiate between malignancy and hemangioma using CT?

Scan without a contrast, then scan again with contrast in the arterial phase, venous and delayed images.

If malignant → very enhanced in arterial phase and the contrast will wash away (dark) in the other two phases.

In hemangioma, with time it gets more enhanced. Sometimes even after 2 minutes of injecting the contrast, you can see the lesion still enhanced.



Good
Luck!