Radiology Team 429

Imaging investgation of the GI tract

Radiology Team 429

In this team we used the outlines from the:

Doctor's slides

Lecture notes

427 Radiology team

Diagnostic Imaging –PETER ARMSTRONG – 6Th Edition

Sorry we don't hold responsibility for any missing information or perhaps – perhaps -wrong material.

We tried our best to present this lecture in the best way, and we hope what we wrote is enough to cover the subjects.

Team Leaders:

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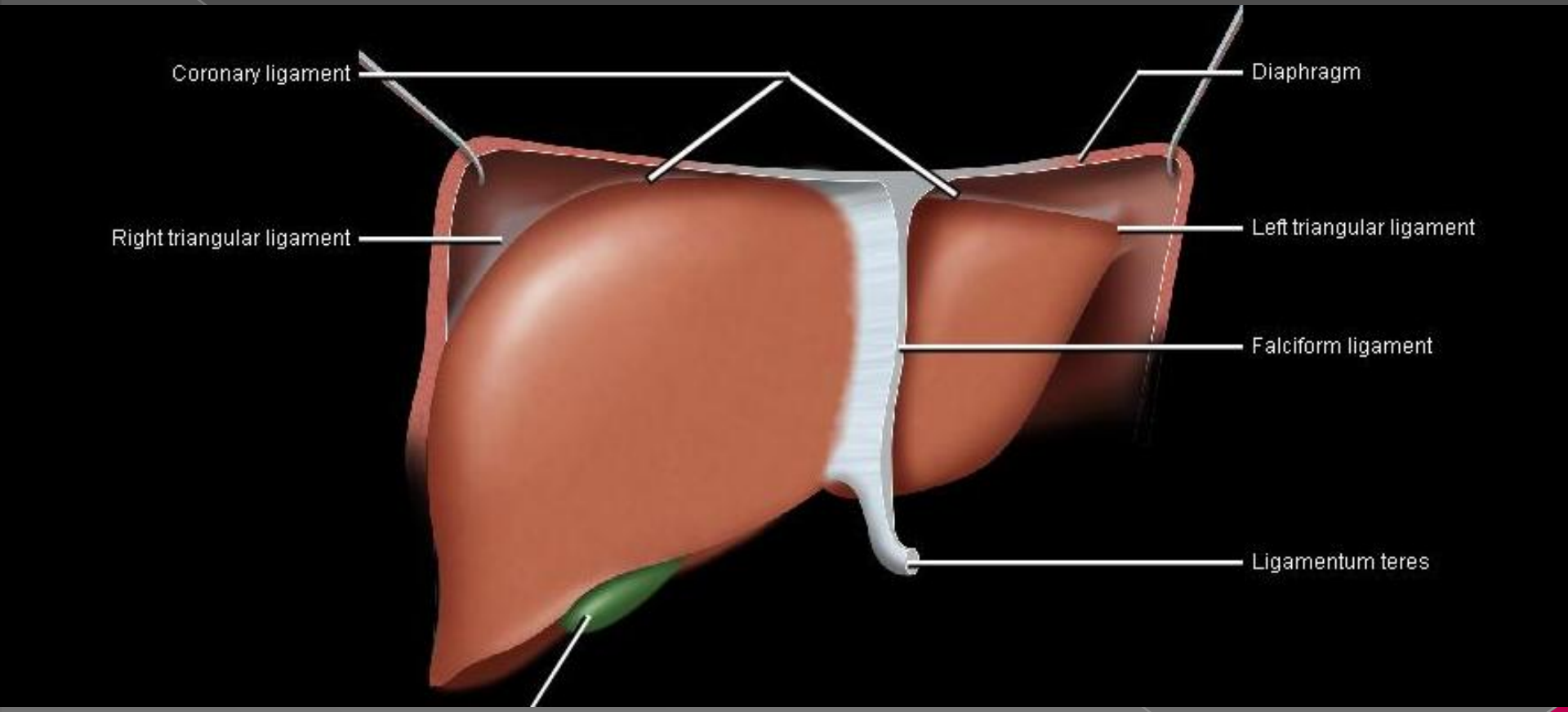
Team Members:

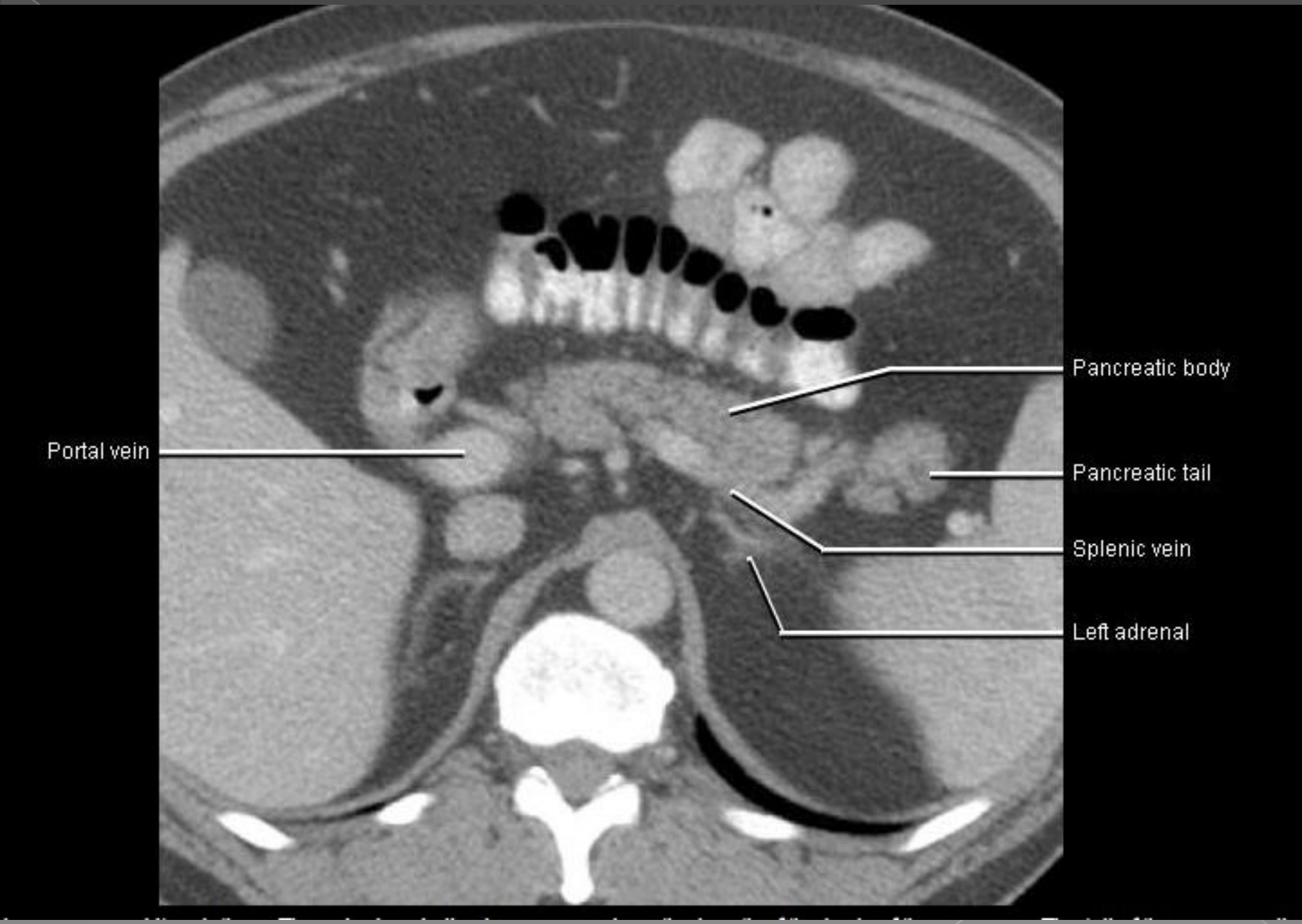
Abdullah aleisa – Abdullah Al-Ogayill

Best Wishes :)

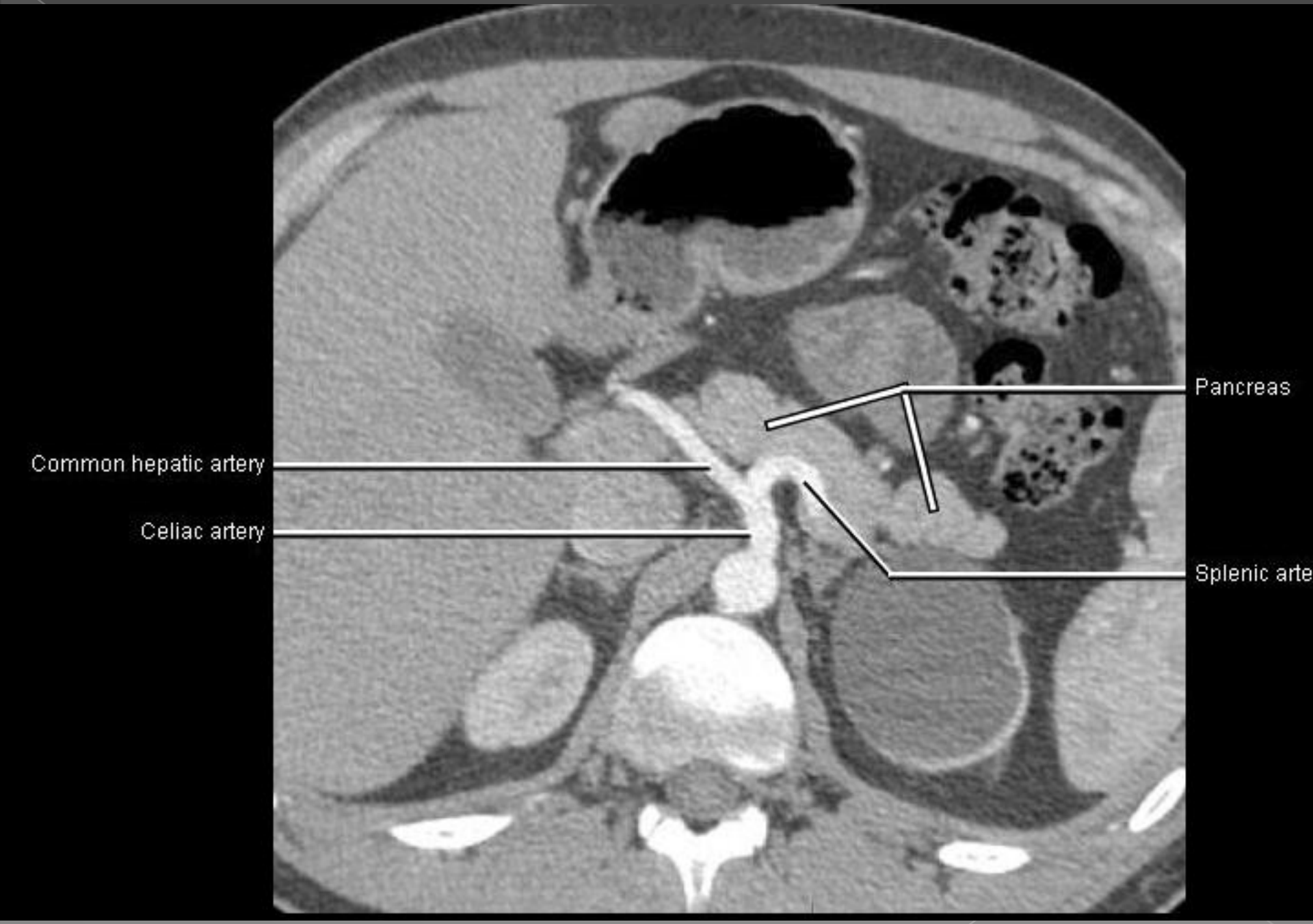
- You will find the note **AFTER** the pic :)


Coronary ligament
Diaphragm
Right triangular ligament
Left triangular ligament
Falciform ligament
Ligamentum teres

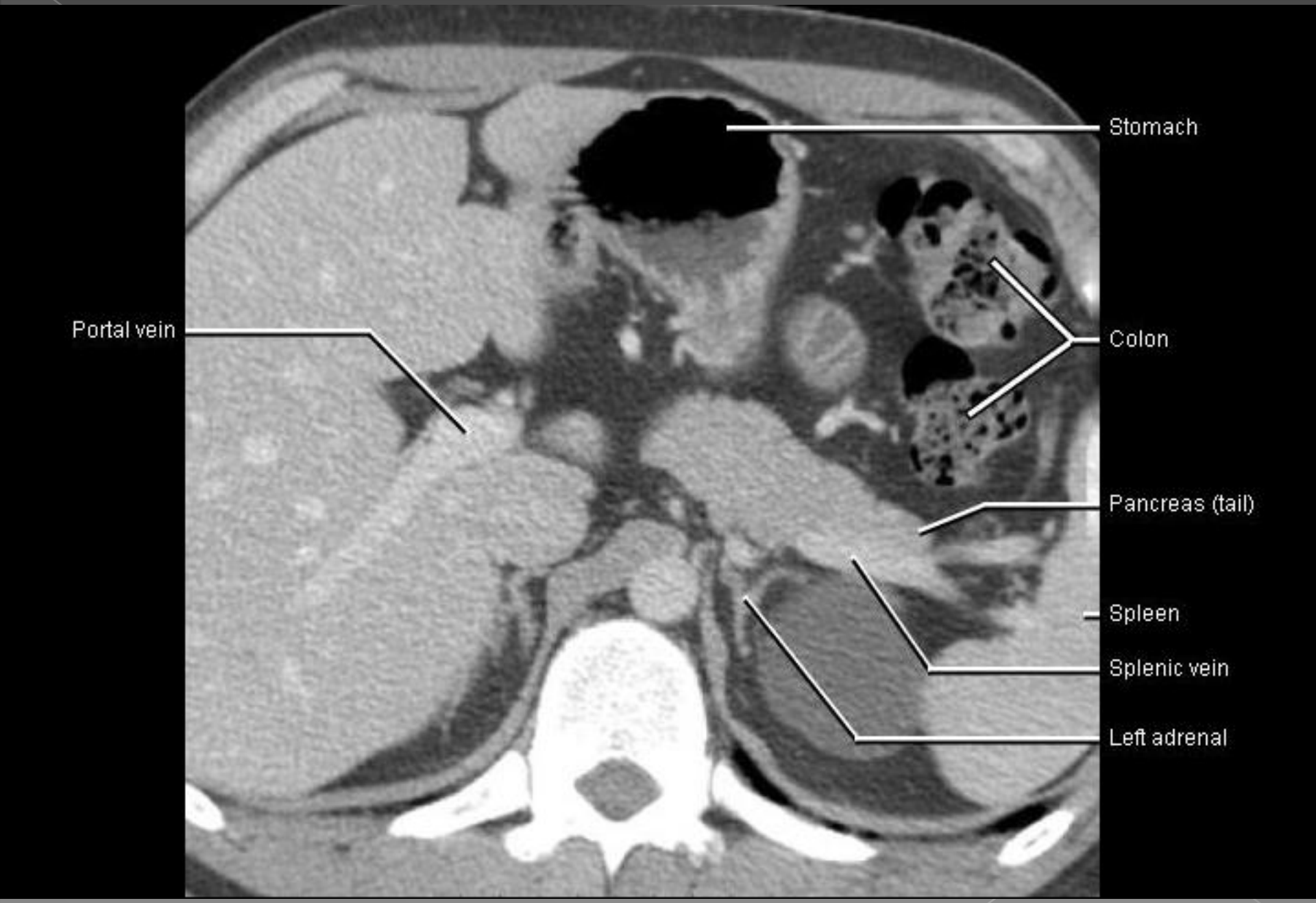
- Liver is composed of right and left lobes and held together by ligamentum teres .. And the liver is held by the coronary ligament which is attached to the diaphragm


Pancreatic body
Portal vein
Pancreatic tail
Splenic vein
Left adrenal

- Sectional CT scan .. **Note: to differentiate between a CT scan and a MRI → look at the bone. " in CT it is usually white, and in MRI it is usually darker"**


Pancreas
Common hepatic artery
Celiac artery
Splenic arte

- **Contrast enhanced scan**
- Aorta → celiac artery → common hepatic artery & Splenic artery
- On top of the splenic vein lies **the pancreas**

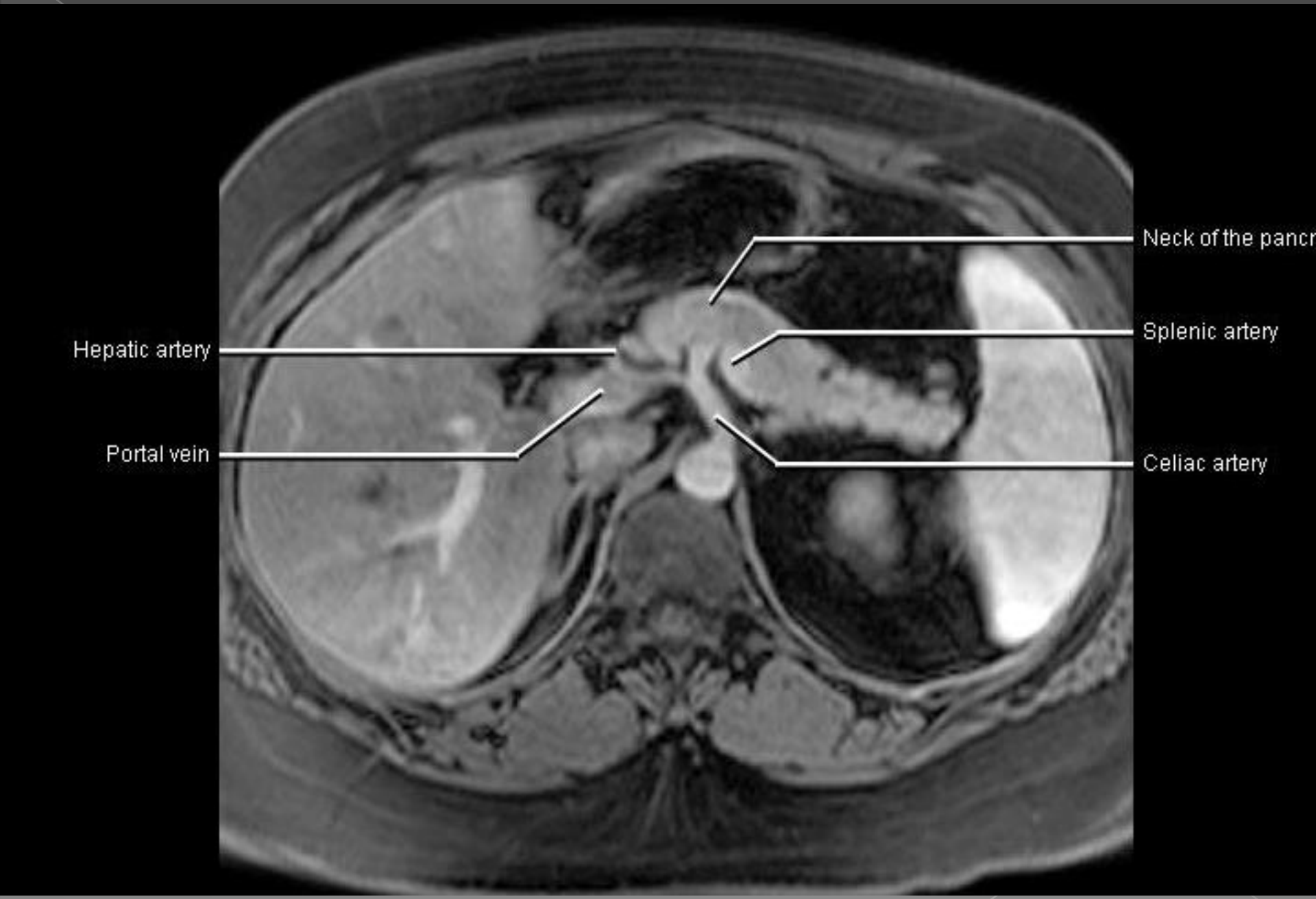

Stomach
Portal vein
Colon
Pancreas (tail)
Spleen
Splenic vein
Left adrenal

- The black thing in the stomach is air “ Black on CT also “.

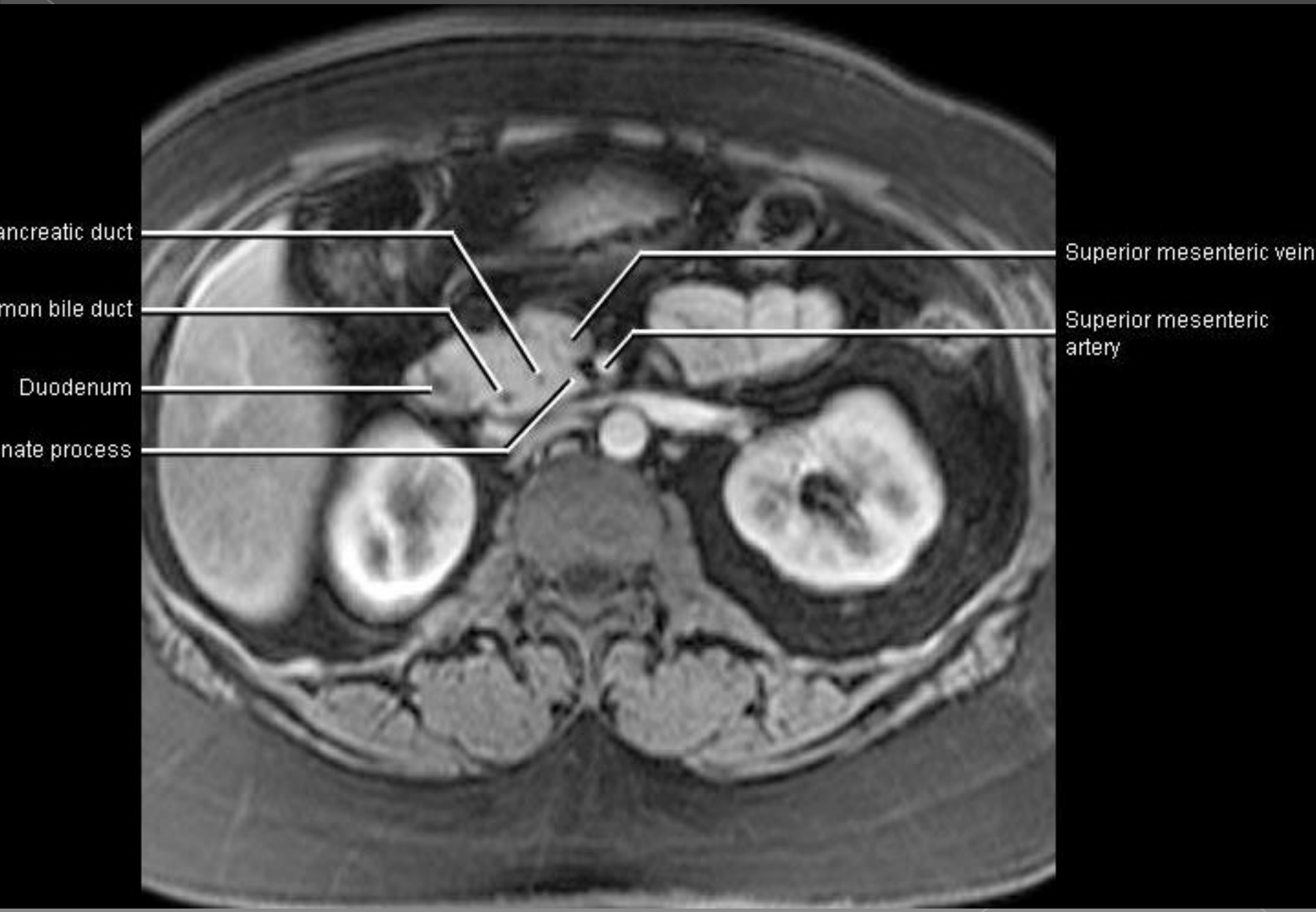

Neck of pancreas
Duodenum
Superior mesenteric vein
Splenic ve
Inferior m

- Coronal view of the liver and pancreas

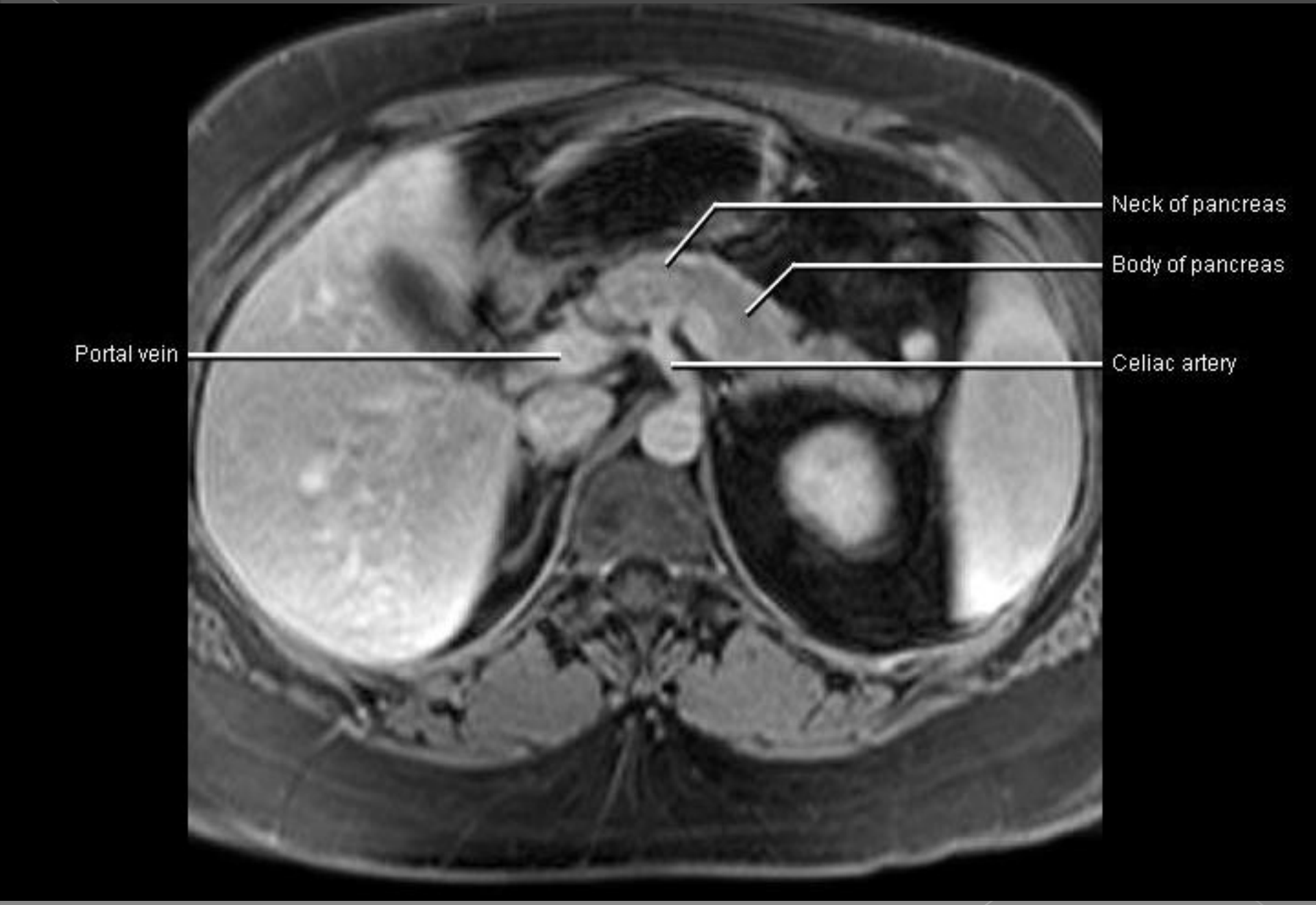

Portal vein
Pancreas
Splenic vein

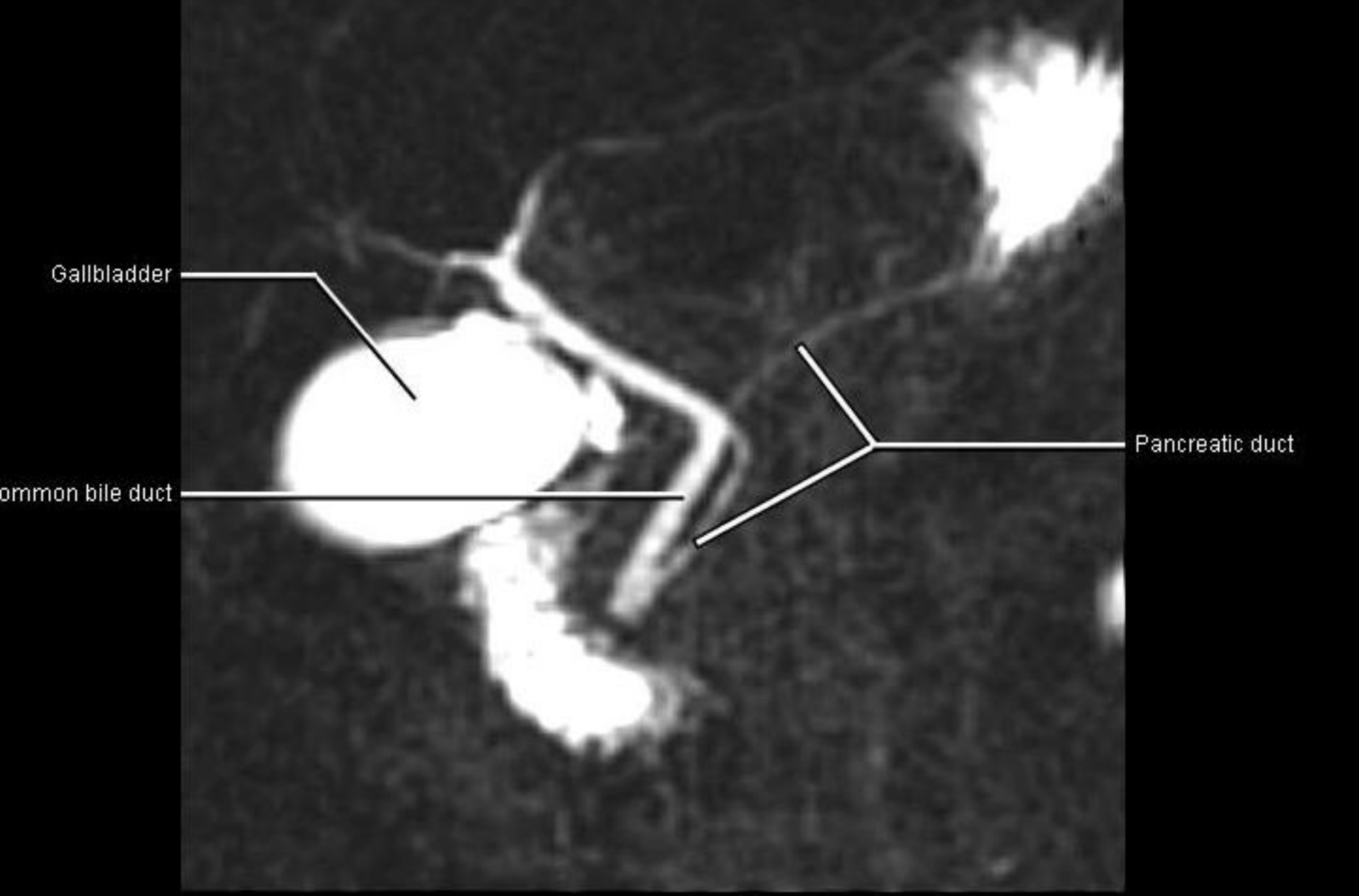

Neck of the pancr
Splenic artery
Hepatic artery
Portal vein
Celiac artery

- Splenic artery is coming off from the celiac artery
- Spleen and liver is noted

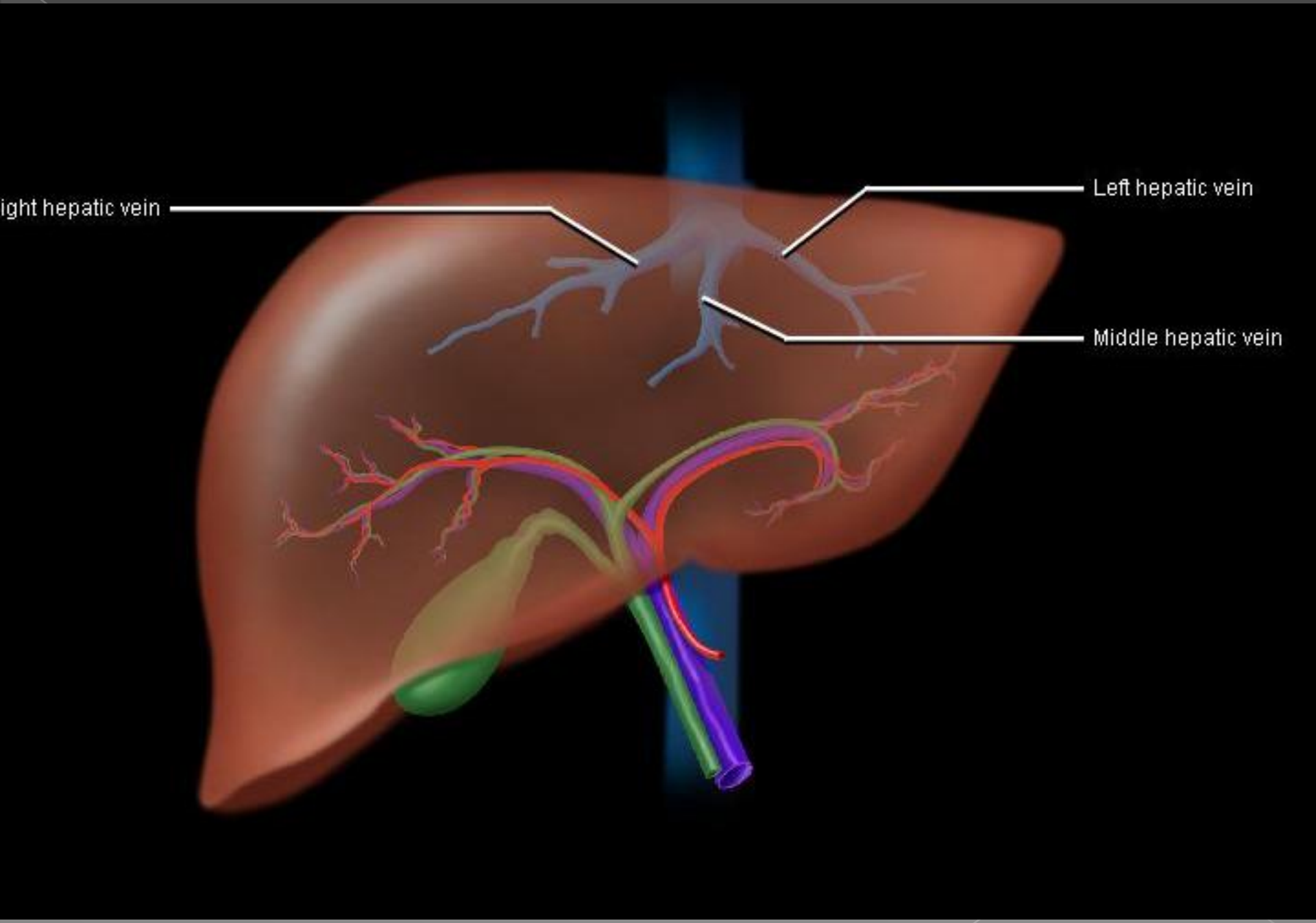

ancreatic duct
mon bile duct
Duodenum
nate process
Superior mesenteric vein
Superior mesenteric artery

- The pancreatic duct comes in close contact with the common bile duct to form the ampulla of vater “ opening in the 2nd part of duodenum”

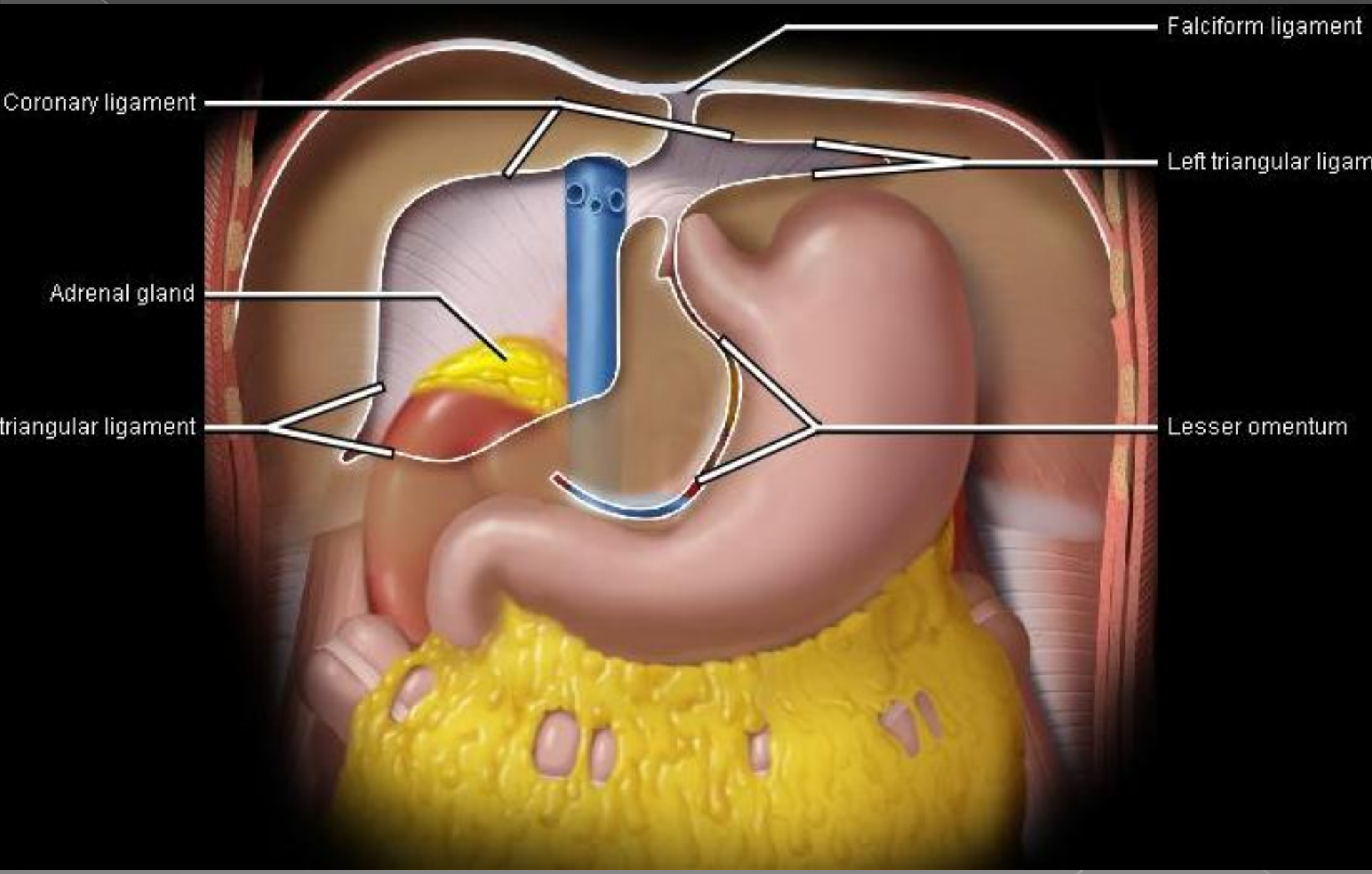

Neck of pancreas
Body of pancreas
Portal vein
Celiac artery

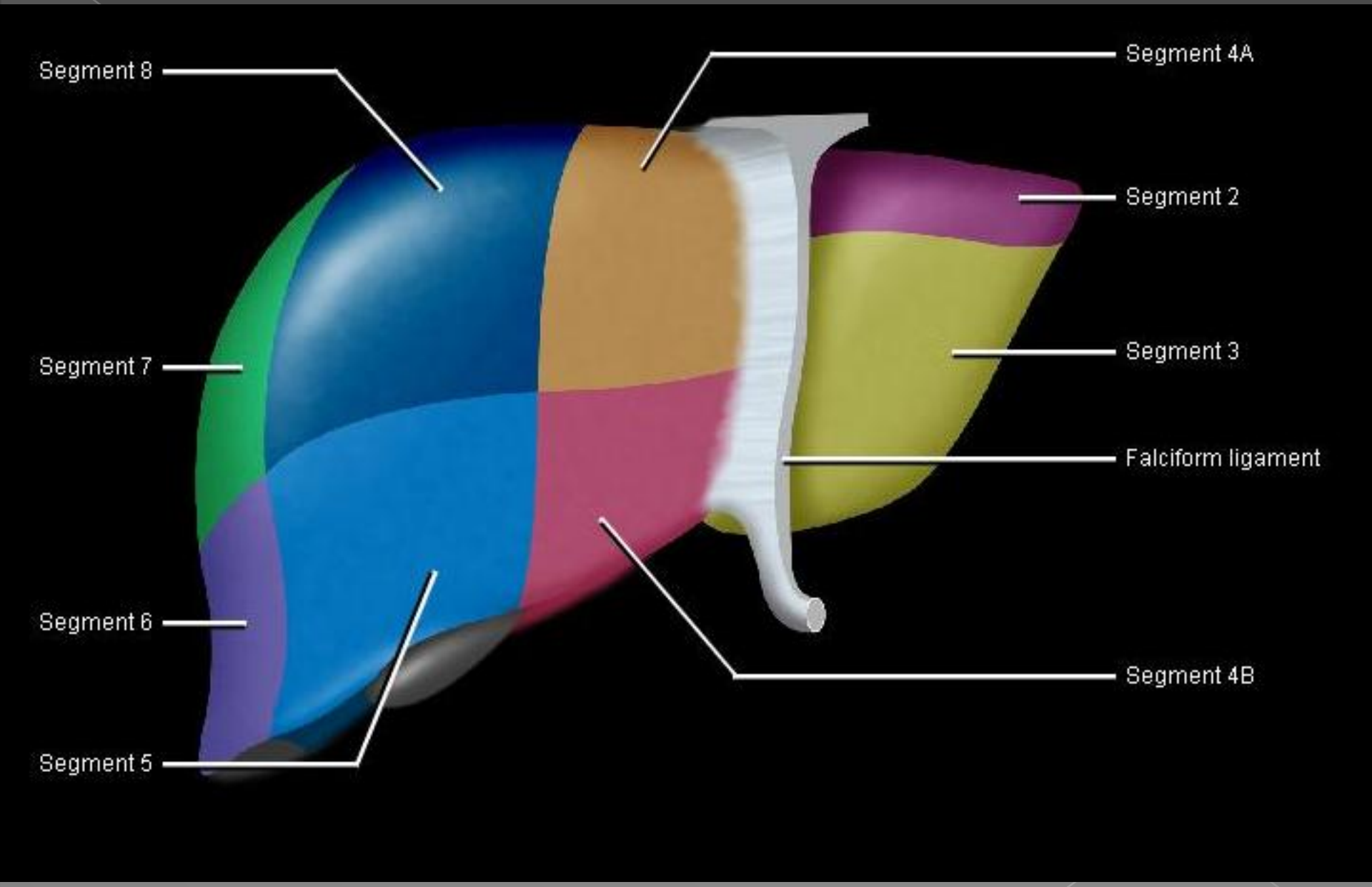

Gallbladder
ommon bile duct
Pancreatic duct

- Magnetic Resonance Cholangiopancreatography (MRCP) study
- Gall bladder is seen and coming out of it is the cystic duct it unites with the hepatic duct to form the common bile duct.
- And the pancreatic duct is also seen which will join together to open in the ampulla of vater.


ight hepatic vein
Left hepatic vein
Middle hepatic vein

- You have to know that the common hepatic artery (red)
- Portal vein (blue)
- Common bile duct (green)
- Always moves together inside the liver.


Falciform ligament
Coronary ligament
Left triangular ligam
Adrenal gland
triangular ligament
Lesser omentum


Segment 8
Segment 4A
Segment 2
Segment 7
Segment 3
Falciform ligament
Segment 6
Segment 4B
Segment 5

- For purposes of better management and description of lesions in the liver they divided the liver into 8 segments

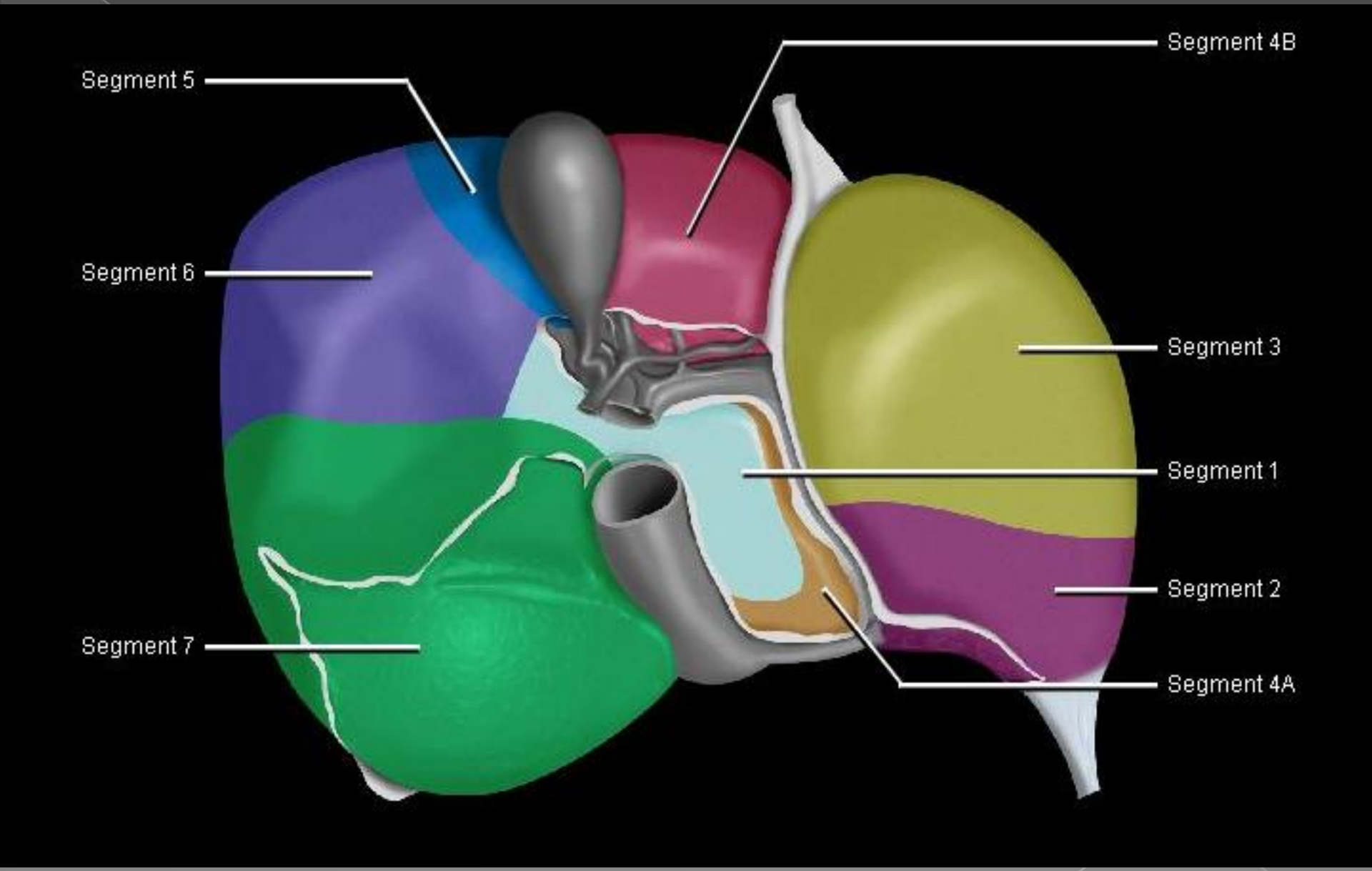
- 1: Caudate lobe of liver
- 2-3: left lobe
- 4A-4B , 5,6,7,8 : Right lobe.

- It is divided by imaging that the portal vein comes in the middle of the liver and divides the upper pole of liver form the lower one.

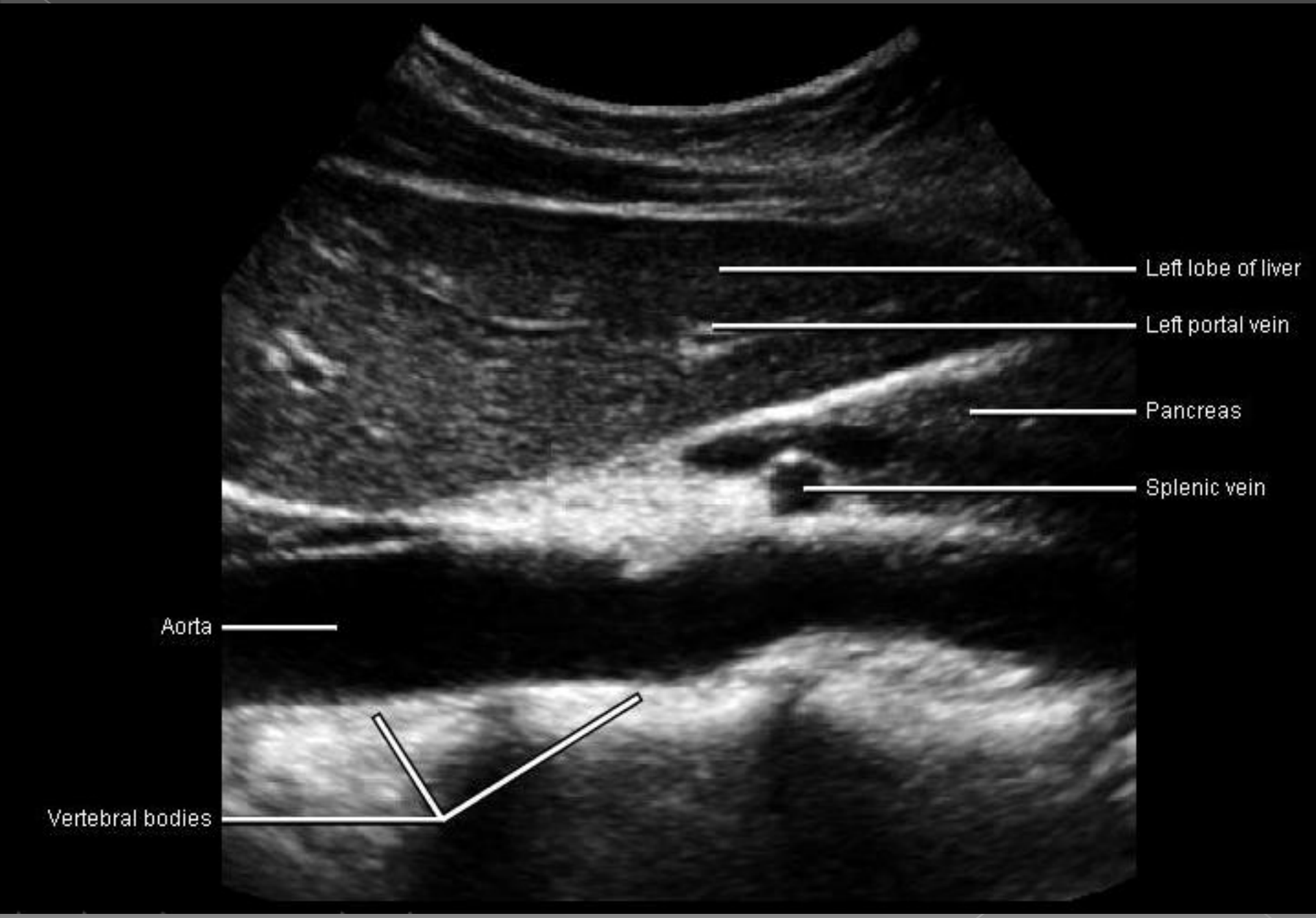
- And the hepatic vein divide it into middle, left & right lobes of liver

- So what's on top is : 2 , 4A , 8 & 7
- And what's below the portal vein : 3 , 4B , 5 & 6

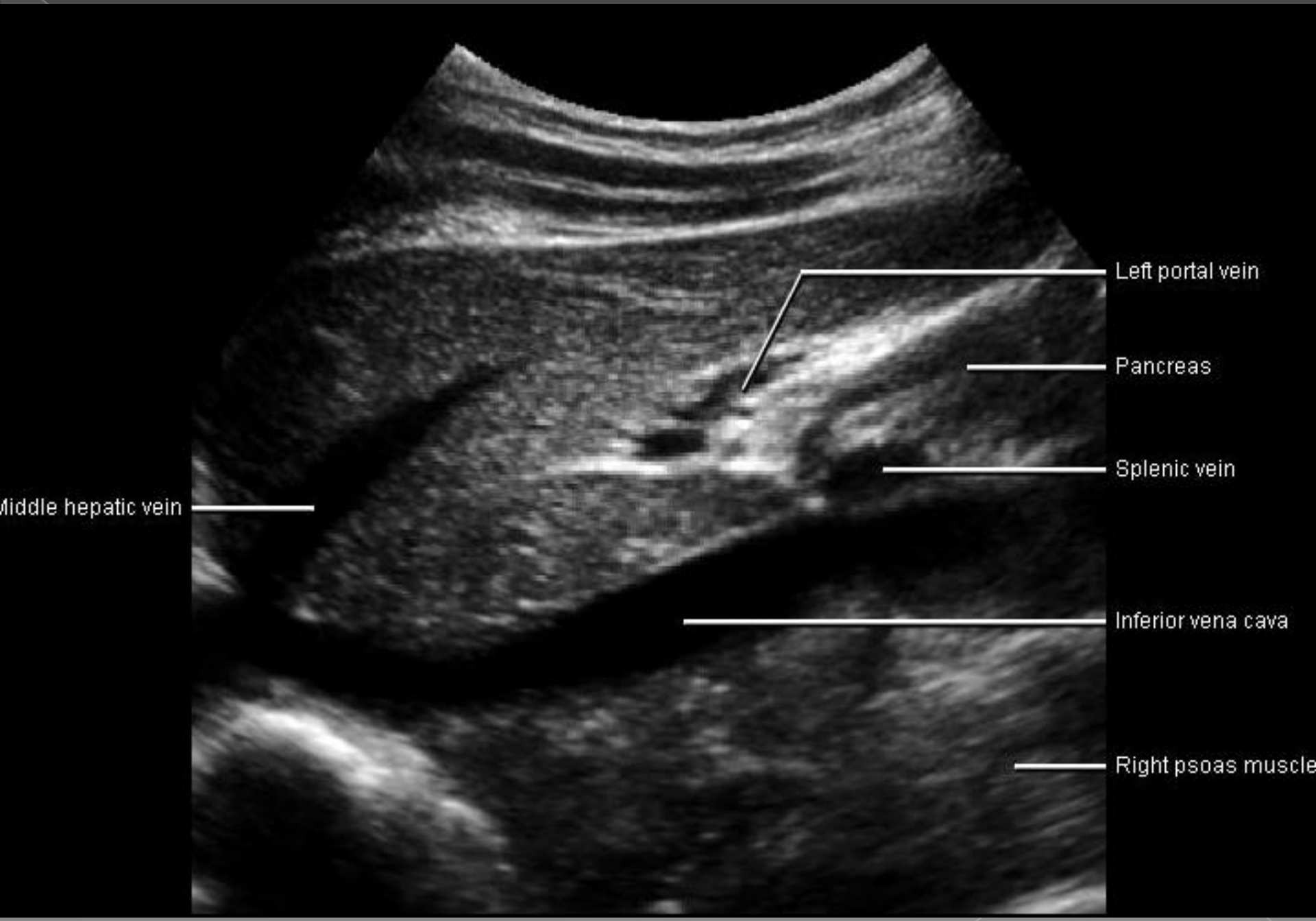
- Other way around this " a way to make it easier to remember " :
- **Upper pole : 2** x **4** = **8 ..** And **8** – 1 = **7**
- **Lower pole: 3,4,5,6 (in sequence)**


Segment 5
Segment 4B
Segment 6
Segment 3
Segment 1
Segment 2
Segment 7
Segment 4A

- Sgements from below
- 4B & 5 are adjacent to the gall bladder.

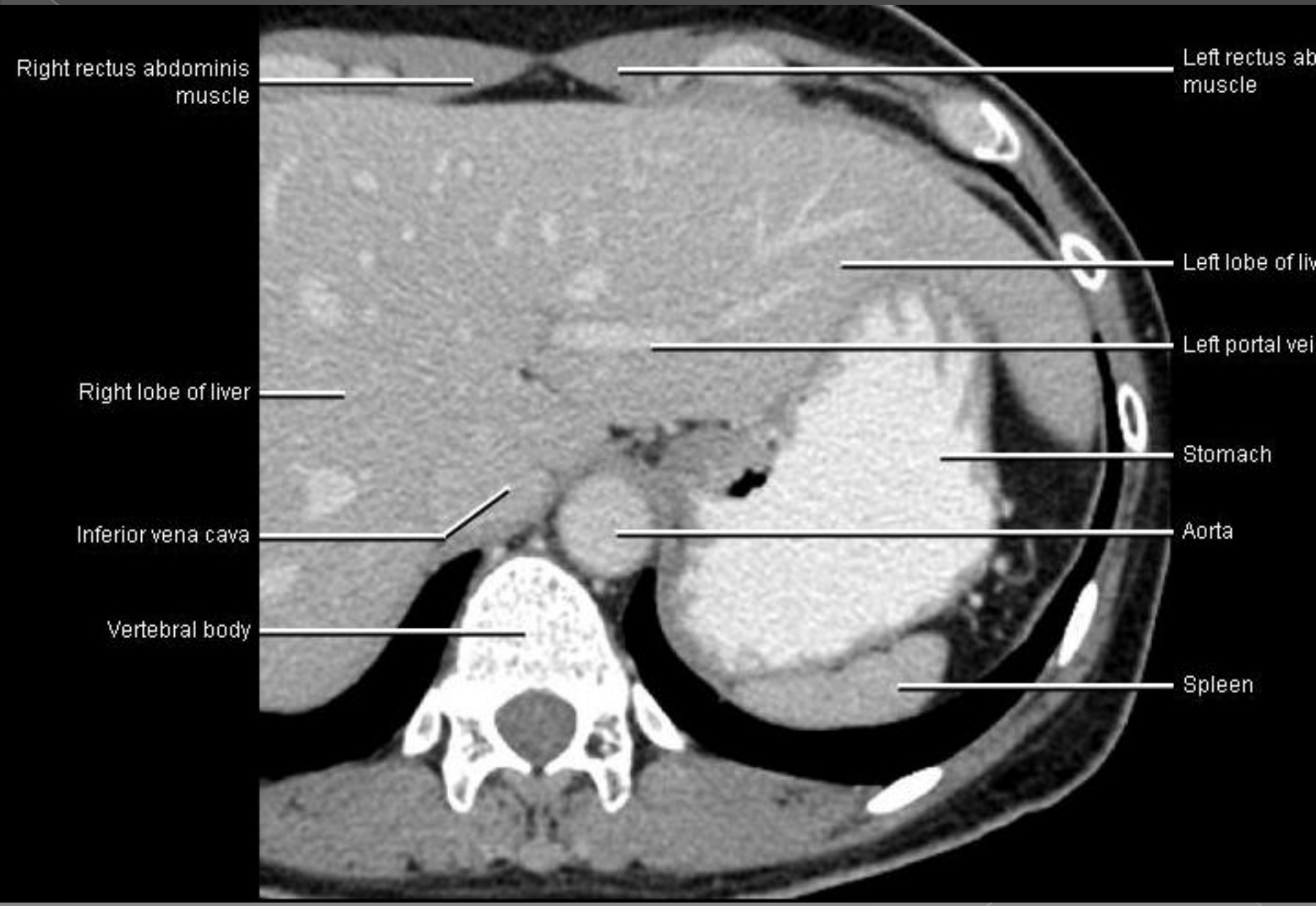

Left lobe of liver
Left portal vein
Pancreas
Splenic vein
Aorta
Vertebral bodies

- Ultrasound (Sagittal view) because the aorta is longitudinal here **“important”**

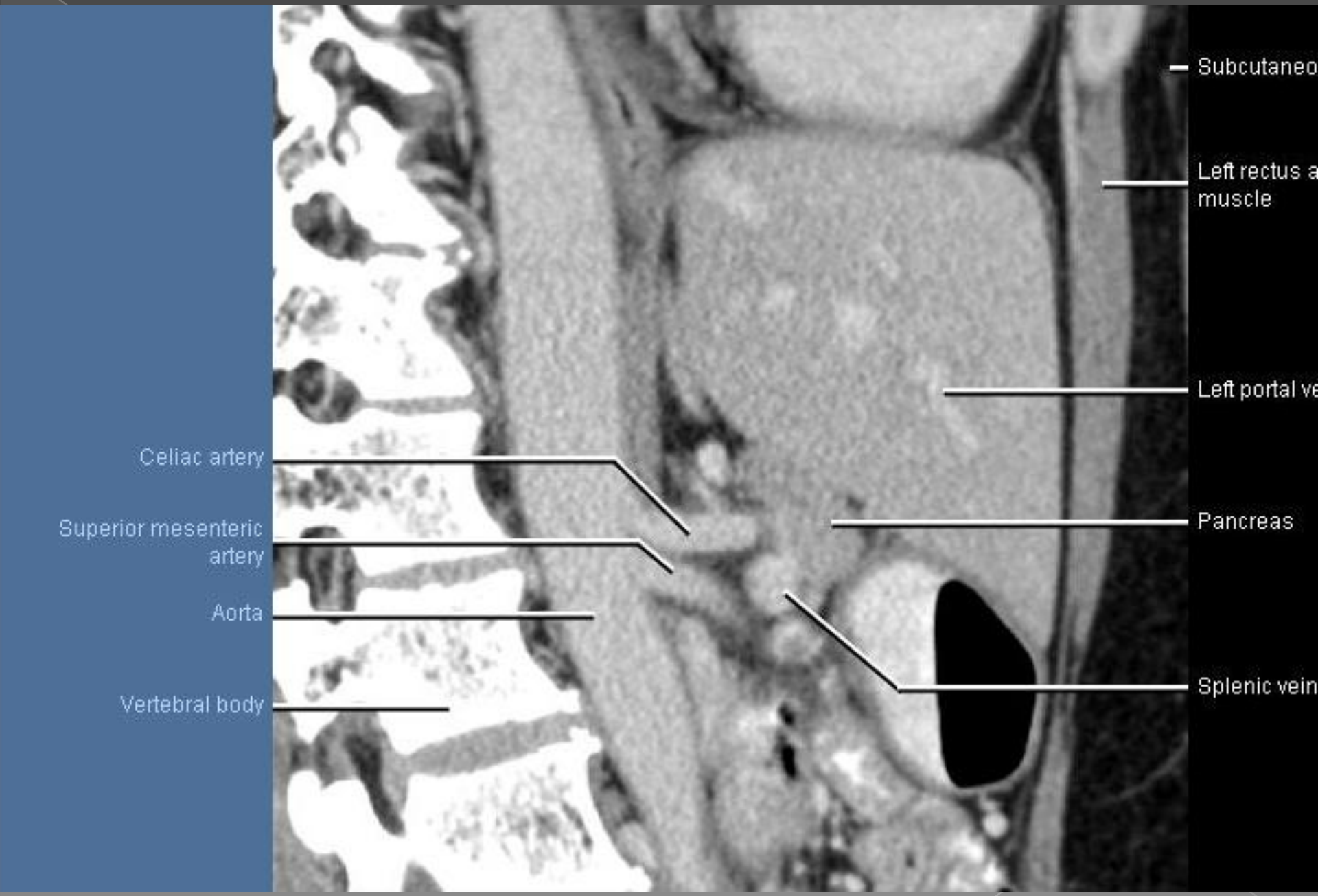

Left portal vein
Pancreas
Splenic vein
Middle hepatic vein
Inferior vena cava
Right psoas muscle

- Ultrasound (sagittal view)
- Inferior venacava and beside it is the splenic vein which drain into the portal vein also superor mesentric vein

- Middle hepatic vein is branched from IVC


Right rectus abdominis muscle
Left rectus ab muscle
Left lobe of liv
Left portal vei
Right lobe of liver
Stomach
Inferior vena cava
Aorta
Vertebral body
Spleen

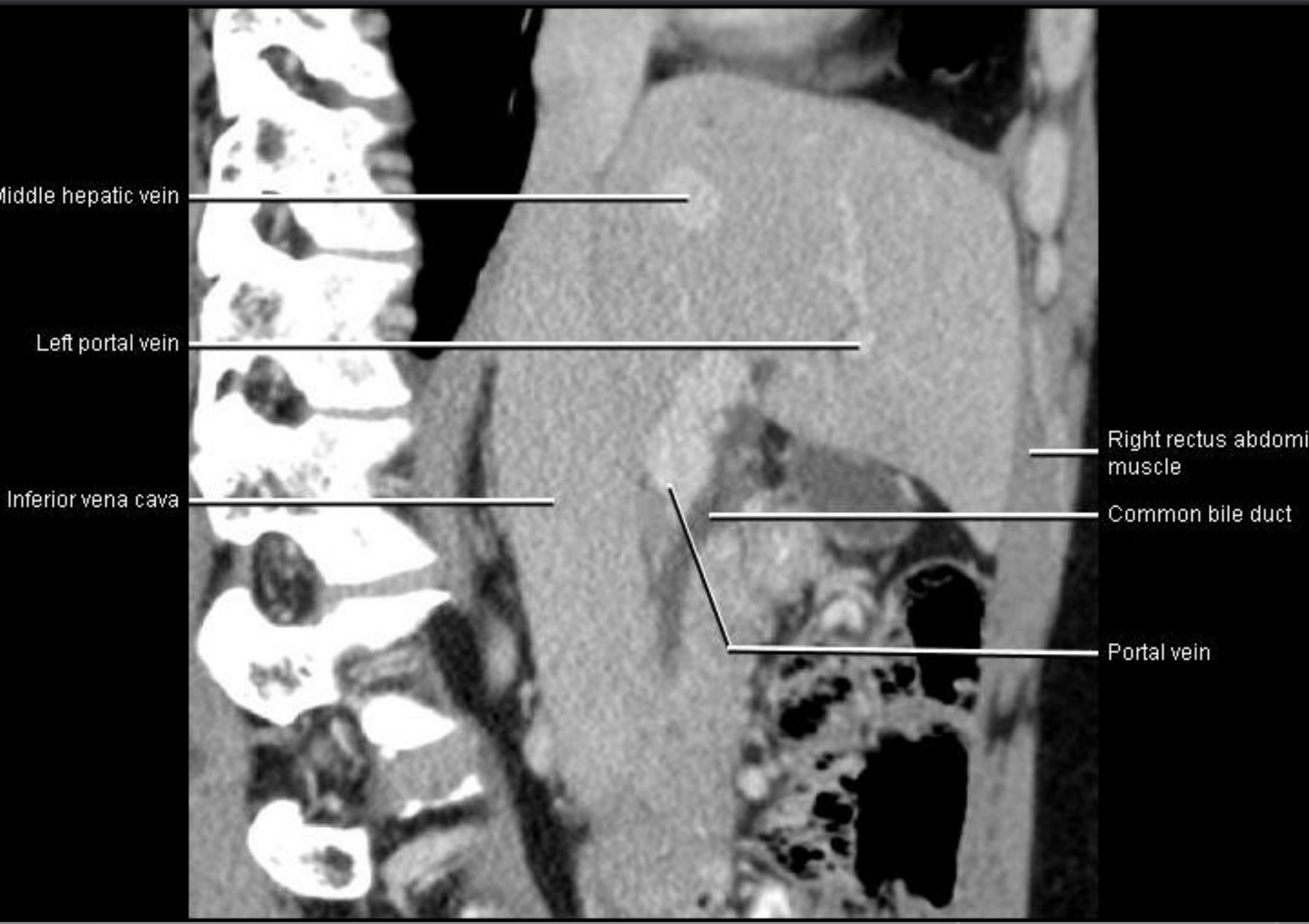
- CT with contrast (axial)

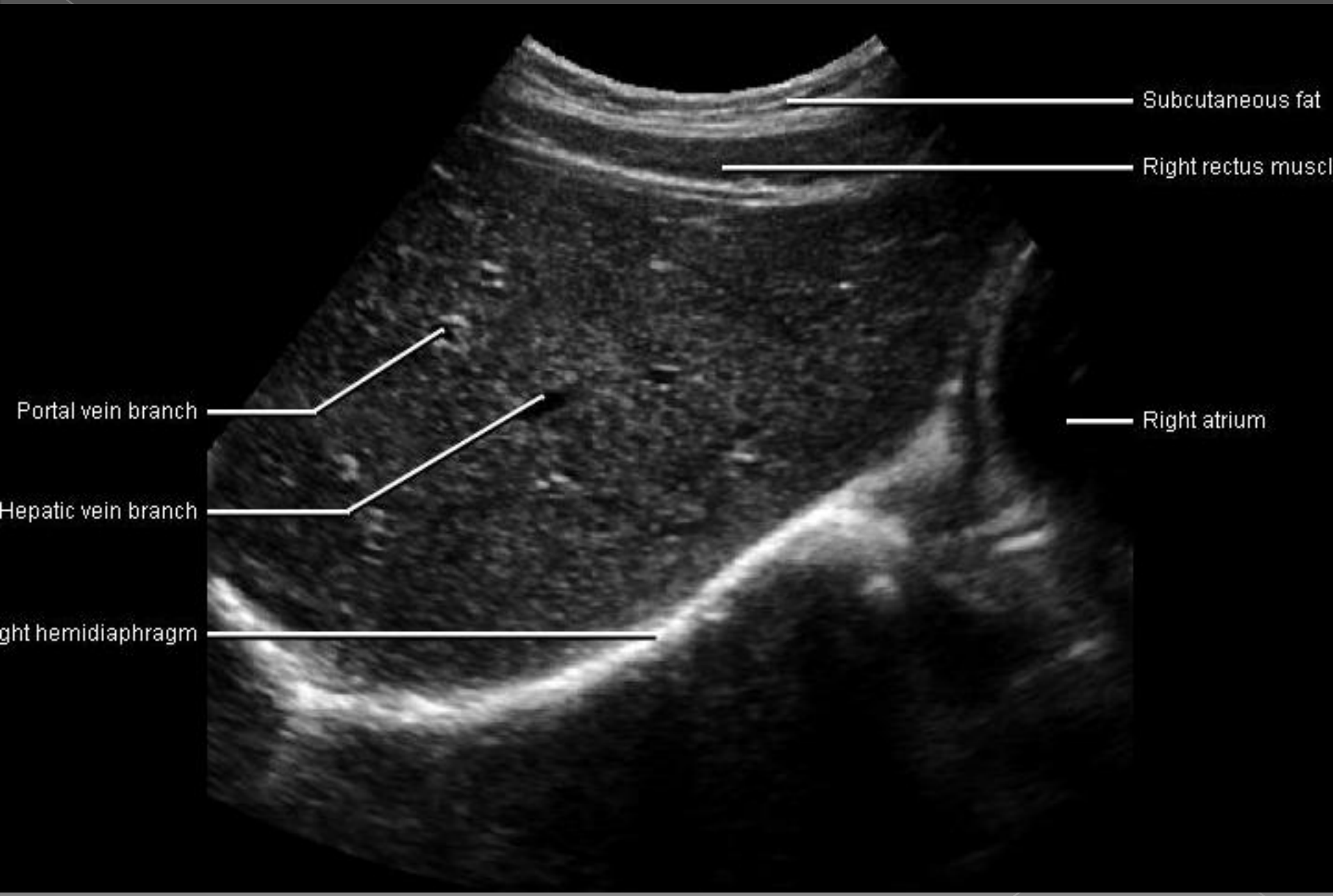

Subcutaneo
Left rectus a
muscle
Left portal ve
Celiac artery
Superior mesenteric
artery
Pancreas
Aorta
Splenic vein
Vertebral body

- CT scan (Sagittal view because you can see the vertebrae)
- Aorta is seen and celiac artery is the first branch from it.

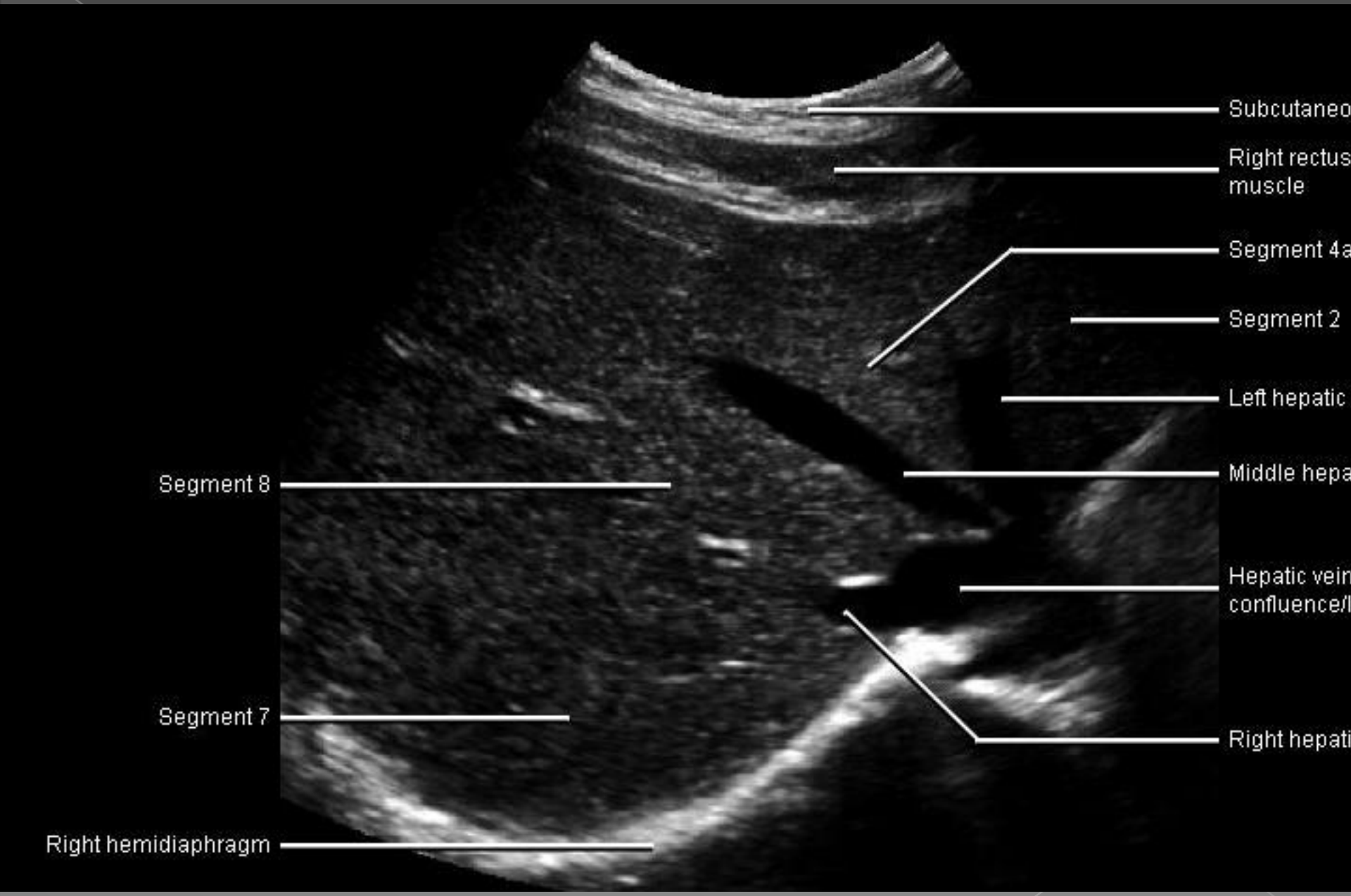

Middle hepatic vein
Subcutaneous fat
Left portal vein
Pancreas
Splenic vein
Inferior vena cava

- CT (sagittal)
- Middle hepatic vein coming of the IVC


Middle hepatic vein
Left portal vein
Inferior vena cava
Right rectus abdomi
muscle
Common bile duct
Portal vein

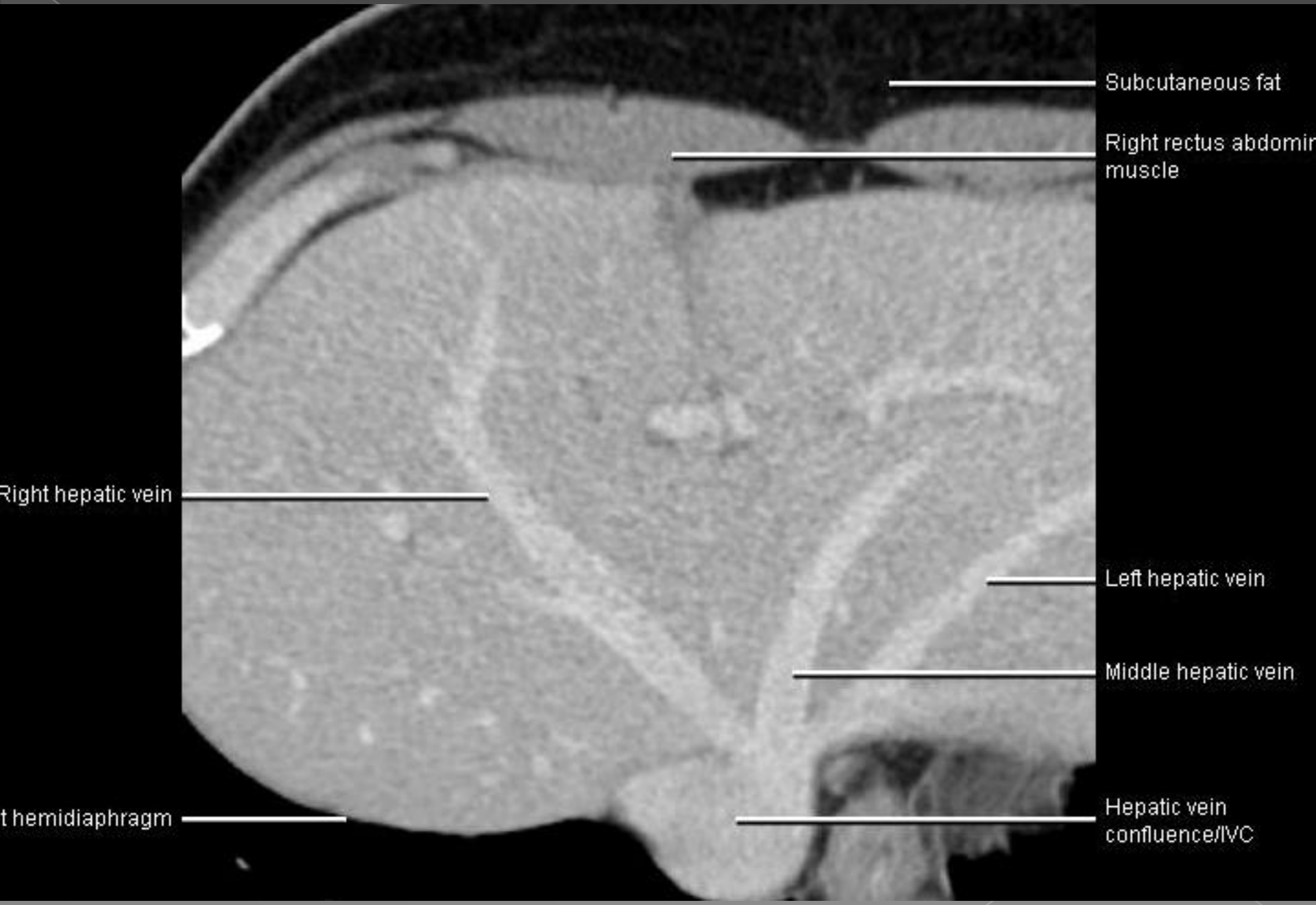

Subcutaneous fat
Right rectus muscl
Portal vein branch
Right atrium
Hepatic vein branch
ght hemidiaphragm

- Ultrasound
- - Left lobe of the liver is seen “ because the right atrium is in the image “

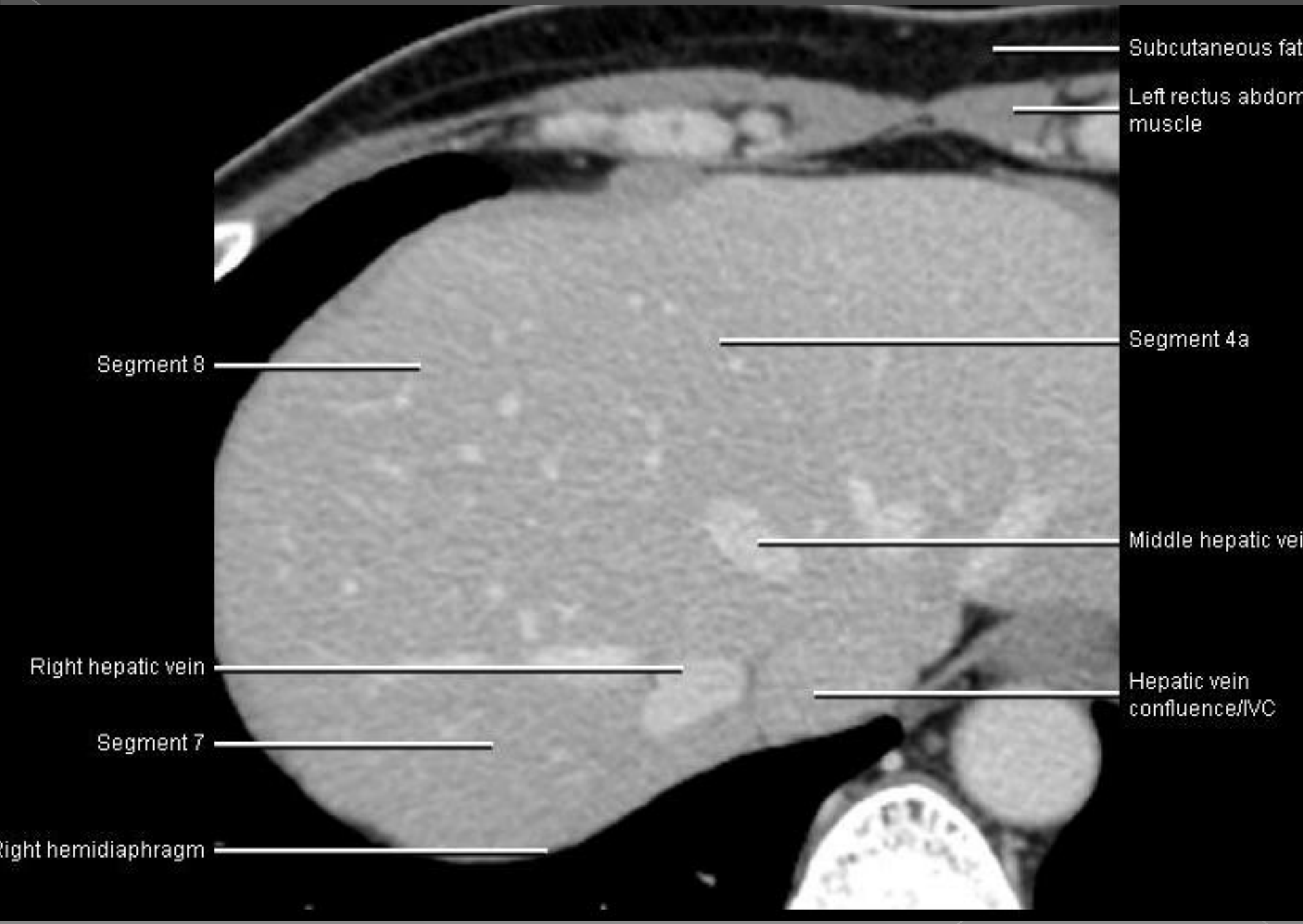

Subcutaneo
Right rectus muscle
Segment 4a
Segment 2
Left hepatic
Middle hepa
Hepatic vein confluence/I
Right hepati
Segment 8
Segment 7
Right hemidiaphragm

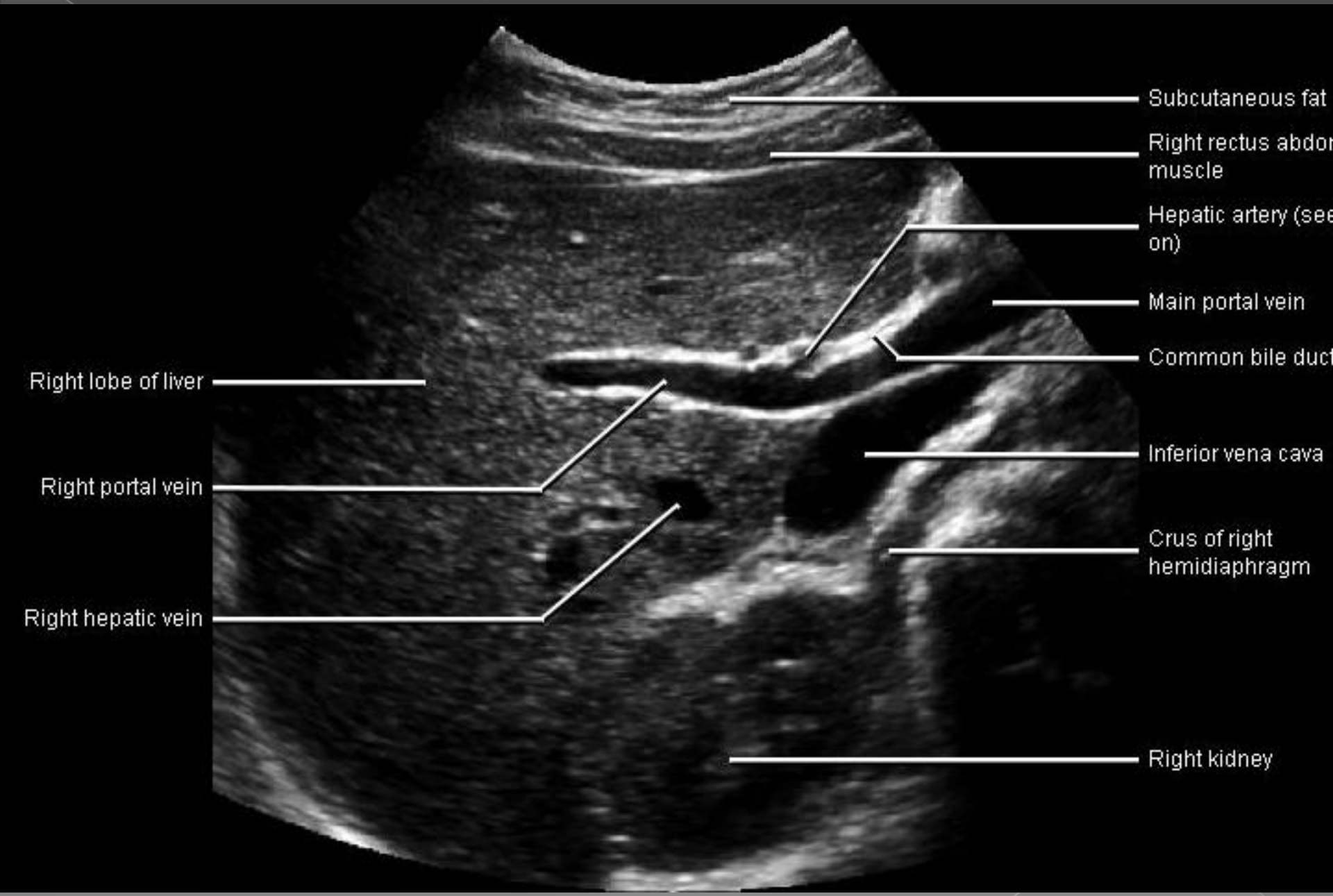
- ultrasound

- Right lobe of liver
- Largest segment is (8)
- Underneath it is (7)
- And on the left is (4A) & (2) segments

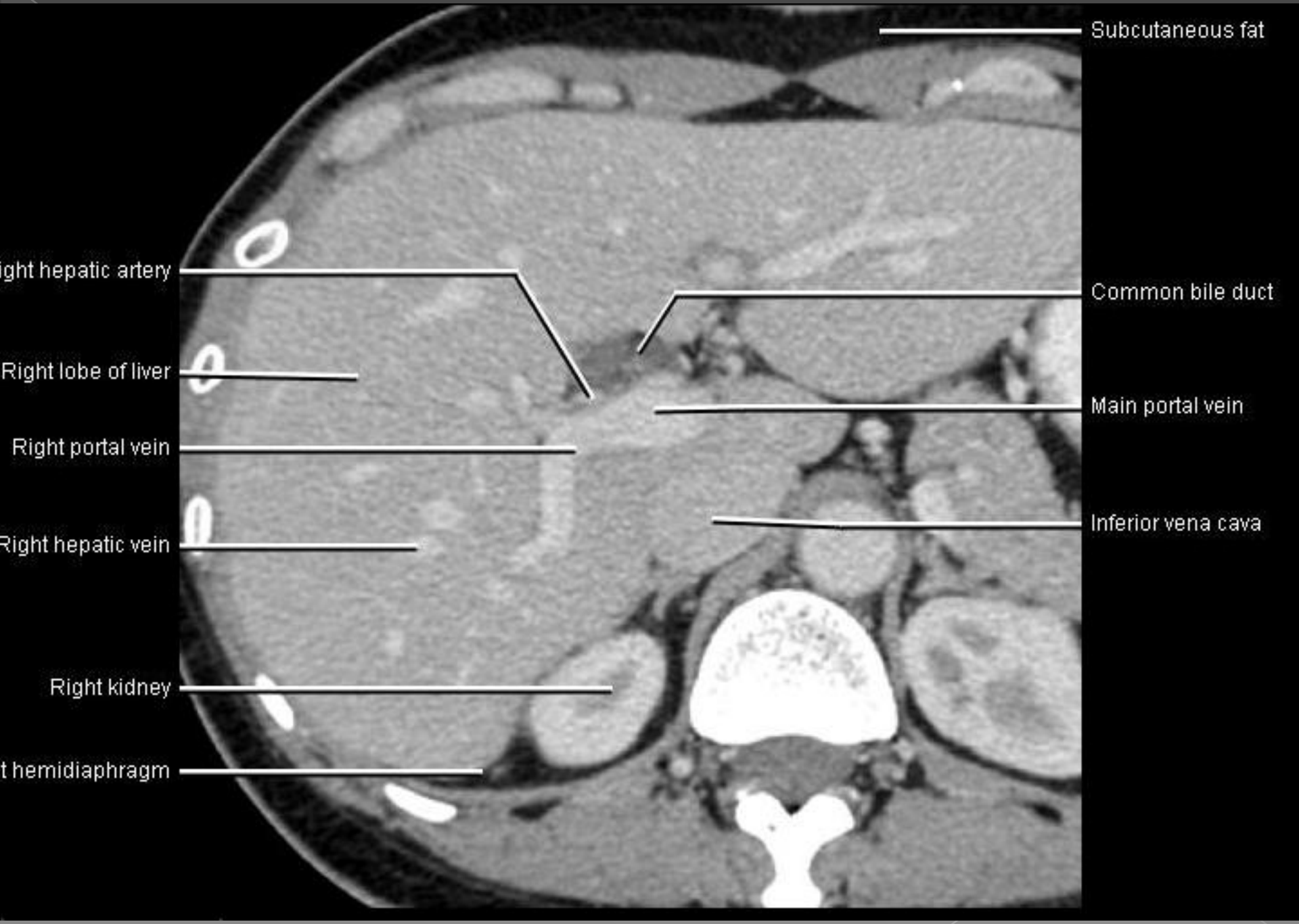

Subcutaneous fat
Right rectus abdomin
muscle
Right hepatic vein
Left hepatic vein
Middle hepatic vein
t hemidiaphragm
Hepatic vein
confluence/IVC

- The appearance of a **deers head ? “ not sure “**
- Composed by the hepatic veins which also divide the liver into lobes “ as mentioned earlier “


Subcutaneous fat
Left rectus abdom
muscle
Segment 4a
Segment 8
Middle hepatic vei
Right hepatic vein
Hepatic vein
confluence/IVC
Segment 7
Right hemidiaphragm


Subcutaneous fat
Right rectus abdor
muscle
Hepatic artery (see
on)
Main portal vein
Common bile duct
Right lobe of liver
Inferior vena cava
Right portal vein
Crus of right
hemidiaphragm
Right hepatic vein
Right kidney

- Ultrasound (transverse)
- - As you can see the portal vein, hepatic artery & common bile duct are always together

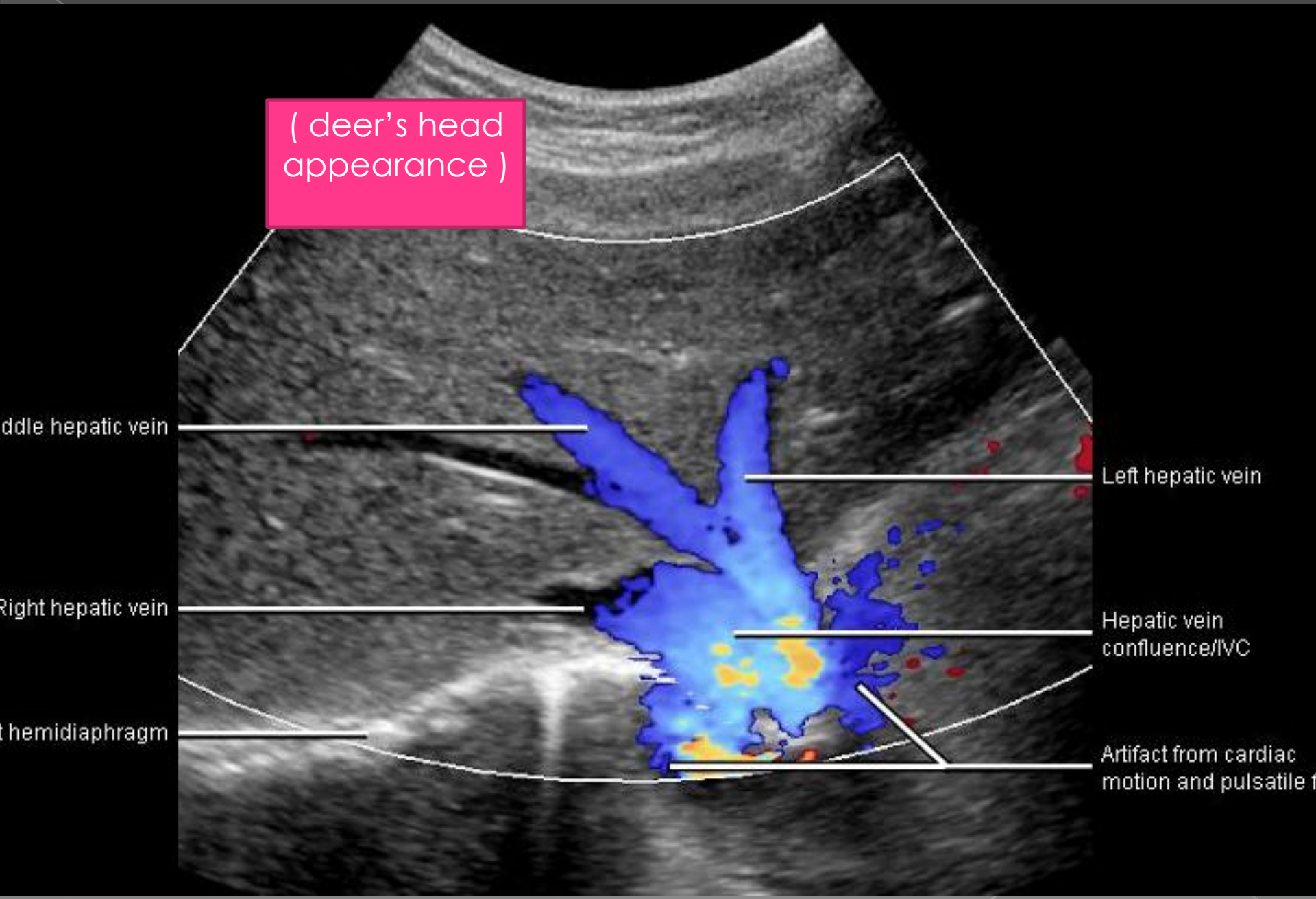

Subcutaneous fat
ight hepatic artery
Common bile duct
Right lobe of liver
Main portal vein
Right portal vein
Inferior vena cava
Right hepatic vein
Right kidney
t hemidiaphragm

- As you can see the portal vein, hepatic artery & common bile duct are always together


Subcutaneous fat
Right rectus abdom muscle
Right lobe of liver
Hepatic artery
Right portal vein
Main portal vein
Inferior vena cava
Crus of right hemidiaphragm
Right kidney

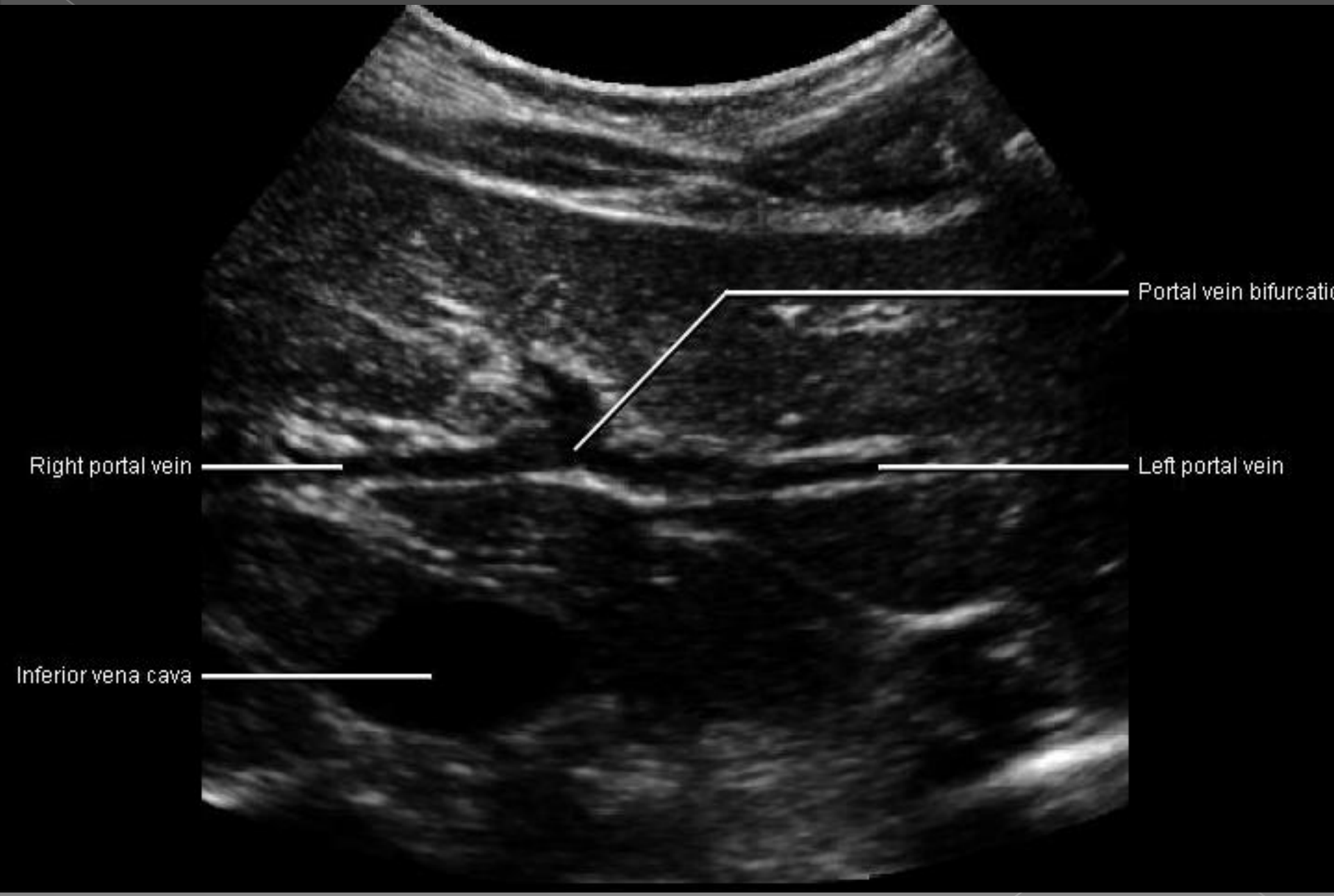

Subcutaneous
Right rectus ab
muscle
Gallbladder
Right lobe of liver
Inferior vena ca
Vertebral body
Right kidney
Right erector spinae
muscle

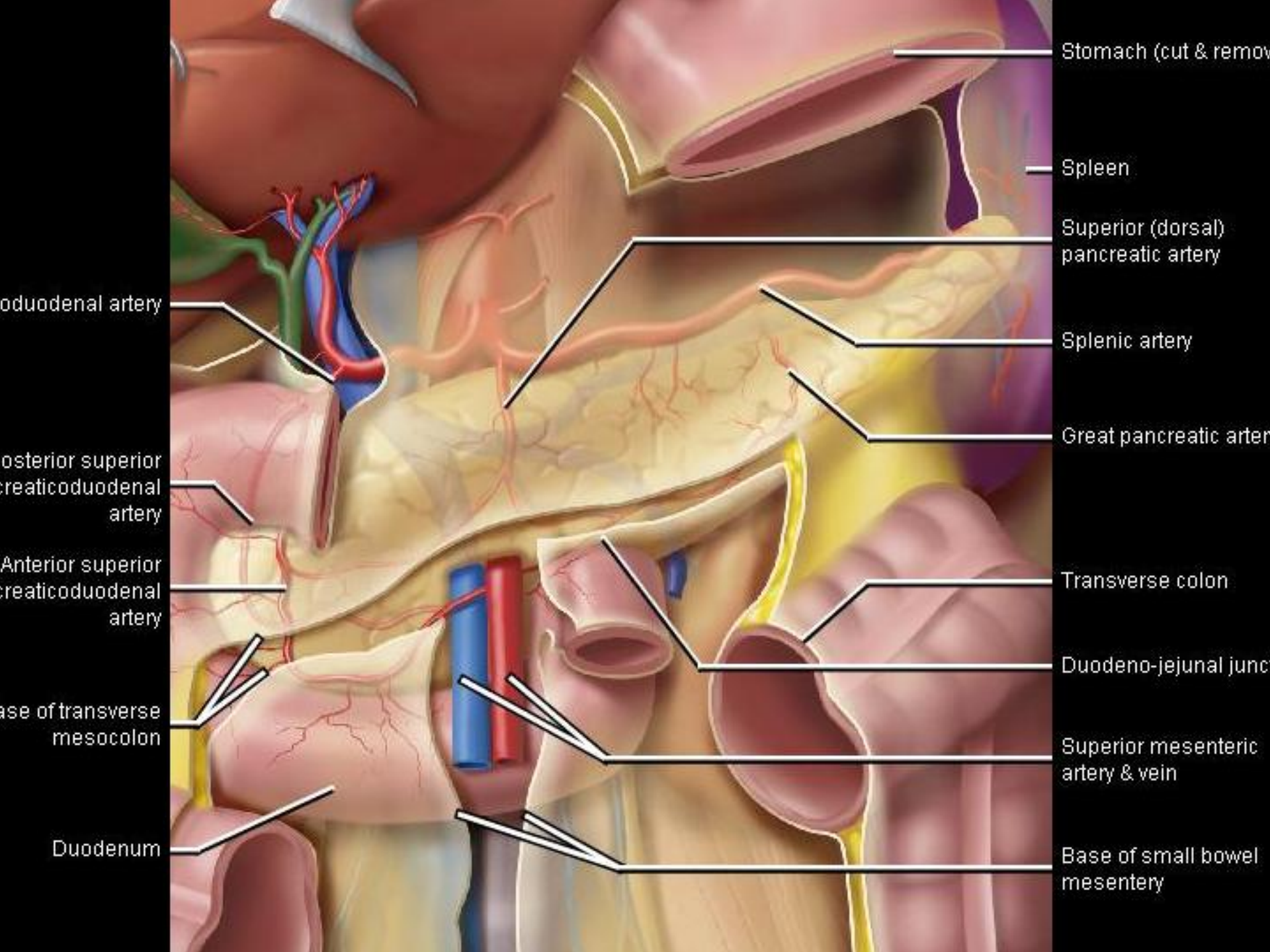

hemidiaphragm
Right lobe of liver
Main portal vein and rig
portal vein branches
Gallbladder
Right kidney

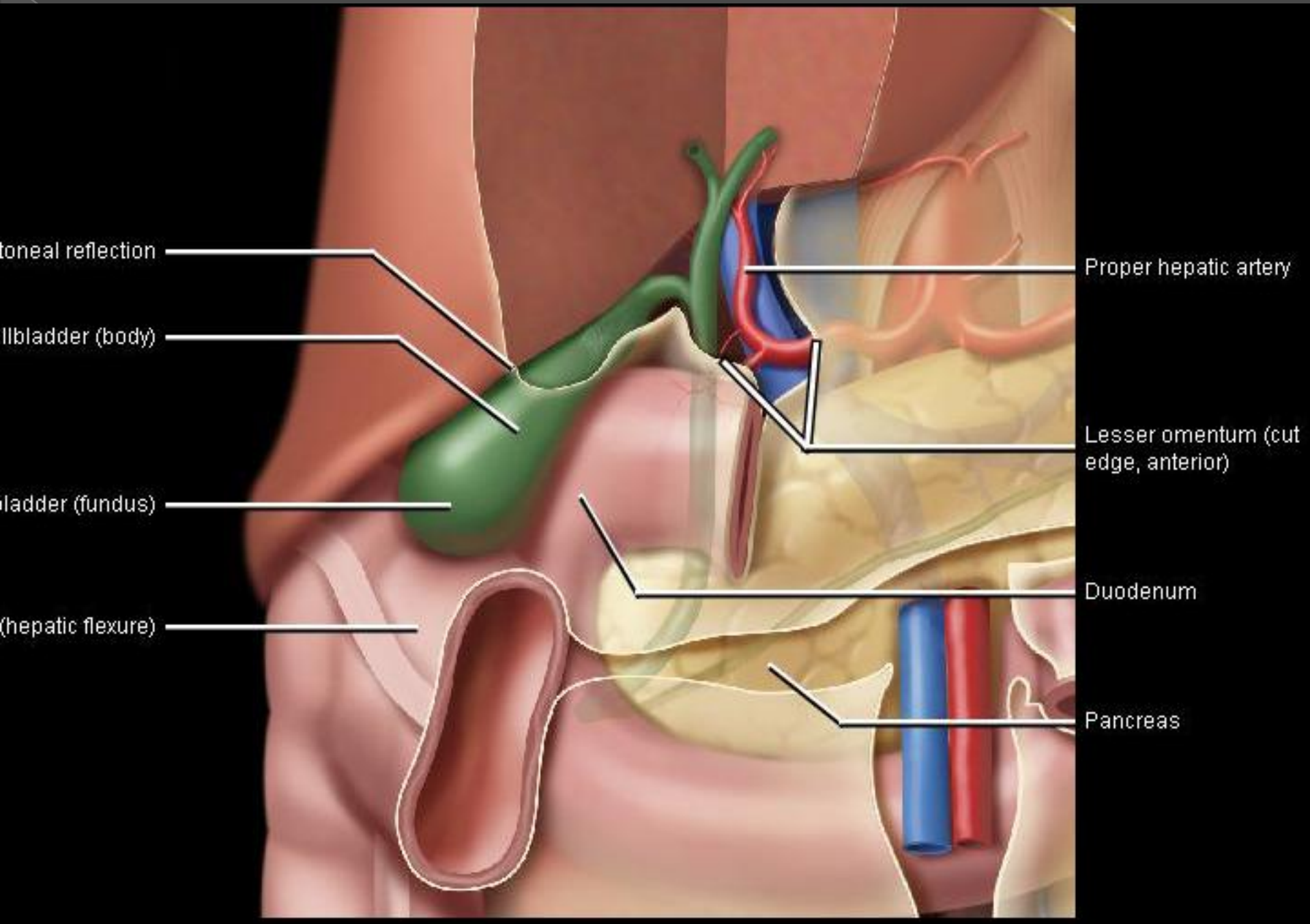

(deer's head appearance)
ddle hepatic vein
Right hepatic vein
t hemidiaphragm
Left hepatic vein
Hepatic vein confluence/IVC
Artifact from cardiac motion and pulsatile f

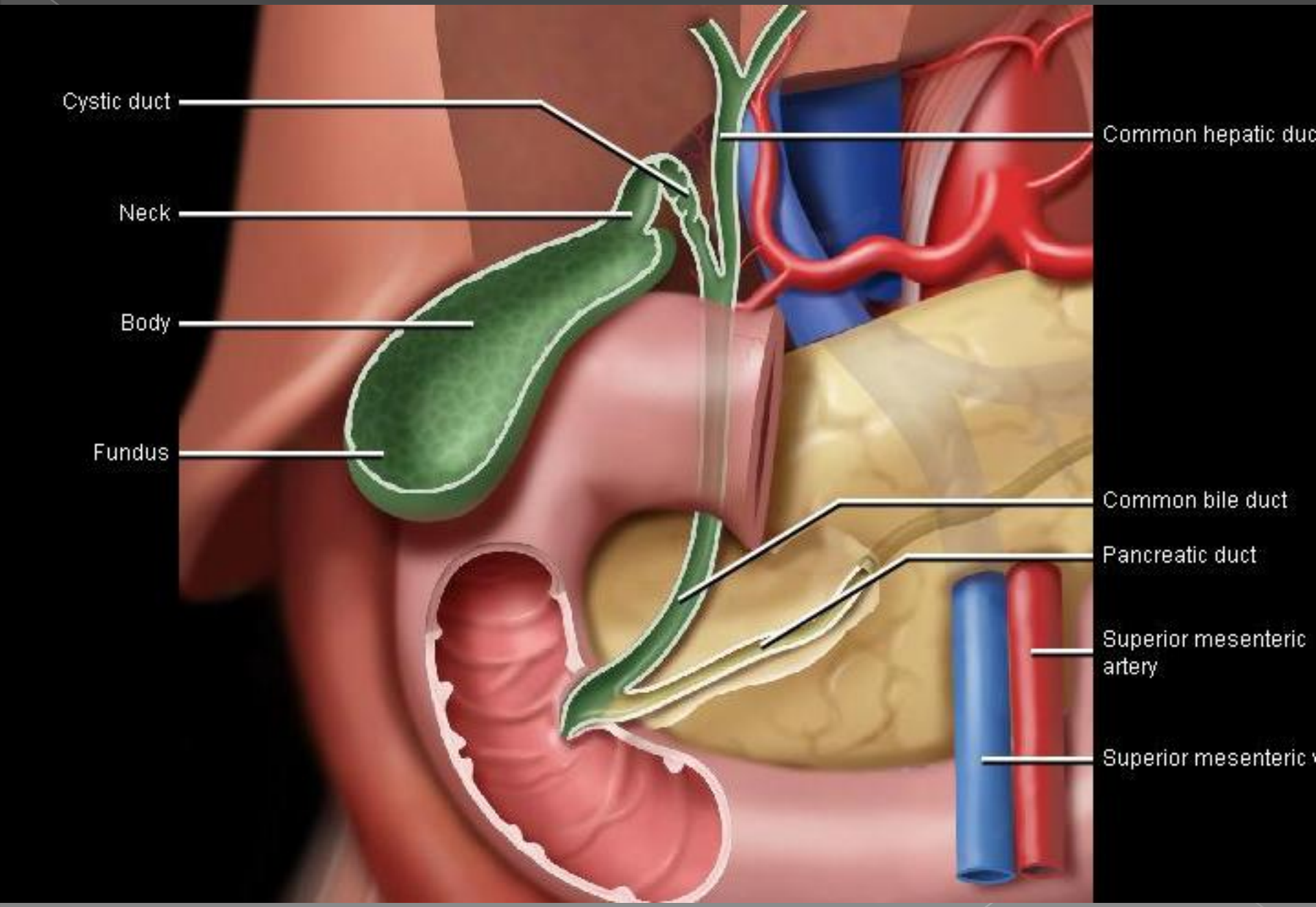

Subcutaneous
Right rectus a
muscle
Main portal vei
Inferior vena c
Right lobe of liver
Vertebral body


Portal vein
Right hepatic vein

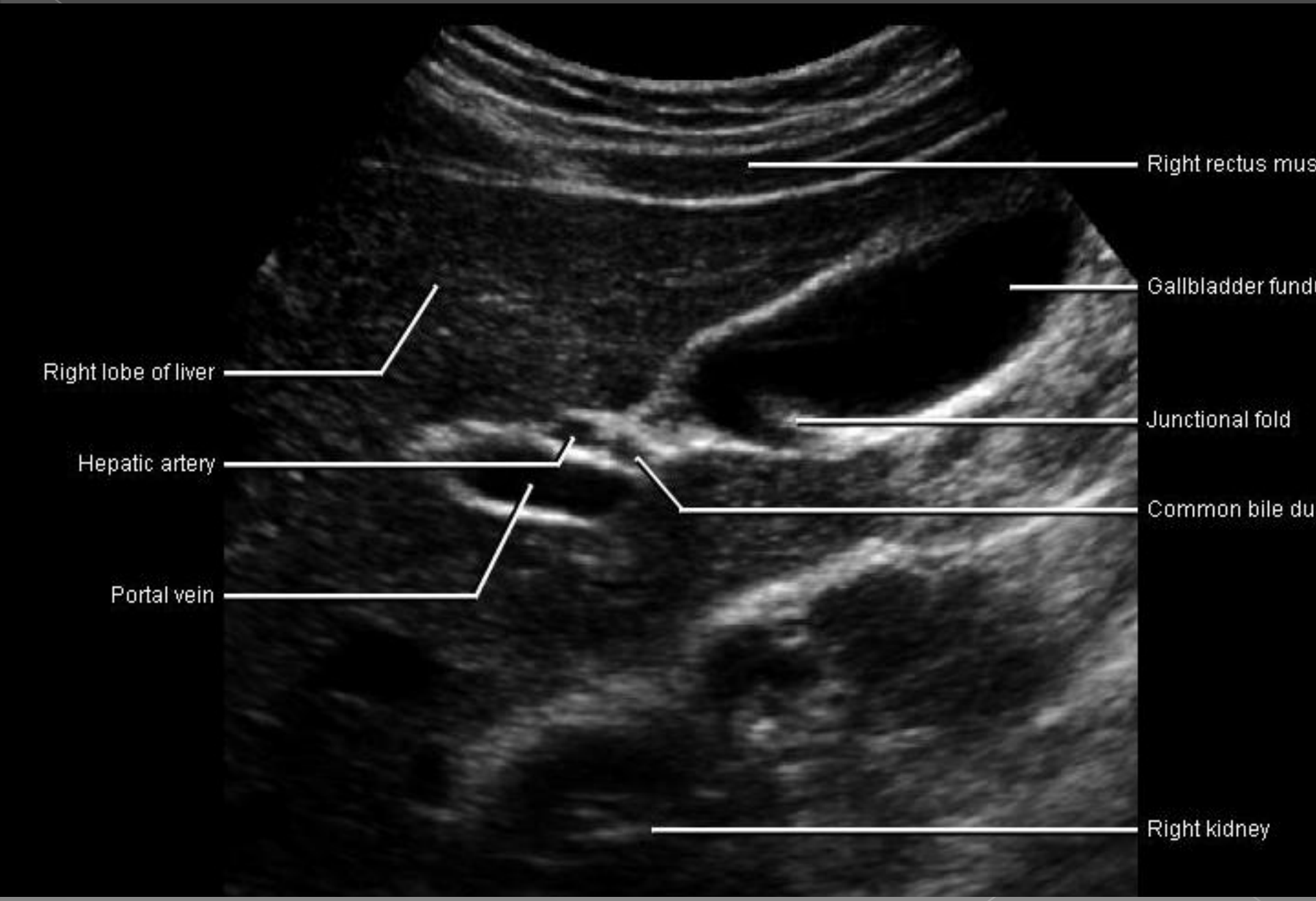

Portal vein bifurcatio
Right portal vein
Left portal vein
Inferior vena cava

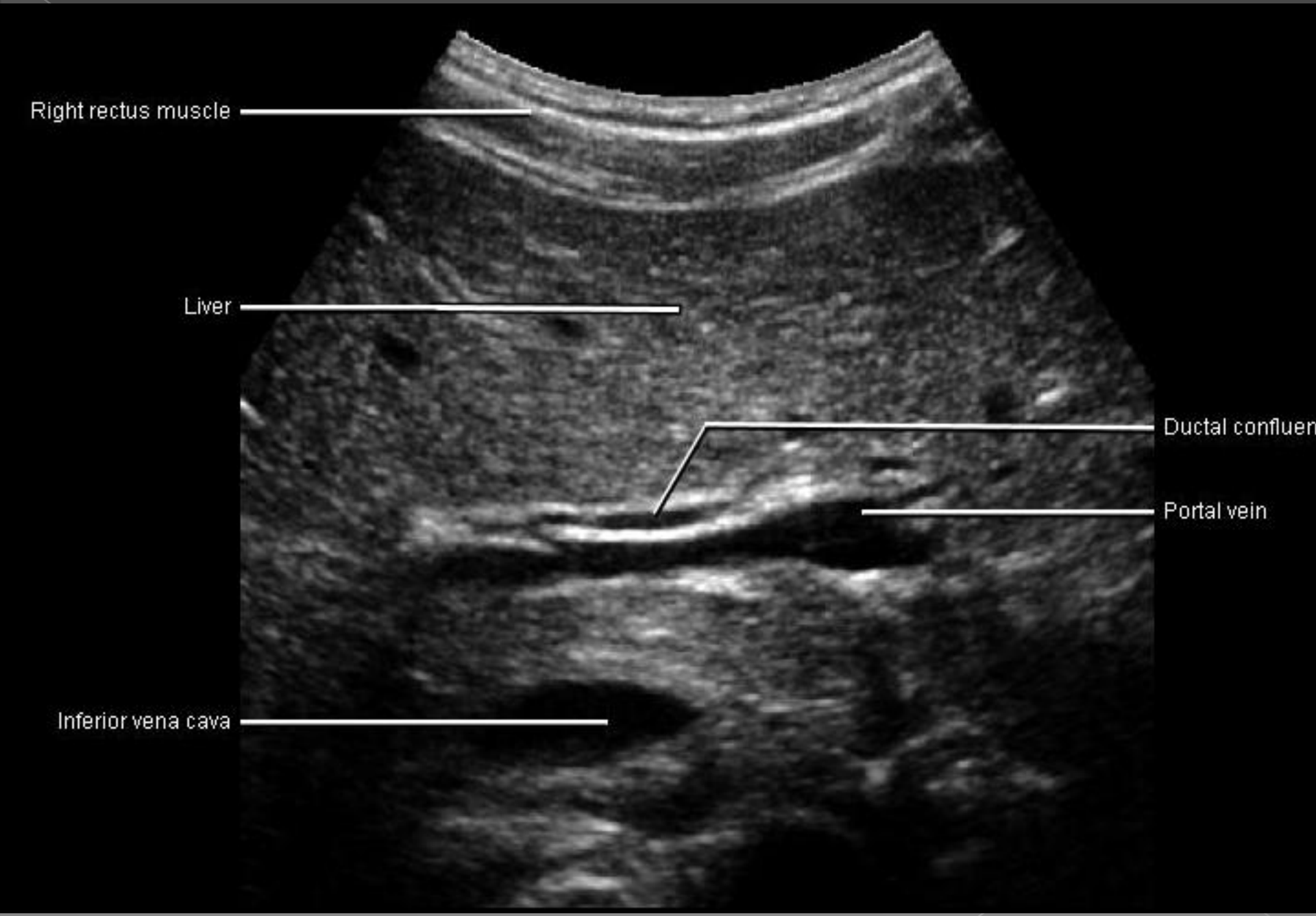

Stomach (cut & remov
Spleen
Superior (dorsal) pancreatic artery
oduodenal artery
Splenic artery
Great pancreatic arter
osterior superior creaticoduodenal artery
Anterior superior creaticoduodenal artery
Transverse colon
Duodeno-jejunal junct
ase of transverse mesocolon
Superior mesenteric artery & vein
Duodenum
Base of small bowel mesentery

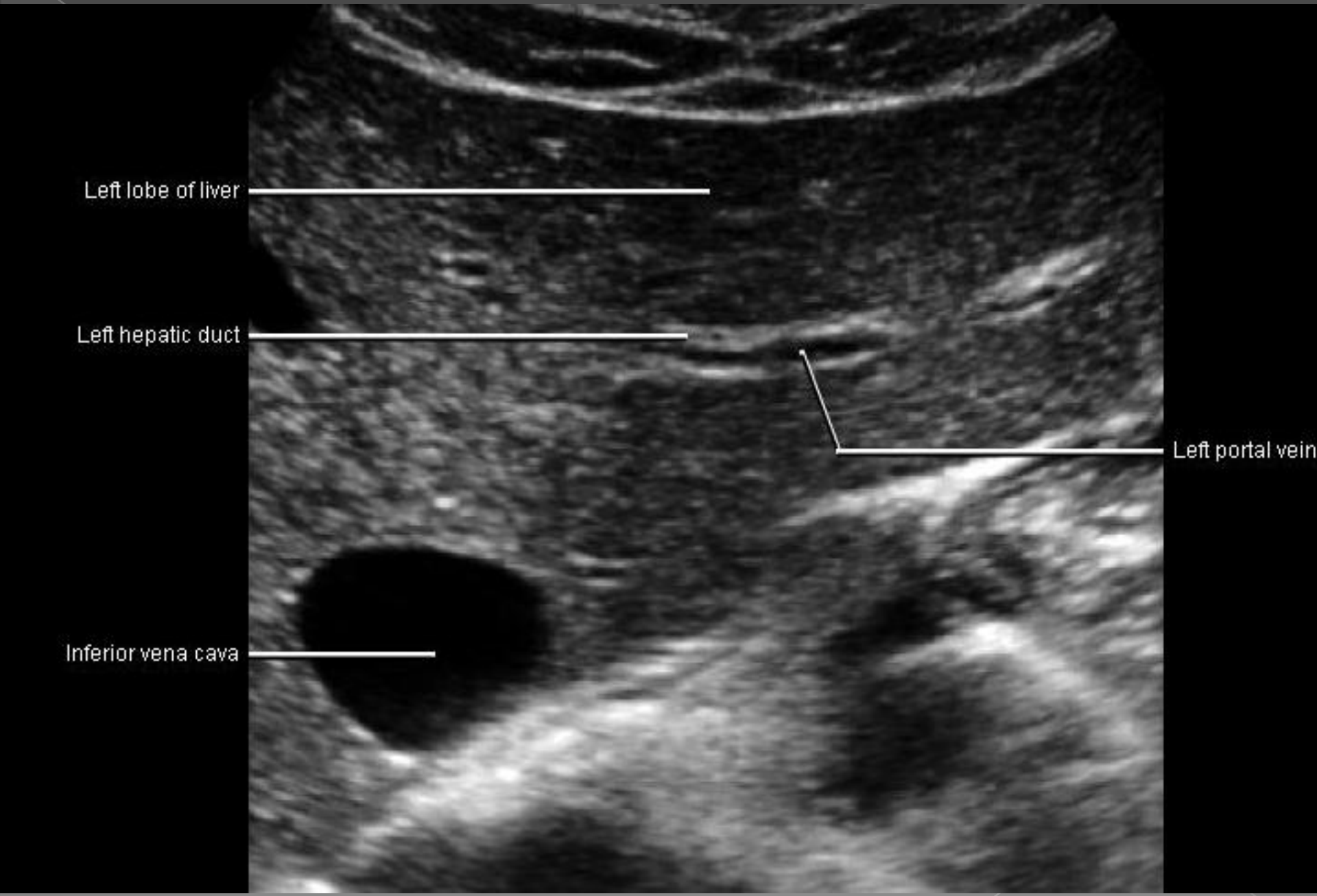

toneal reflection
llbladder (body)
bladder (fundus)
(hepatic flexure)
Proper hepatic artery
Lesser omentum (cut edge, anterior)
Duodenum
Pancreas

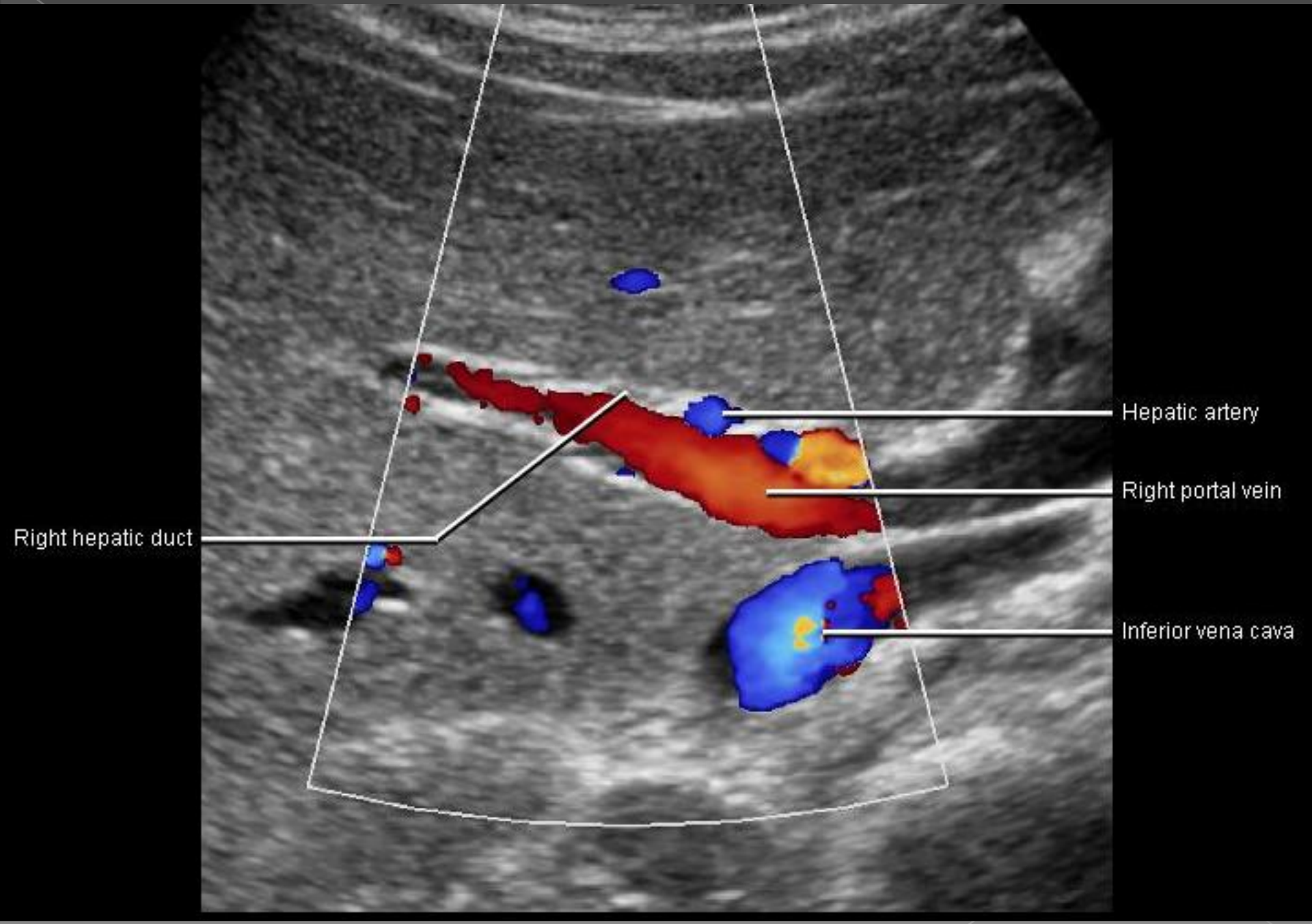

Cystic duct
Neck
Body
Fundus
Common hepatic duc
Common bile duct
Pancreatic duct
Superior mesenteric artery
Superior mesenteric

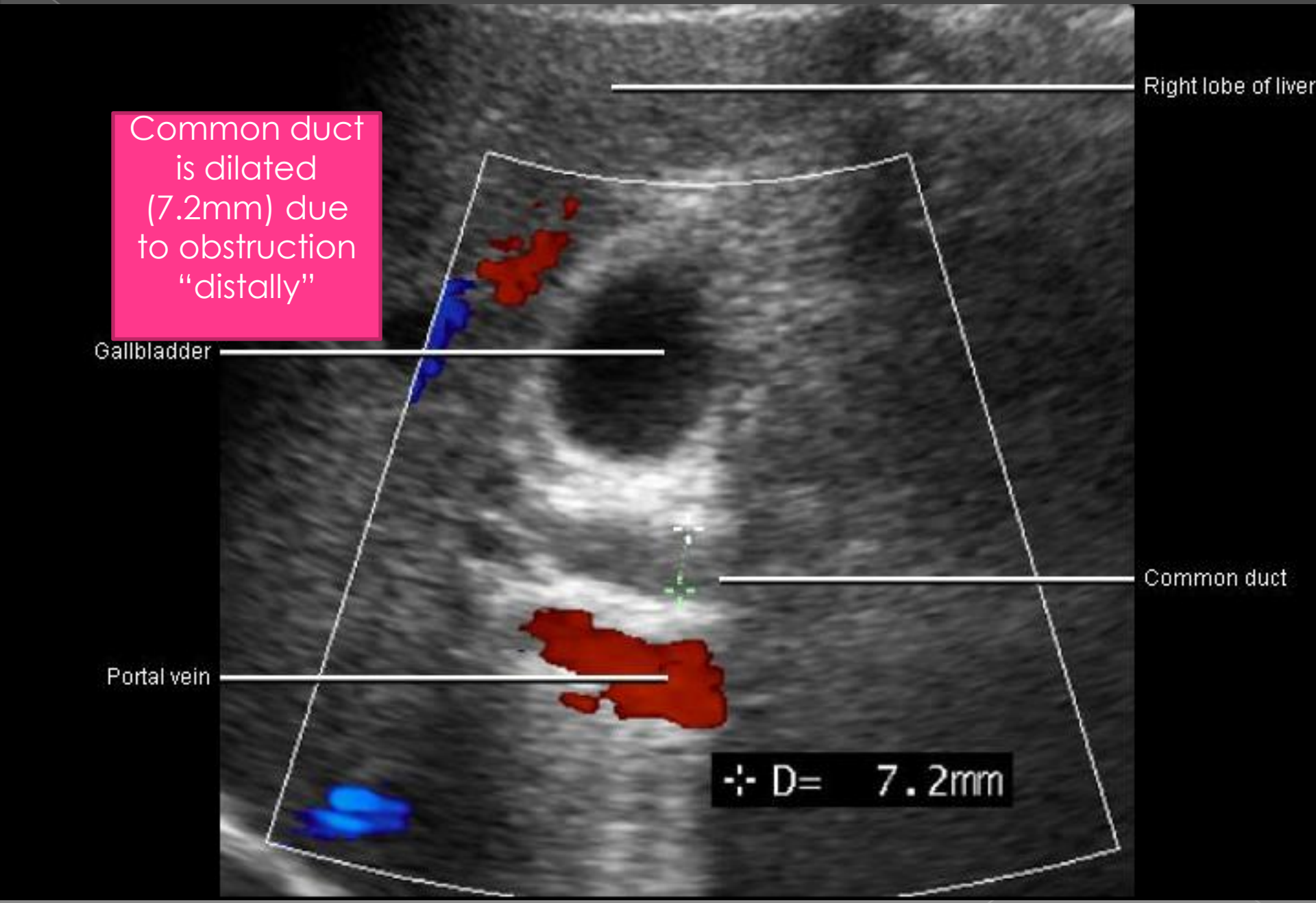
- Superior mesentric vein DOESN’T drain in IVC .. It drains in portal vein.

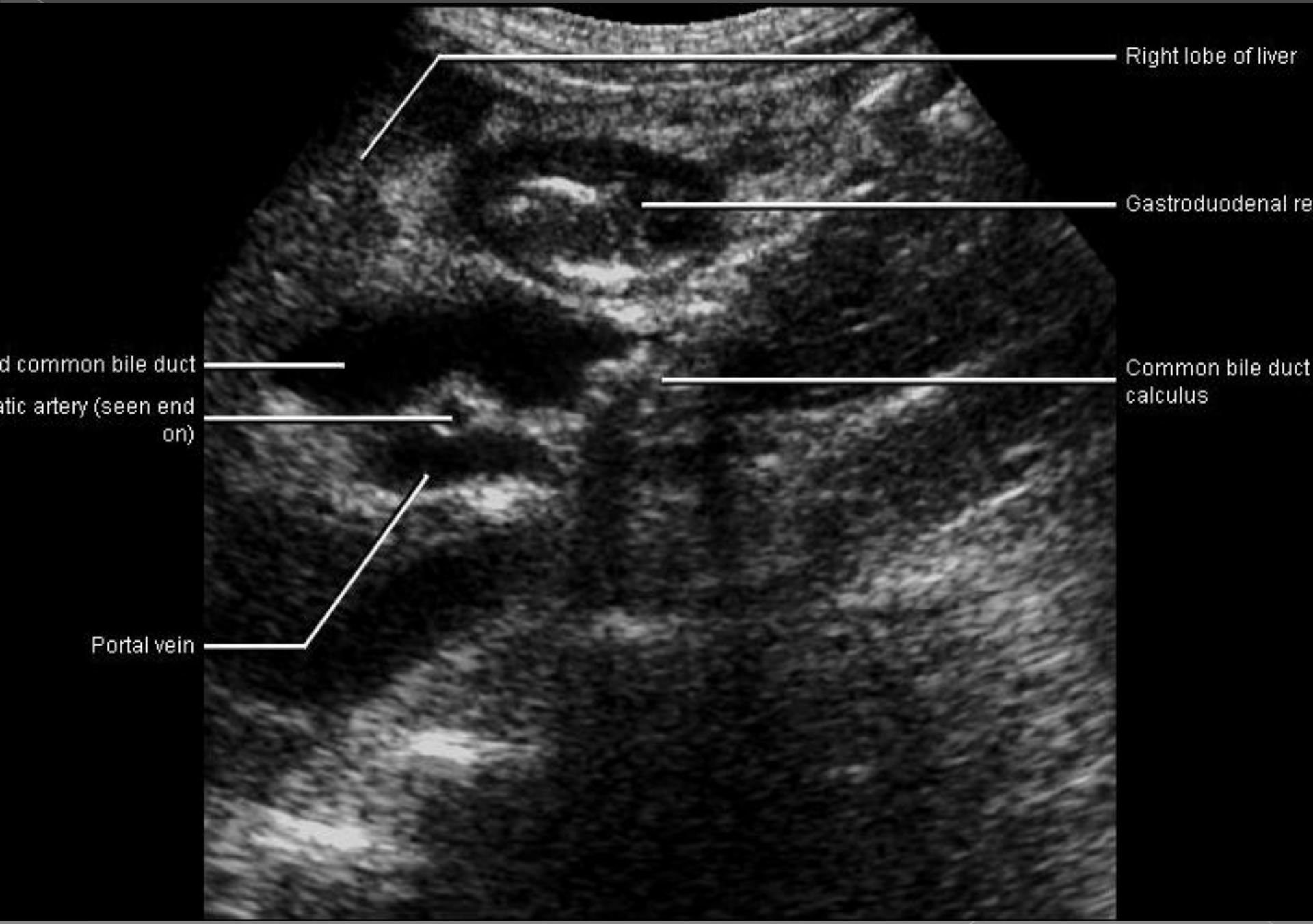

Right rectus mus
Gallbladder fund
Right lobe of liver
Junctional fold
Hepatic artery
Common bile du
Portal vein
Right kidney

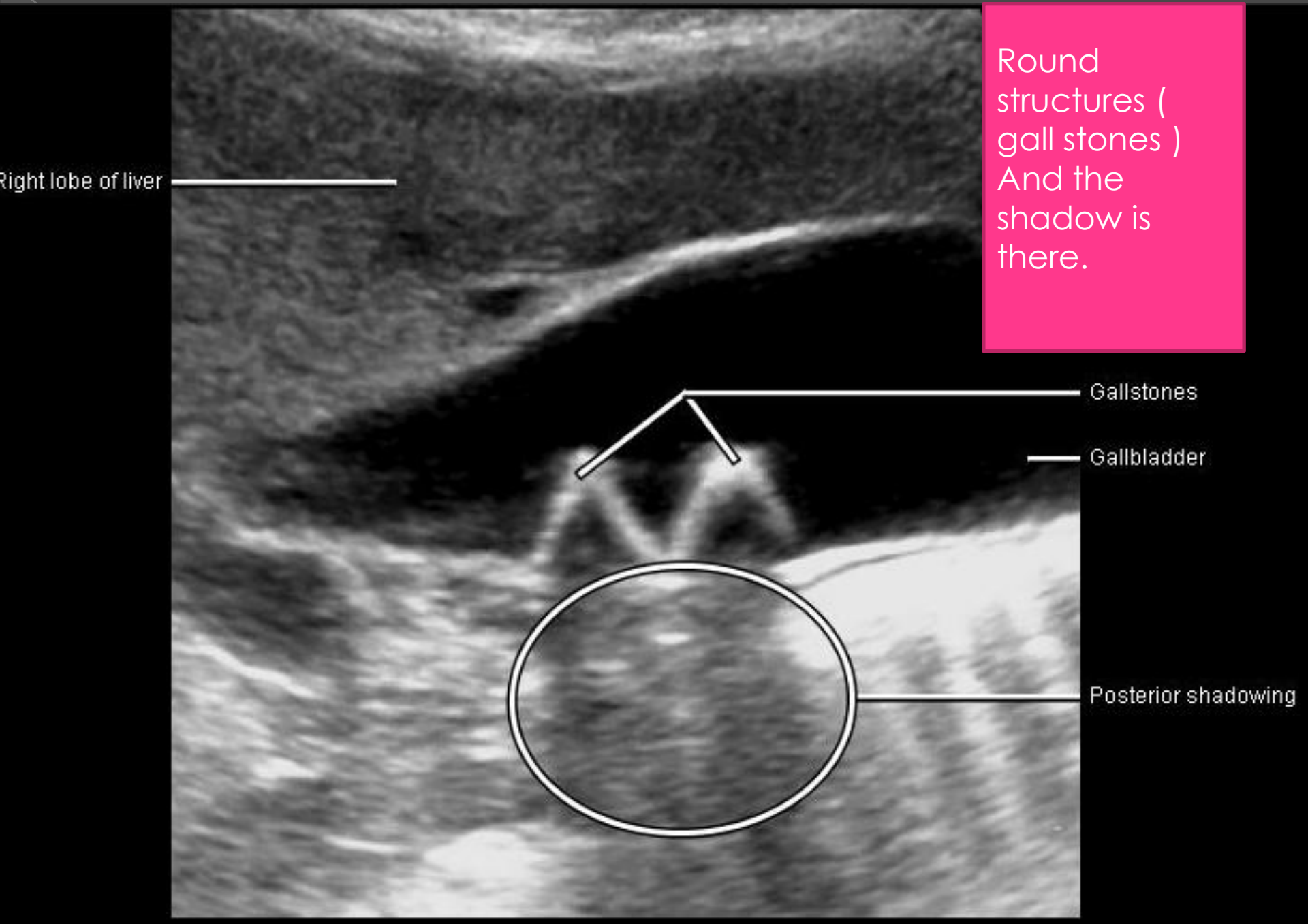

Right rectus muscle
Liver
Ductal confluen
Portal vein
Inferior vena cava


Left lobe of liver
Left hepatic duct
Left portal vein
Inferior vena cava

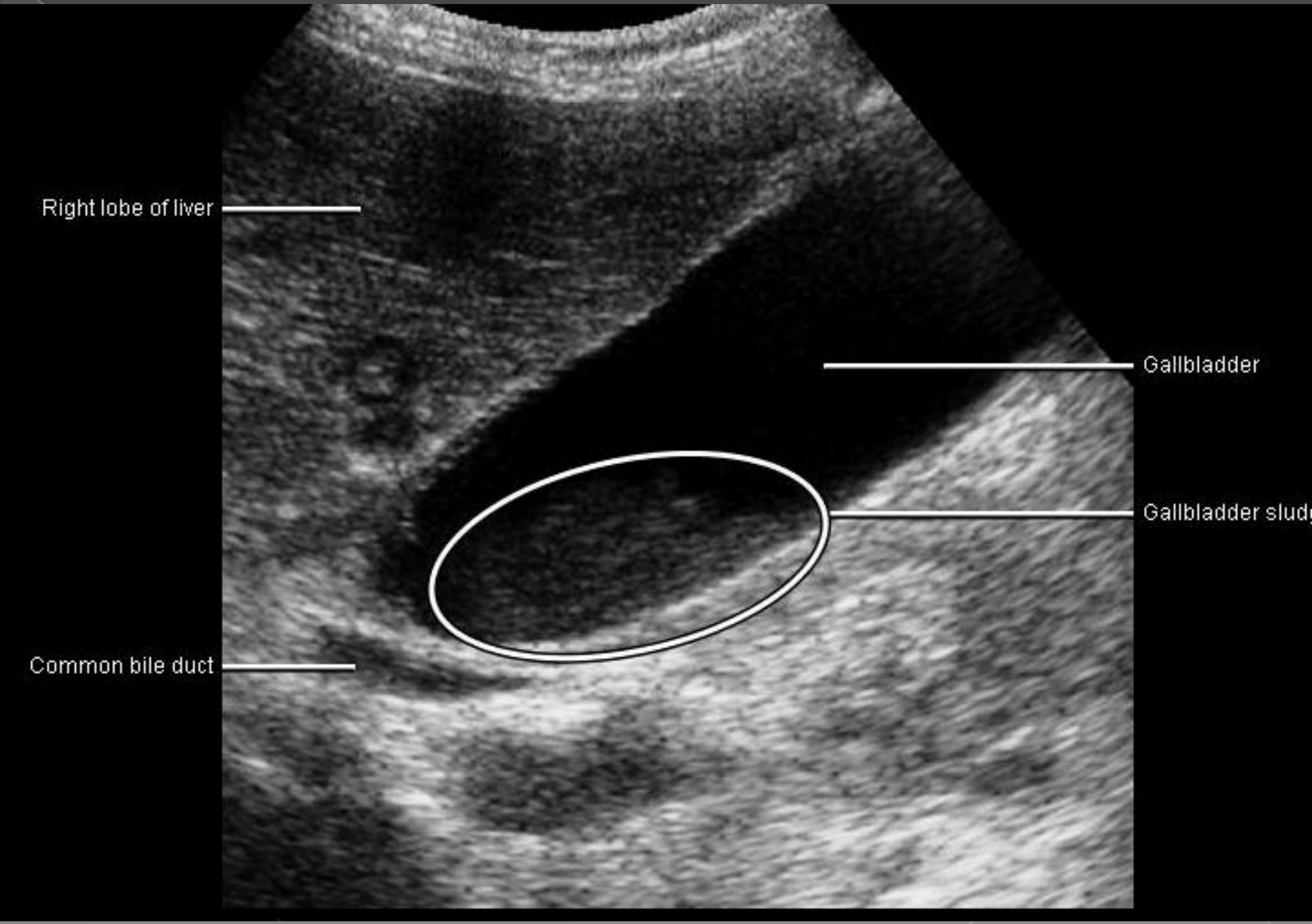

Hepatic artery
Right portal vein
Right hepatic duct
Inferior vena cava

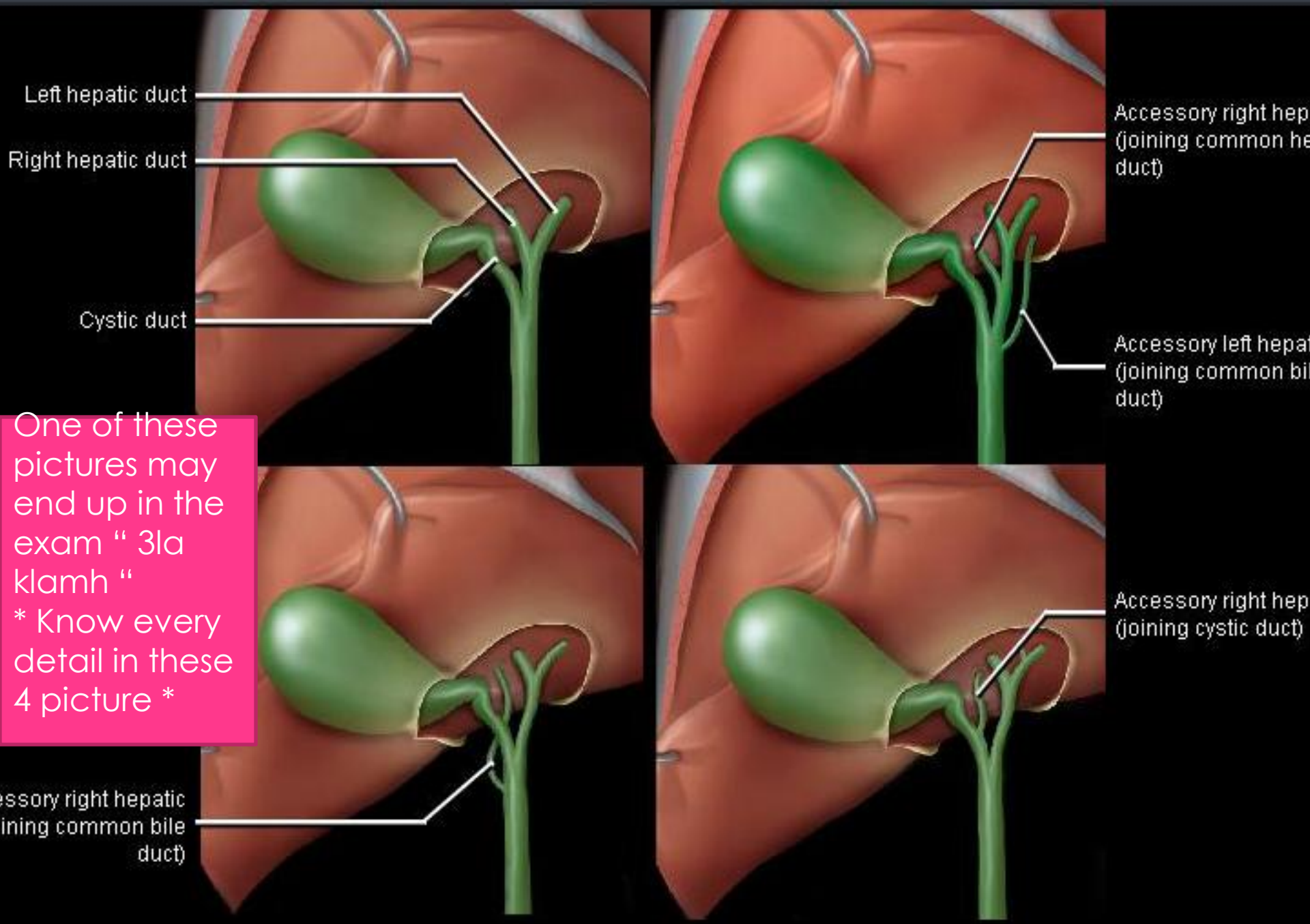

Common duct is dilated (7.2mm) due to obstruction "distally"
Right lobe of liver
Gallbladder
Common duct
Portal vein
D= 7.2mm


Right lobe of liver
Gastroduodenal re
d common bile duct
atic artery (seen end on)
Common bile duct calculus
Portal vein



Round structures (gall stones) And the shadow is there.


Right lobe of liver
Gallbladder
Gallbladder sludg
Common bile duct


Left hepatic duct
Right hepatic duct
Cystic duct
Accessory right hep
(joining common he
duct)
Accessory left hepat
(joining common bi
duct)
One of these pictures may end up in the exam “ 3la klamh “
* Know every detail in these 4 picture *
essory right hepatic
ining common bile
duct)
Accessory right hep
(joining cystic duct)


Liver
Common bile duct
Portal vein
Inferior vena cava

CAT SCAN

ULTRASOUND:

- Rarely used
- **What is Ultrasound?In ultrasound, the following events happen:The ultrasound machine transmits high-frequency (1 to 5 megahertz) sound pulses into your body using a probe.The sound waves travel into your body and hit a boundary between tissues (e.g. between fluid and soft tissue, soft tissue and bone).Some of the sound waves get reflected back to the probe, while some travel on further until they reach another boundary and get reflected.The reflected waves are picked up by the probe and relayed to the machine.The machine calculates the distance from the probe to the tissue or organ (boundaries) using the speed of sound in tissue (5,005 ft/s or1,540 m/s) and the time of the each echo's return (usually on the order of millionths of a second).The machine displays the distances and intensities of the echoes on the screen, forming a two dimensional image like the one shown below.In a typical ultrasound, millions of pulses and echoes are sent and received each second. The probe can be moved along the surface of the body and angled to obtain various views.**Advantages:
  - inexpensive
  - allows comparison with the opposite side, normal side
  - uses no ionizing radiation,
  - performed at bed side or in the operating room.
  - It is a non invasive modality


Portal vein
Right hepatic vein

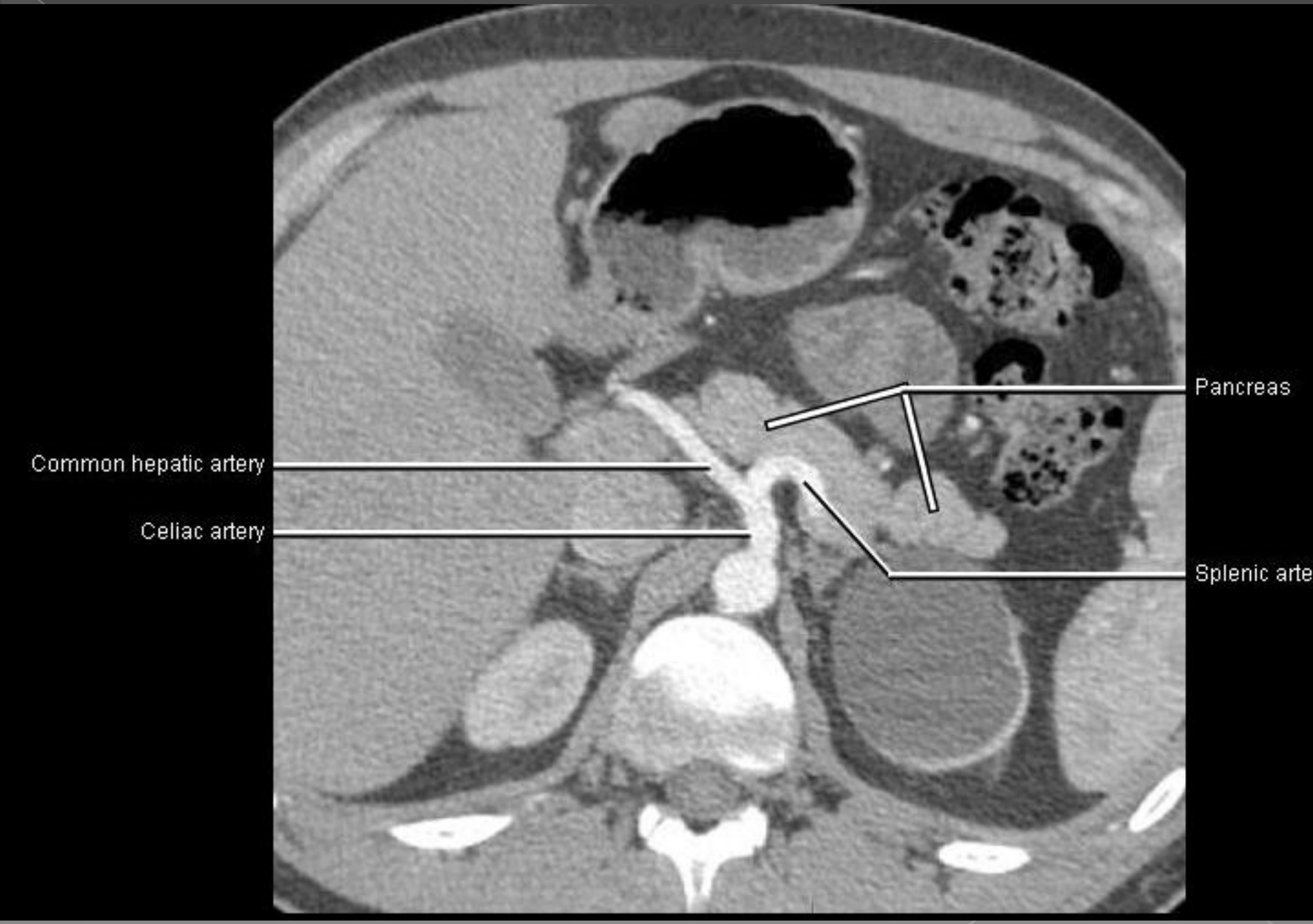
COMPUTED TOMOGRAPHY:

COMPONENTS:

-X ray source

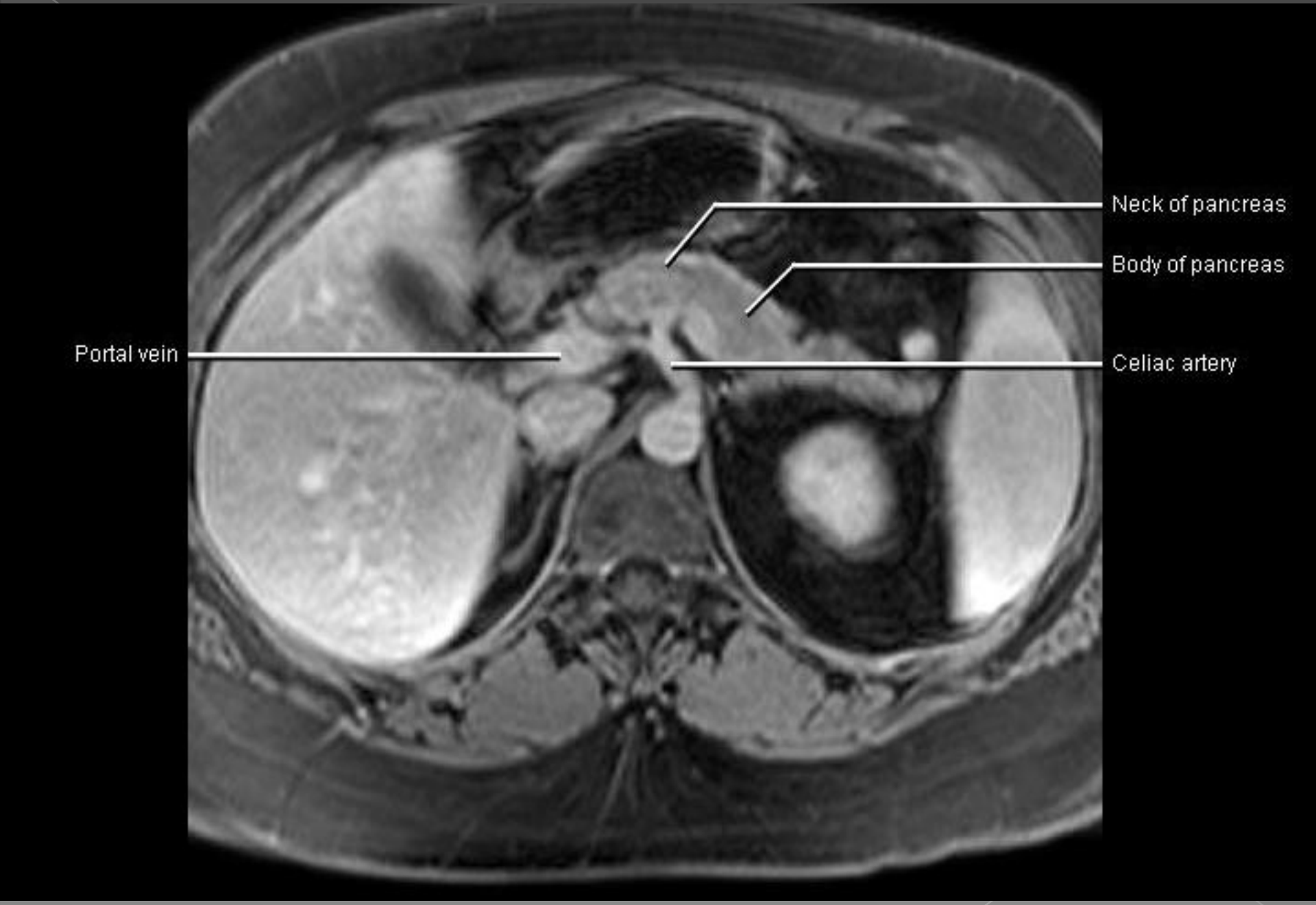
-Detectors

- Computer data processing system


Pancreas
Common hepatic artery
Celiac artery
Splenic arte

MRI

- Magnet
- RF coils
- Computer


Neck of pancreas
Body of pancreas
Portal vein
Celiac artery

What is

من هنا بدا يسلك الدكتور الى نهاية المحاضرة

- 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 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.

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

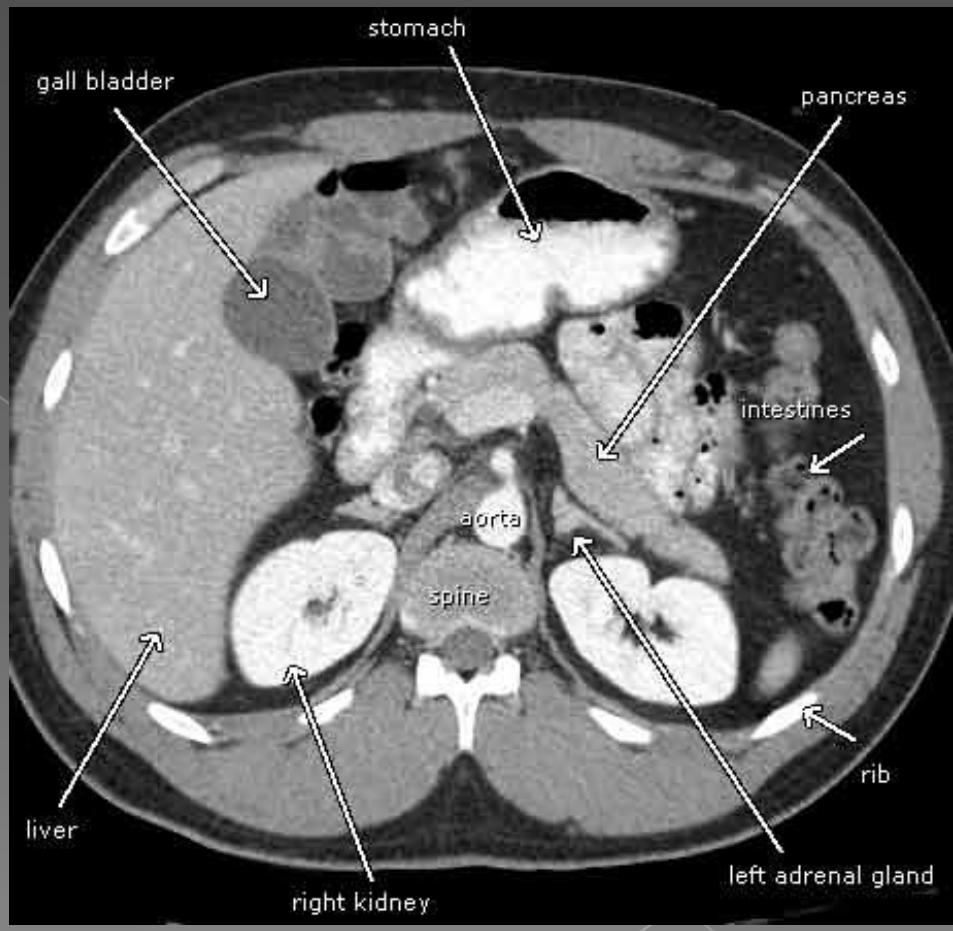
- This procedure is typically used to help diagnose the cause of abdominal pain and diseases of the bowel and colon, such as:
- abscesses in the abdomen
- inflamed colon
- cancers of the colon, liver, pancreas and kidneys
- pancreatitis
- lymphoma
- staging for cancer
- diverticulitis
- appendicitis

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

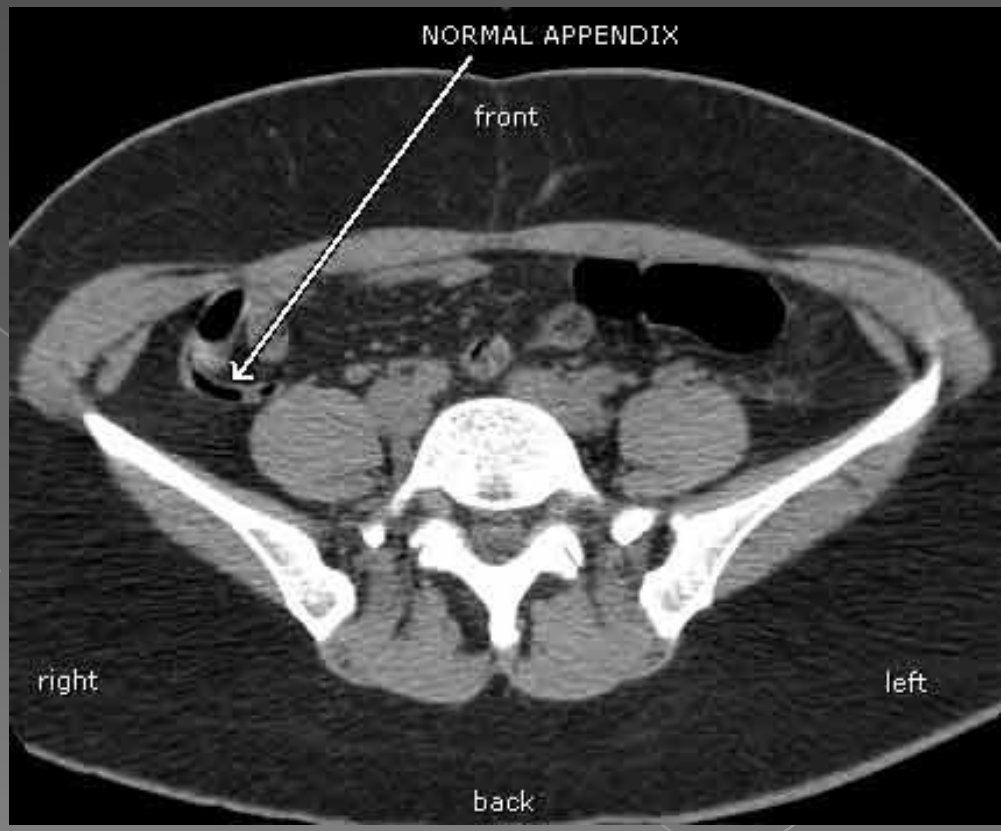
- visualize the liver, spleen, pancreas and kidneys
- plan and properly administer radiation treatments for tumors
- guide biopsies and other minimally invasive procedures
- CT imaging can also play a significant role in the detection, diagnosis and treatment of vascular disorders that can lead to stroke,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

How does the procedure work?

- In many ways CT scanning works very much like other x-ray examinations. X-rays are a form of radiation—like light or radio waves—that can be directed at the body. Different body parts absorb the x-rays in varying degrees.
- In a conventional x-ray exam, a small burst of radiation is aimed at and passes through the body, recording an image on photographic film or a special image recording plate. Bones appear white on the x-ray; soft tissue shows up in shades of gray and air appears black.
- With CT scanning, numerous x-ray beams and a set of electronic x-ray detectors rotate around you, measuring the amount of radiation being absorbed throughout your body. At the same time, the examination table is moving through the scanner, so that the x-ray beam follows a spiral path. A special computer program processes this series of pictures, or slices of your body, to create two-dimensional cross-sectional images, which are then displayed on a monitor.



- CT imaging is sometimes compared to looking into a loaf of bread by cutting the loaf into thin slices. When the image slices are reassembled by computer software, the result is a very detailed multidimensional view of the body's interior.
- Refinements in detector technology allow new CT scanners to obtain multiple slices in a single rotation. These scanners, called "multislice CT" or "multidetector CT," allow thinner slices to be obtained in a shorter period of time, resulting in more detail and additional view capability.



- Modern CT scanners are so fast that they can scan through large sections of the body in just a few seconds. Such speed is beneficial for all patients but especially children, the elderly and critically ill.
- For some CT exams, a contrast material is used to enhance visibility in the area of the body being studied

Is CT a good idea for abdominal pain assessment?

- Conflicting results of trials

examining impact of CT on negative appendectomy rates or perforation rates

- But these are historical studies, not randomized controlled trials

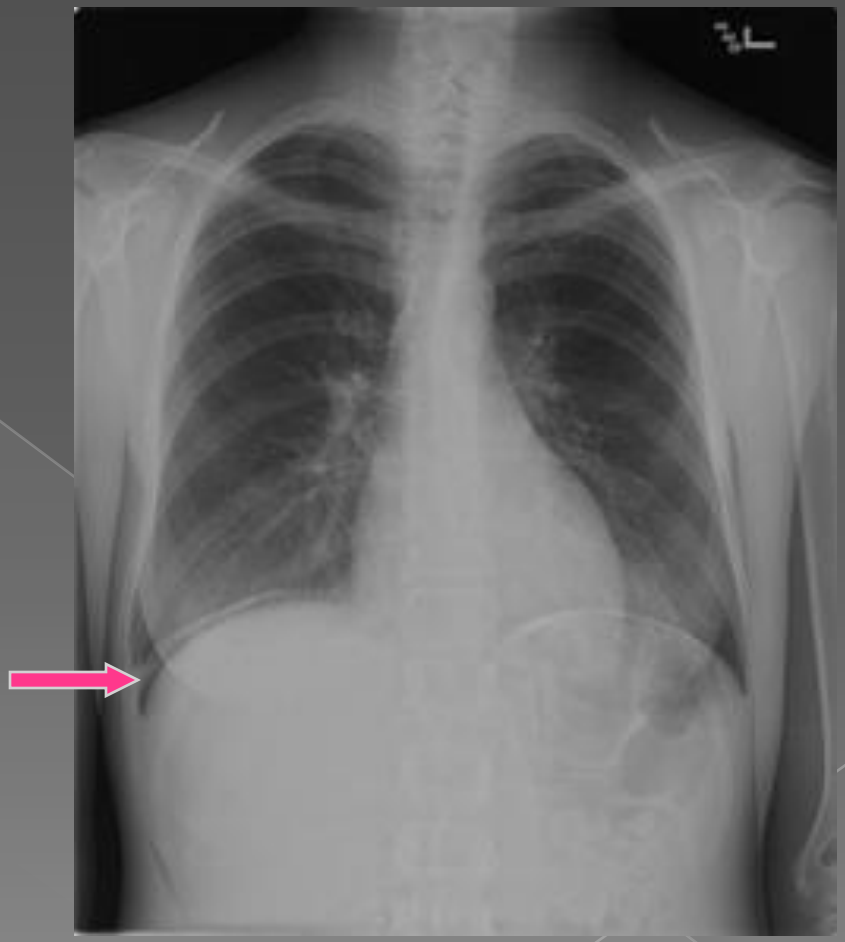
- When is contrast needed?
- Discuss the
- indications for oral, rectal, and IV contrast.
- Is it true, as recent studies have
- suggested, that we don't need contrast?

Enhancement

- Increased
- attentuation after
- administration of
- contrast
- ☐ Vascular lesions
- ☐ Inflammation
- ☐ Infection
- ☐ Neoplasms

Free air: Visible on NONCONTRAST CT

- CXR vs CT
- ☐ Patients s/p DPL
- ☐ CXR 38% sensitive
- ☐ Only 33% sensitive for collections less than 13mm
- ☐ CT 100% sensitive
- ☐ CT found pockets as small as 1mm
- ☐ Stapakis JC, Thickman D. Diagnosis of pneumoperitoneum: abdominal CT vs. upright chest film. J Comput Assist Tomogr. 1992 Sep-Oct;16(5):713-6.



- CXR vs CT
- ☐ CXR
- ☐ subdiaphragmatic
- ☐ perihepatic
- ☐ CT
- ☐ subdiaphragmatic
- ☐ perihepatic
- ☐ anterior midline
- ☐ Earls JP, Dachman AH, Colon E, Garrett MG, Molloy M. Prevalence and duration of postoperative pneumoperitoneum: sensitivity of CT vs left lateral decubitus radiography. AJR Am J Roentgenol. 1993 Oct;161(4):781-5.
- ☐ Stapakis JC, Thickman D. Diagnosis of pneumoperitoneum: abdominal CT vs. upright chest film. J Comput Assist Tomogr. 1992 Sep-Oct;16(5):713-6.

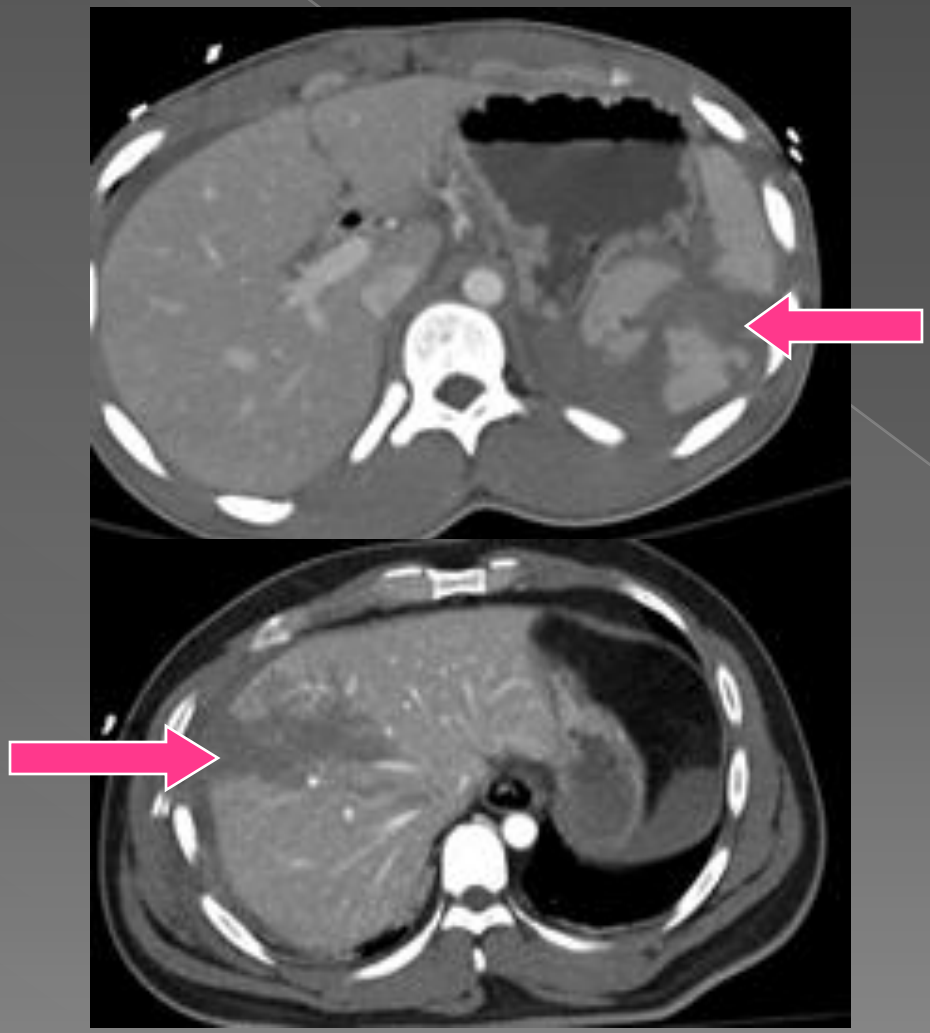
- On plain film
- ☐ Air-fluid levels
- ☐ Dilated loops
- ☐ On CT
- ☐ Dilated loops
- ☐ Air-fluid levels
- ☐ Enhancement
- ☐ Free fluid
- ☐ Transition point
- ☐ NO ORAL CONTRAST NEEDED
- ☐ Nicolaou S, Kai B, Ho S, Su J, Ahamed K . Imaging of acute small-bowel obstruction. AJR Am J Roentgenol. 2005 Oct;185(4):1036-44.

- Plain film
- ☐ 49% sensitive for SBO
- ☐ CT
- ☐ 75-84% sensitive

Abdominal Aortic Aneurysm

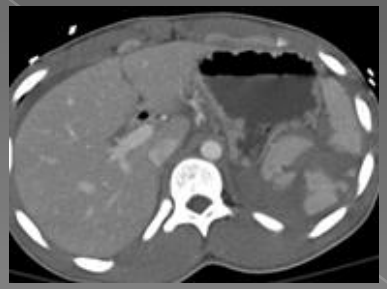
- What percentage of AAAs will die within 2 hours of ED arrival?
- ☐ 12.5%
- ☐ Lloyd GM, Bown MJ, Norwood MG, Deb R, Fishwick G, Bell PR, Sayers RD. Feasibility of preoperative computer tomography in patients with ruptured abdominal aortic aneurysm: a time-to-death study in patients without operation. J Vasc Surg. 2004 Apr;39(4):788-91.

Blunt trauma



- Free fluid
- ☐ Spleen injury
- ☐ Liver injury
- ☐ Bowel injury
- ☐ Renal injuries
- ☐ IV contrast
- ☐ assists with diagnosis of active bleeding
- ☐ PO contrast
- ☐ rarely helpful
- ☐ bowel injuries can be detected without PO contrast
- ☐ Clancy TV, Ragozzino MW, Ramshaw D, Churchill MP, Covington DL, Maxwell JG. Oral contrast is not necessary in the evaluation of blunt abdominal trauma by computed tomography. Am J Surg. 1993 Dec;166(6):680-4; discussion 684-5.

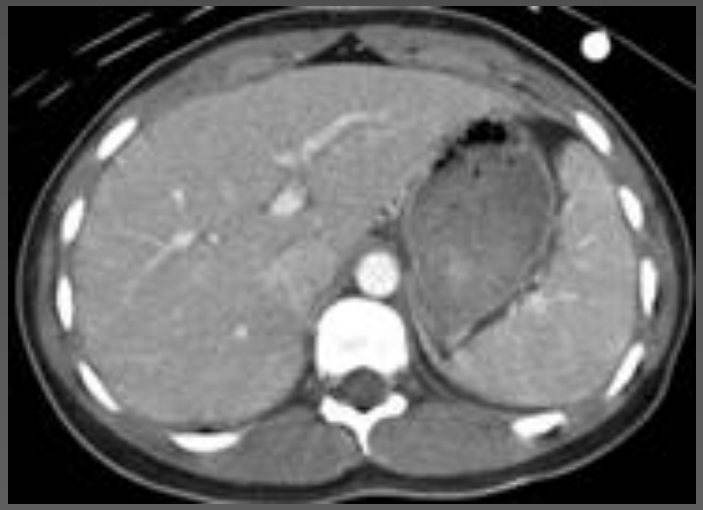
Spleen injuries



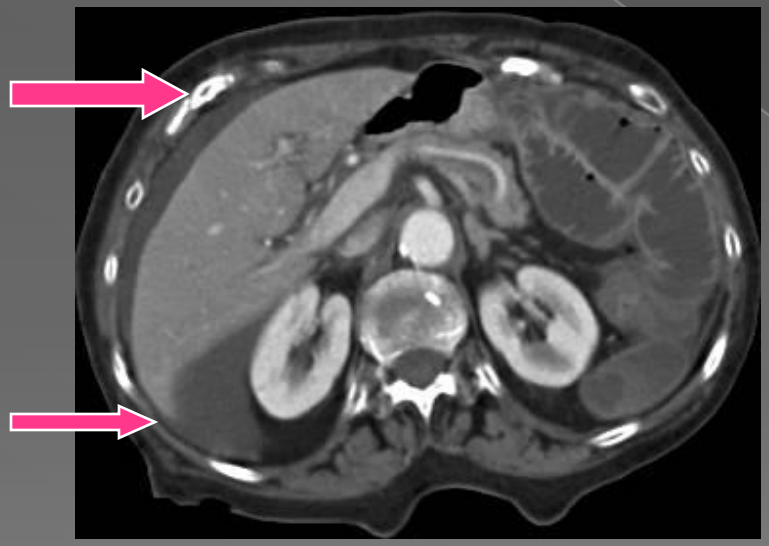
Liver injuries

Active hemorrhage

- Hypoattenuation = injury
- ☐ Hyperattenuation =
- active bleeding
- ☐ Rhodes CA, Dinan D, Jafri
- SZ, Howells G, McCarroll
- K. Clinical outcome of
- active extravasation in
- splenic trauma. Emerg
- Radiol. 2005
- Nov;11(6):348-52. Epub
- 2005 Jun 10.



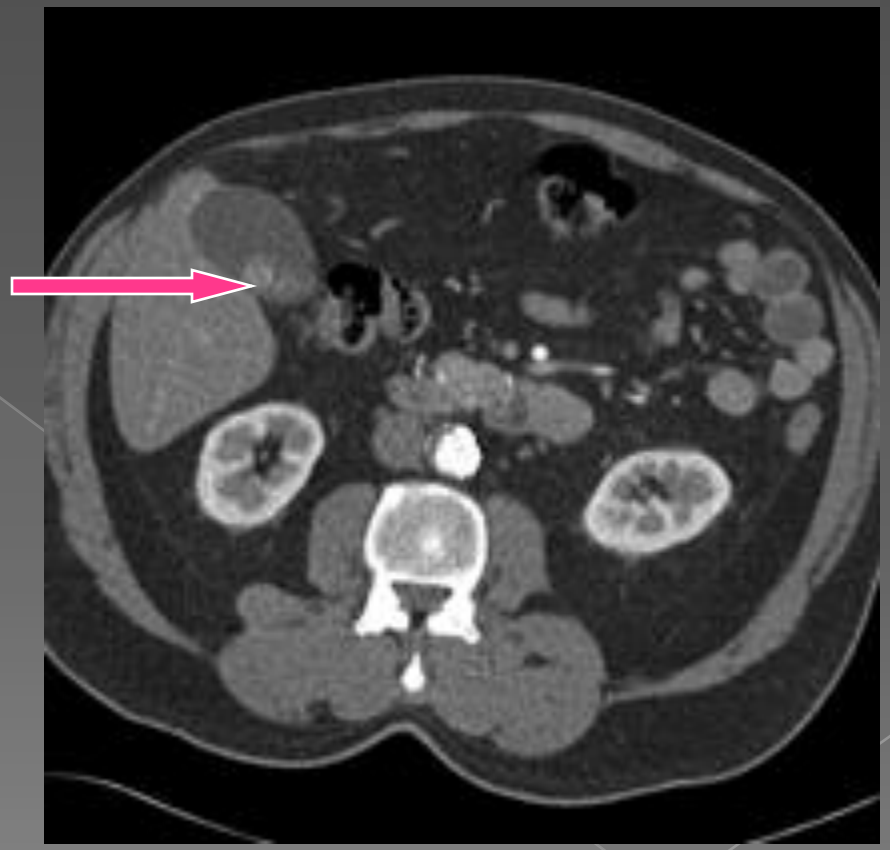
Free fluid



- ☐ Free fluid without
- solid organ injury
- ☐ Bowel injury
- ☐ Mesenteric injury
- ☐ Nontrauma?
- ☐ ascites

Cholelithiasis

- Stones alone do not indicate cholecystitis
- ☐ Pericholecystic fluid
- ☐ Thickened wall
- ☐ Sensitivity for stone?
- ☐ Approximately 70%
- ☐ Specificity
- ☐ Approximately 97%
- ☐ Abdom Imaging. 2006 Jul-Aug;31(4):425-32. Epub 2006 Sep 12. Diagnosis of intrahepatic and common duct stones: combined unenhanced and contrast-enhanced helical CT in 1090 patients. Lee JK, Kim TK, Byun JH, Kim AY, Ha HK, Kim PN, Lee MG.
- ☐ Fidler J, Paulson EK, Layfield L. AJR Am J Roentgenol. 1996 May;166(5):1085-8. CT evaluation of acute cholecystitis: findings and usefulness in diagnosis.



"We've given you a brain scan and we can't find anything."

CT risks

- What is the radiation risk
- associated with exposure to
- multiple CTs?
- ☐ Cancer?
- ☐ Teratogenicity?
- ☐ What is the risk from one CT?
- ☐ How does this change with
- age?
- ☐ Is the risk additive?
- ☐ Is there a safe threshold?

CT risks

- CT risks
- ☐ Q: For radiation dose, how many CXR = 1 CT?
- ☐ A: 1 CT abdomen= roughly 250-500 CXRs!
- ☐ International Commission on Radiological
- Protection (ICRP)

- Q: Does radiation cause
- fetal or oocyte mutations?
- ☐ A: low doses (less than
- 10 rad) from most
- medical procedures pose
- insignificant mutation risk
- ☐ Health Physics Society
- ☐ http://hps.org

- Q: Does radiation
- cause fetal or oocyte
- mutations?
- ☐ A: But some evidence
- suggests increased
- childhood leukemias
- and other cancers
- from low level
- exposures

What are the limitations of CT Scanning

- A person who is very obese may not fit into the opening of a conventional CT unit.
- CT Scanning of the abdomen may not be as sensitive in identifying gallstones as ultrasound of the abdomen.
- For some conditions, including but not limited to some liver, adrenal and pancreatic abnormalities, the evaluation and diagnosis with MRI may be preferable over CT scanning.

Summary

- ☐ Review recent literature supporting the use of CT to assess abdominal
- pain in the ED
- ☐ We are moving from proving the ability to detect disease with CT to the more
- difficult stage of proving clinical benefit to patients
- ☐ Discuss the indications for oral, rectal, and IV contrast
- ☐ For many indications, noncontrast CT may be able to detect disease
- ☐ But a more sophisticated understanding of the role of contrast can help you
- pick patients for whom contrast may be helpful
- ☐ Discuss the etiologies that abdominal CT will miss
- ☐ CT is limited in detection of bowel pathology, diaphragm injuries, and
- gallstones….
- ☐ Discuss the safety of discharging patients with a normal abdominal CT

- ☐ Because CT is very good at detecting the most common injuries, the safety of discharge is very good for blunt trauma
- ☐ But rarer injuries can be missed
- ☐ Little known about the safety of nontraumatic abdominal pain with negative CT
- ☐ Review the risk of exposing patients to multiple abdominal CTs
- ☐ No safe threshold
- ☐ Risk is cumulative and age-related
- ☐ Cancer risk is small but measurable, on order of 1 in 1000
- ☐ Consider the risk and benefits when ordering