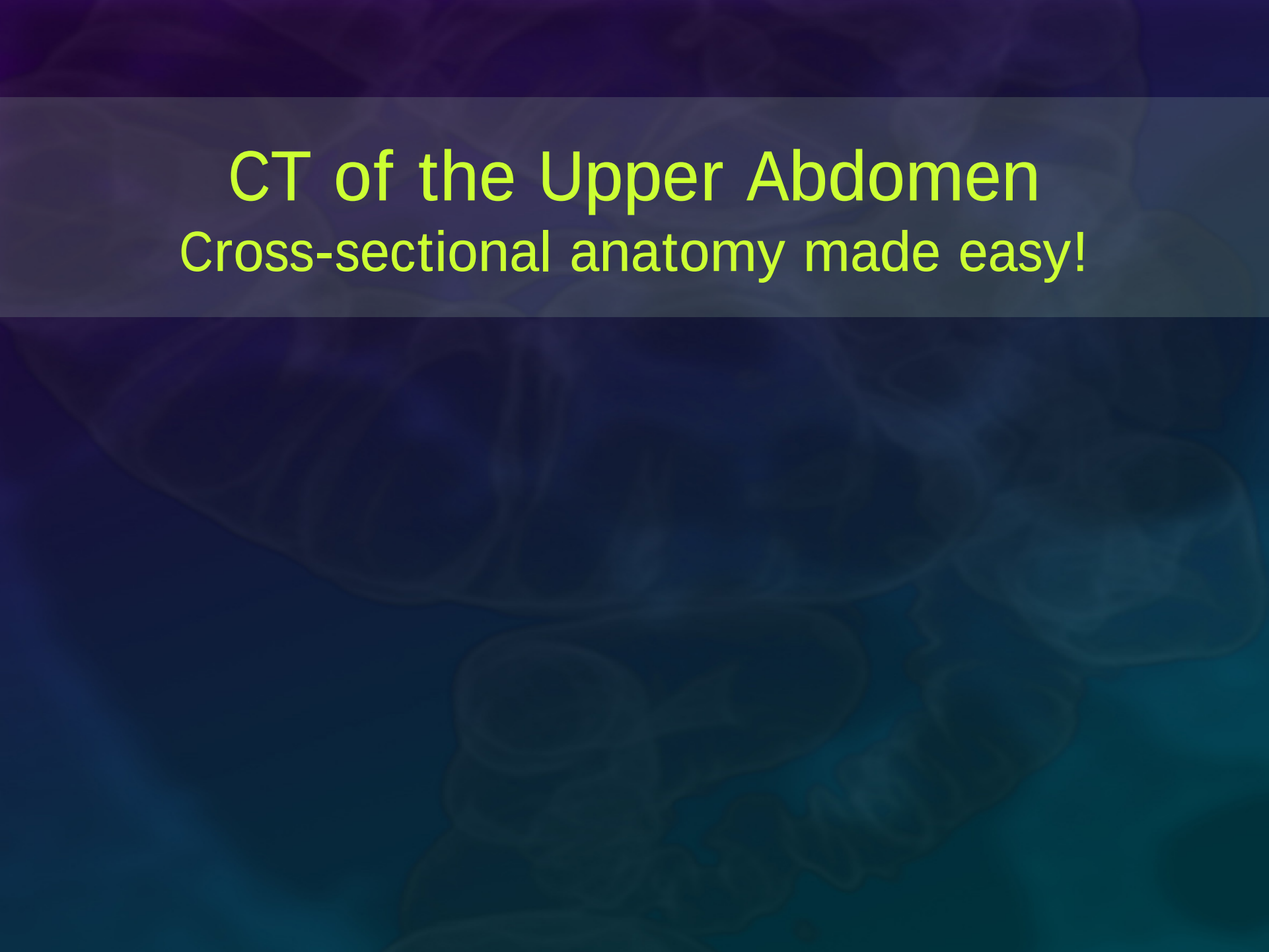




CT of the Upper Abdomen

Cross-sectional anatomy made easy!

Introduction

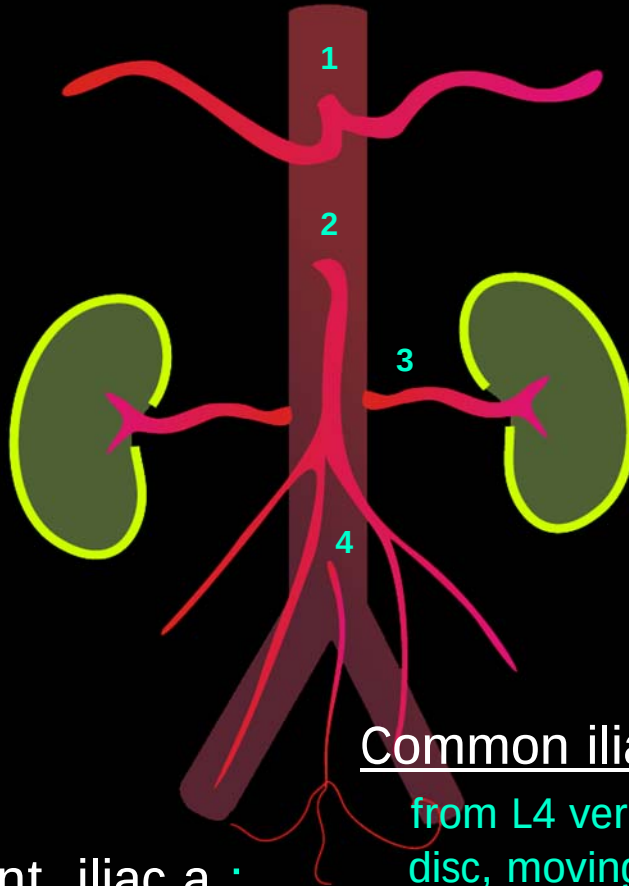
- Correlation of basic landmarks and schematic diagrams allows us to understand WHY structures appear the way they do on CT.
- This is particularly important when attempting to interpret non-contrast images.

Landmarks

- Abdominal Aorta
- Renal Vessels
- Portal Vein and Hepatic Circulation
- IVC
- Duodenum
- Pancreas
- Adrenals

Abdominal Aorta: Branches

Abdominal aorta
from T12 to lower L4



Common iliac a.:

from L4 vertebra to just below the lumbosacral disc, moving in front of their corresponding v.

Int. iliac a.:

from lumbosacral disc & end at upper margin of greater sciatic notch

Abdominal Aorta: Branches

1. Coeliac Axis

- first branch
- hepatic art. splenic art.
- lt. gastric art

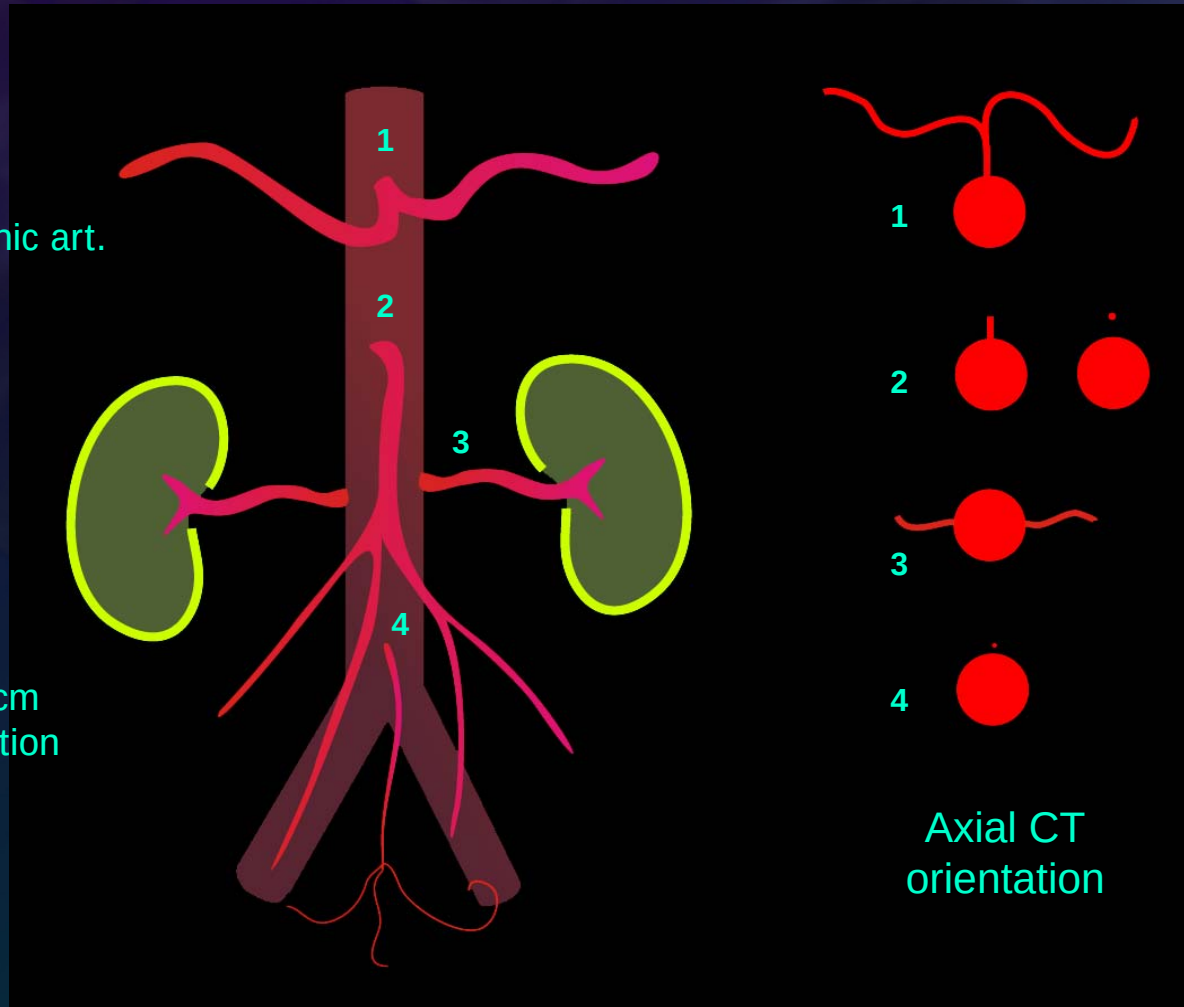
2. SMA

- approximate
1 cm below
coeliac trunk

3. Renal Arteries

4. IMA

- at L3, about 3-4cm
above its bifurcation



Abdominal Aorta: Branches

1. Coeliac Axis

- first branch
- btw T12 & L1
- just below the aortic opening of diaphragm

2. SMA

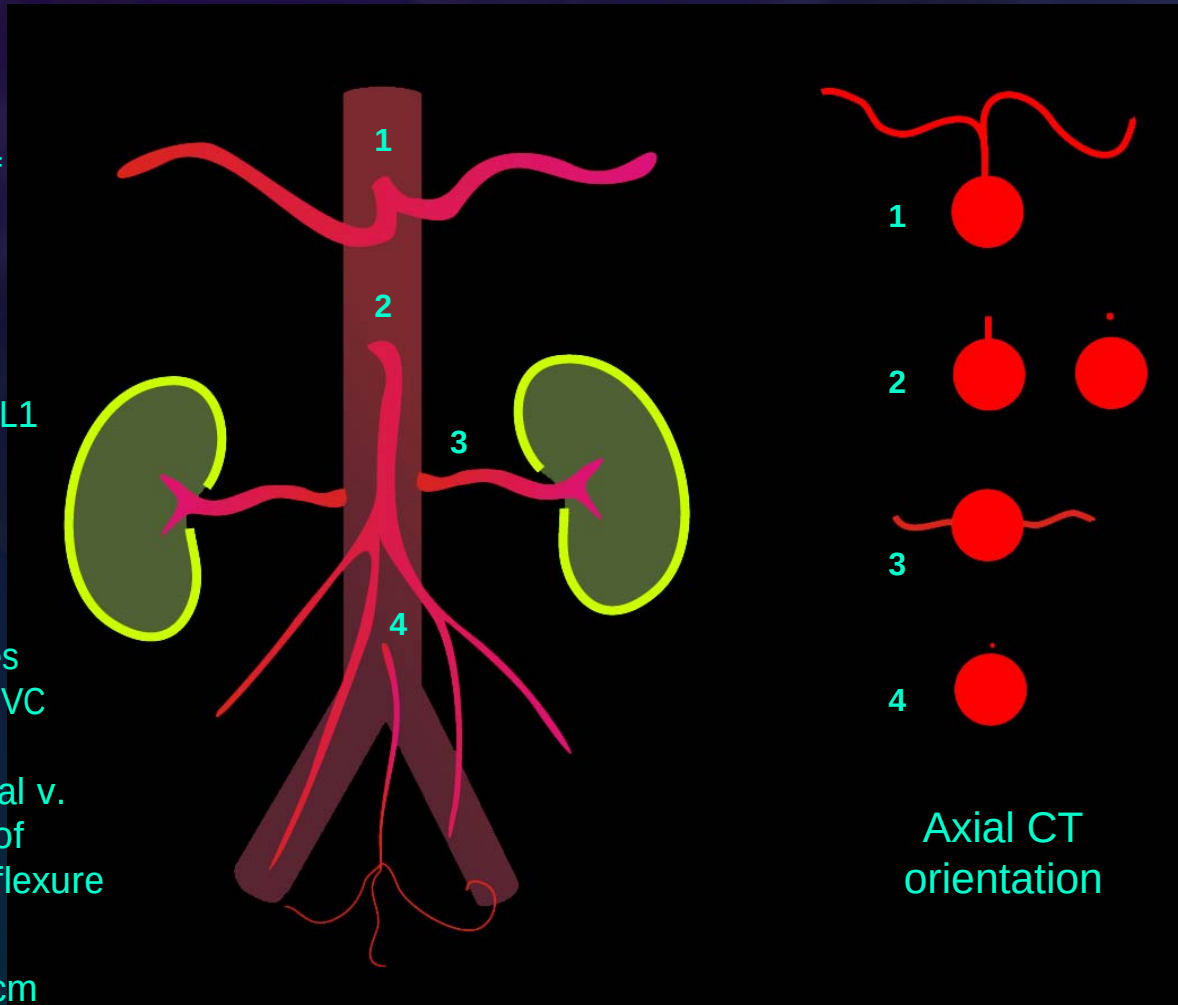
- approximate 1 cm below coeliac trunk, at L1
- behind body of pancreas

3. Renal Arteries

- just below SMA
- Rt renal a. passes laterally behind IVC
- Lt renal a. run behind the Lt renal v. splenic v., body of pancreas & DJ flexure

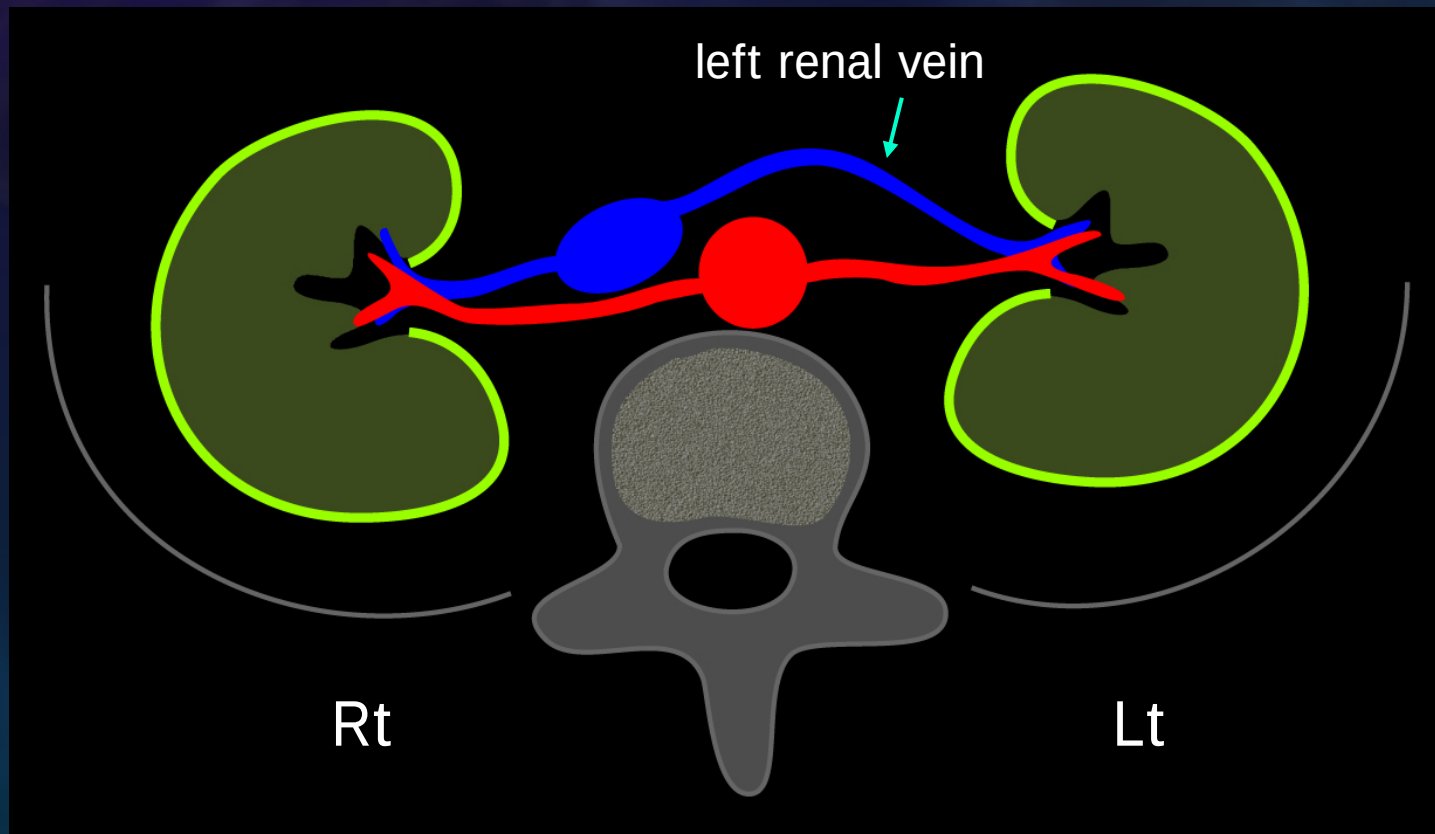
4. IMA

- at L3, about 3-4cm above its bifurcation
- behind 3rd part of duodenum



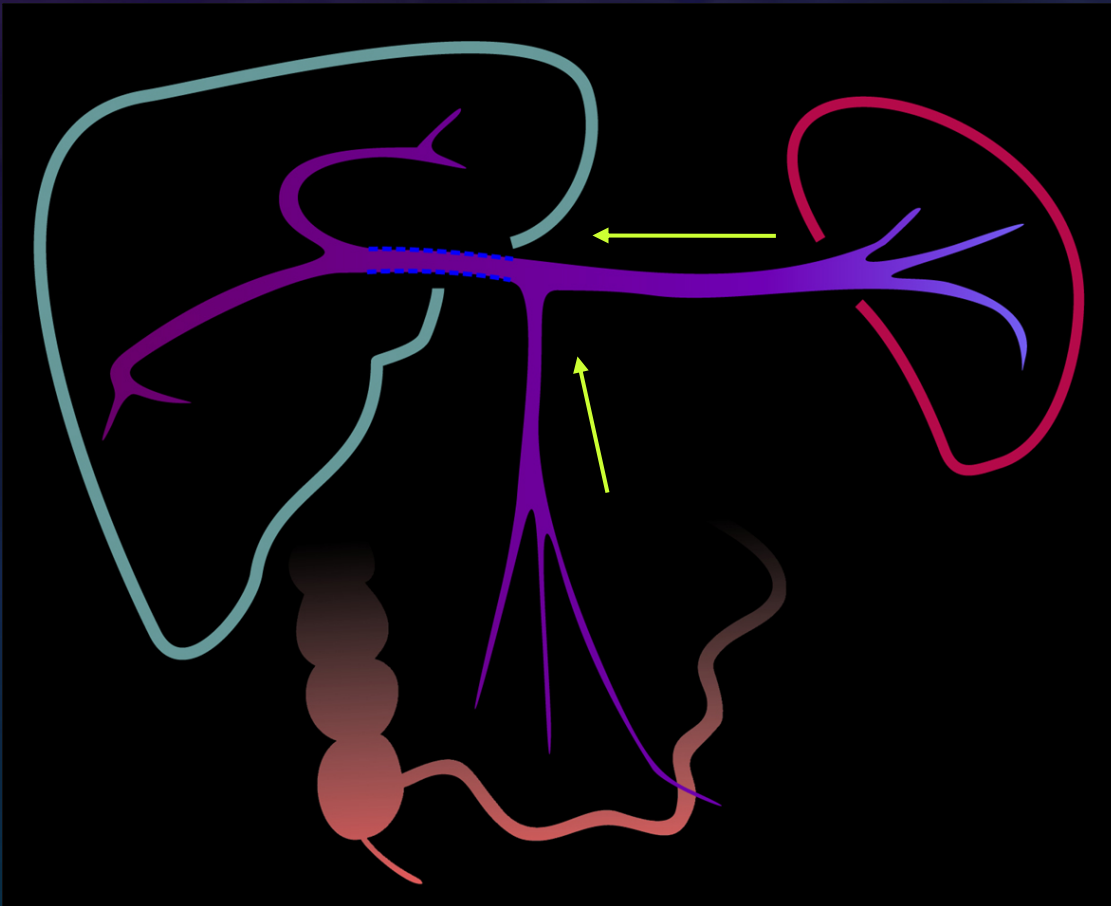
Renal Vessels

- Left renal vein has a longer course (crosses over aorta to drain into IVC)
- Occasionally passes behind aorta (normal variant: retroaortic left renal vein)



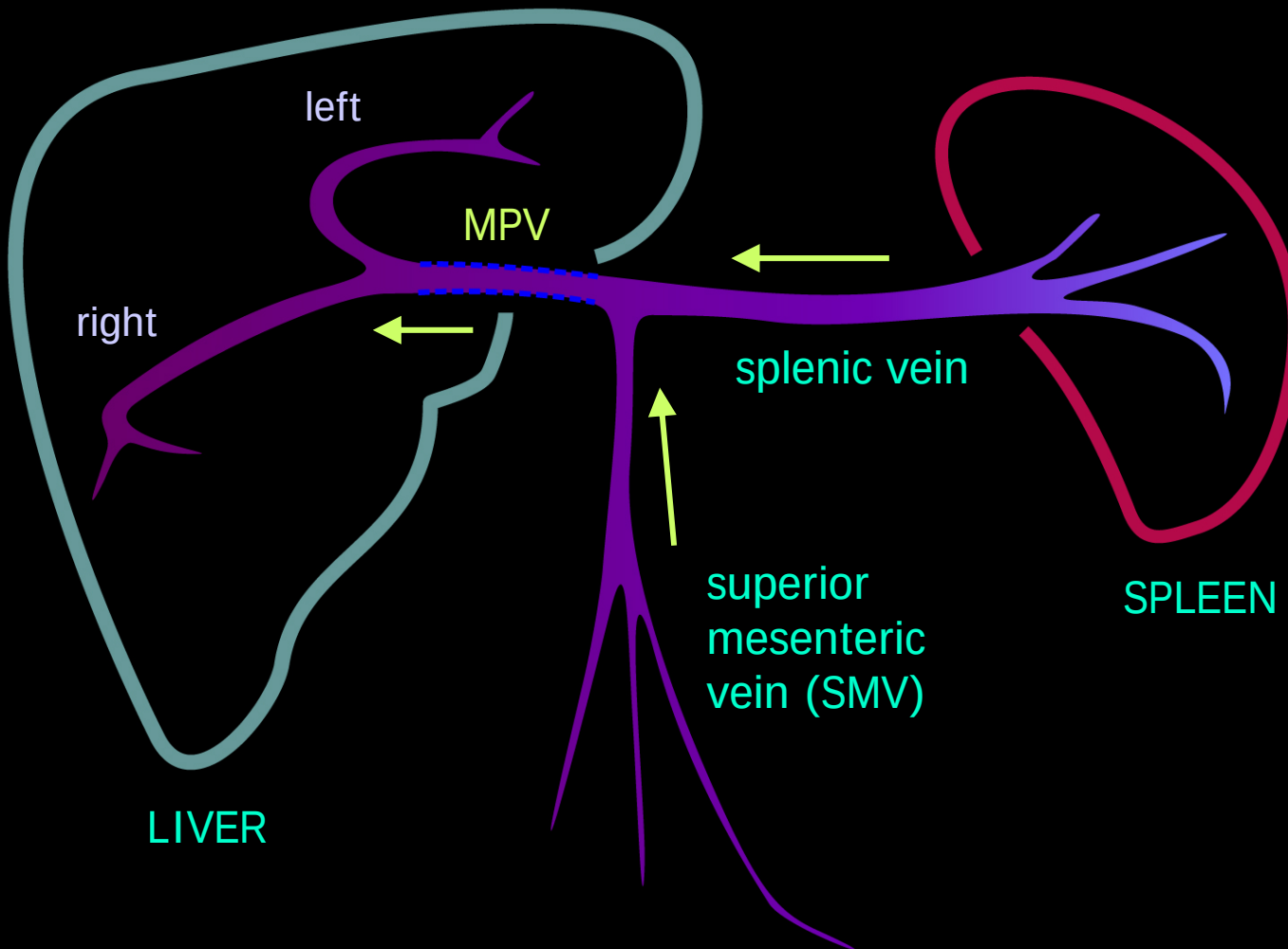
Portal Vein

The liver has an important role in metabolism and therefore receives blood from the GI tract (particularly small bowel) and spleen, via the **portal vein**.



- The portal vein is unique to the liver, and is a large vessel
- Most other organs simply have an arterial and a venous supply
- 70% of hepatic blood supply
- Remainder arises from hepatic artery

Portal Vein



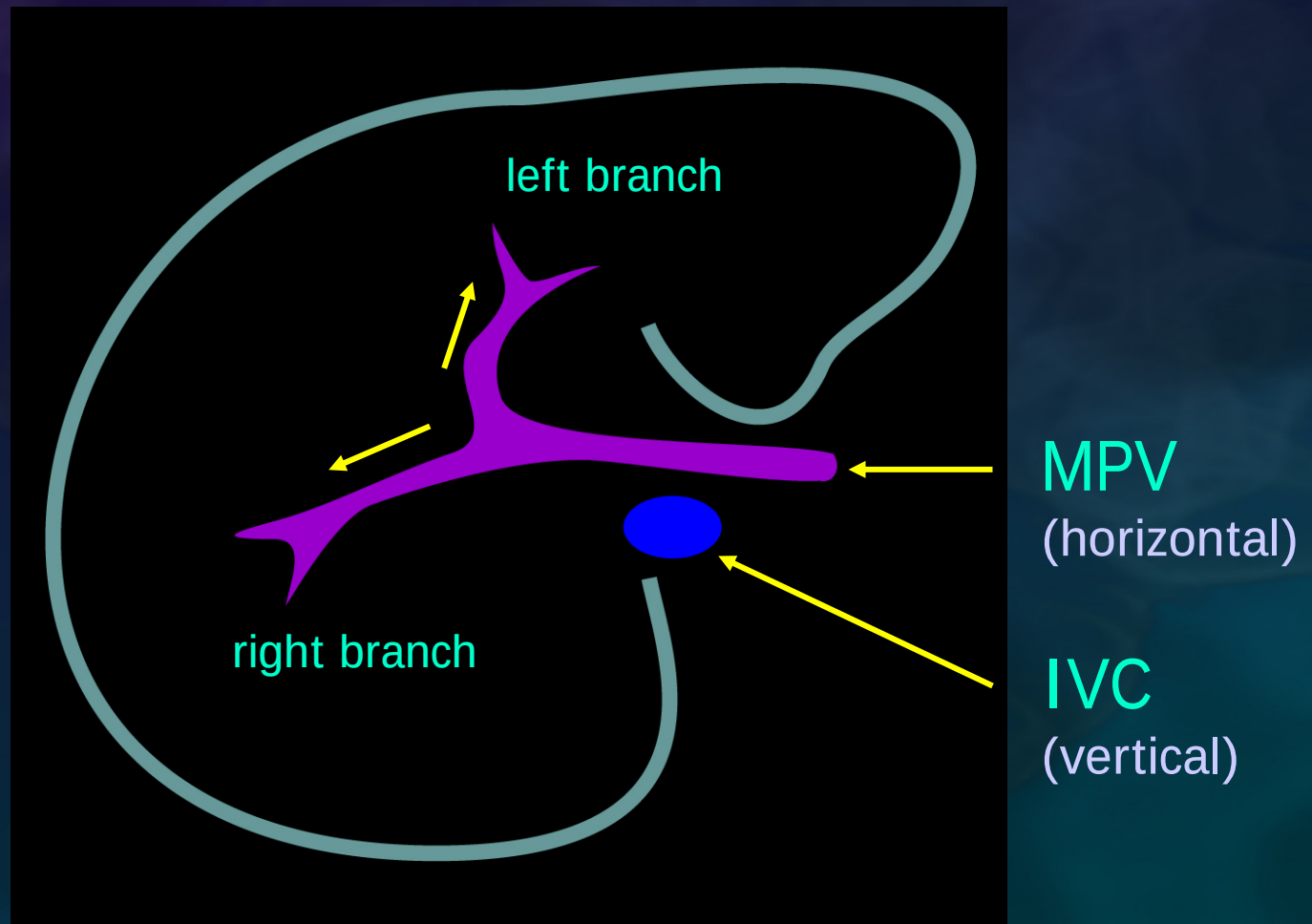
Arises at
junction of
splenic vein
and SMV

Divides into
left and right
branches to
supply
hepatic lobes

MPV = main
portal vein

Portal Vein Branches

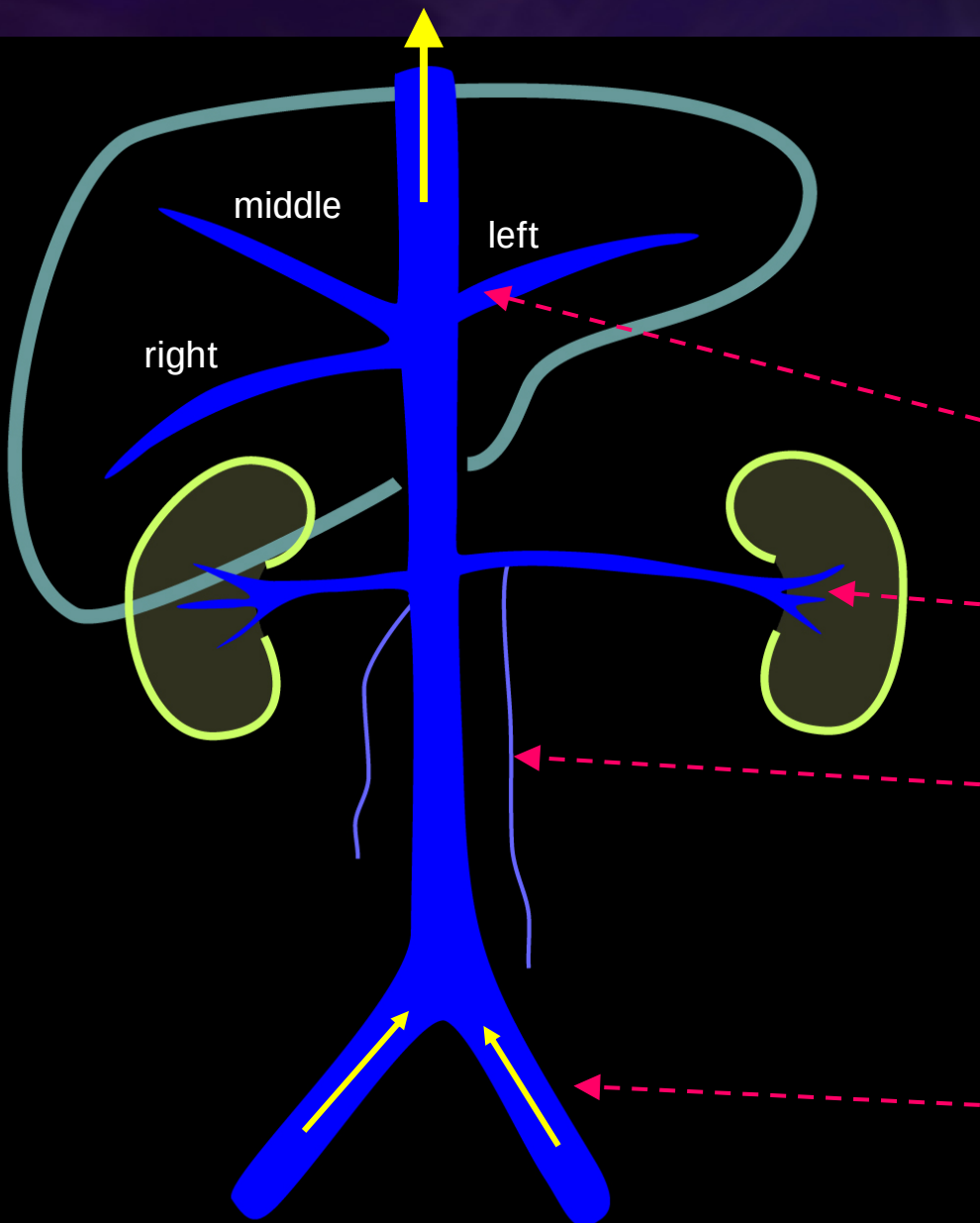
Axial CT Orientation



IVC

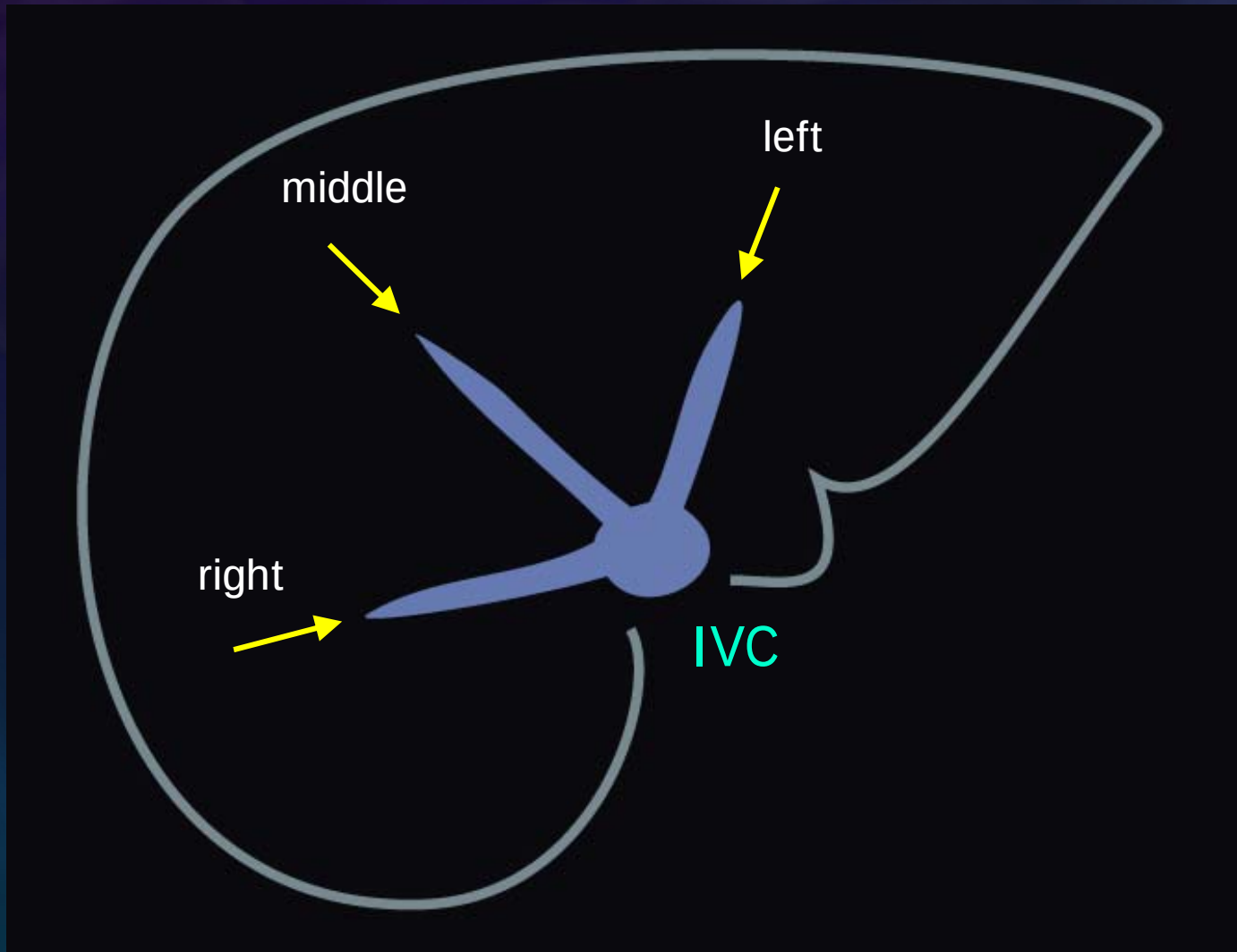
The following vessels drain into the IVC:

- **Hepatic veins** x 3 (this is how venous blood leaves the liver)
- **Renal veins** (left crosses over aorta = longer course)
- **Gonadal veins** (ovarian or testicular)
 - right drains directly into IVC
 - left drains into left renal vein
- **Common iliac veins**

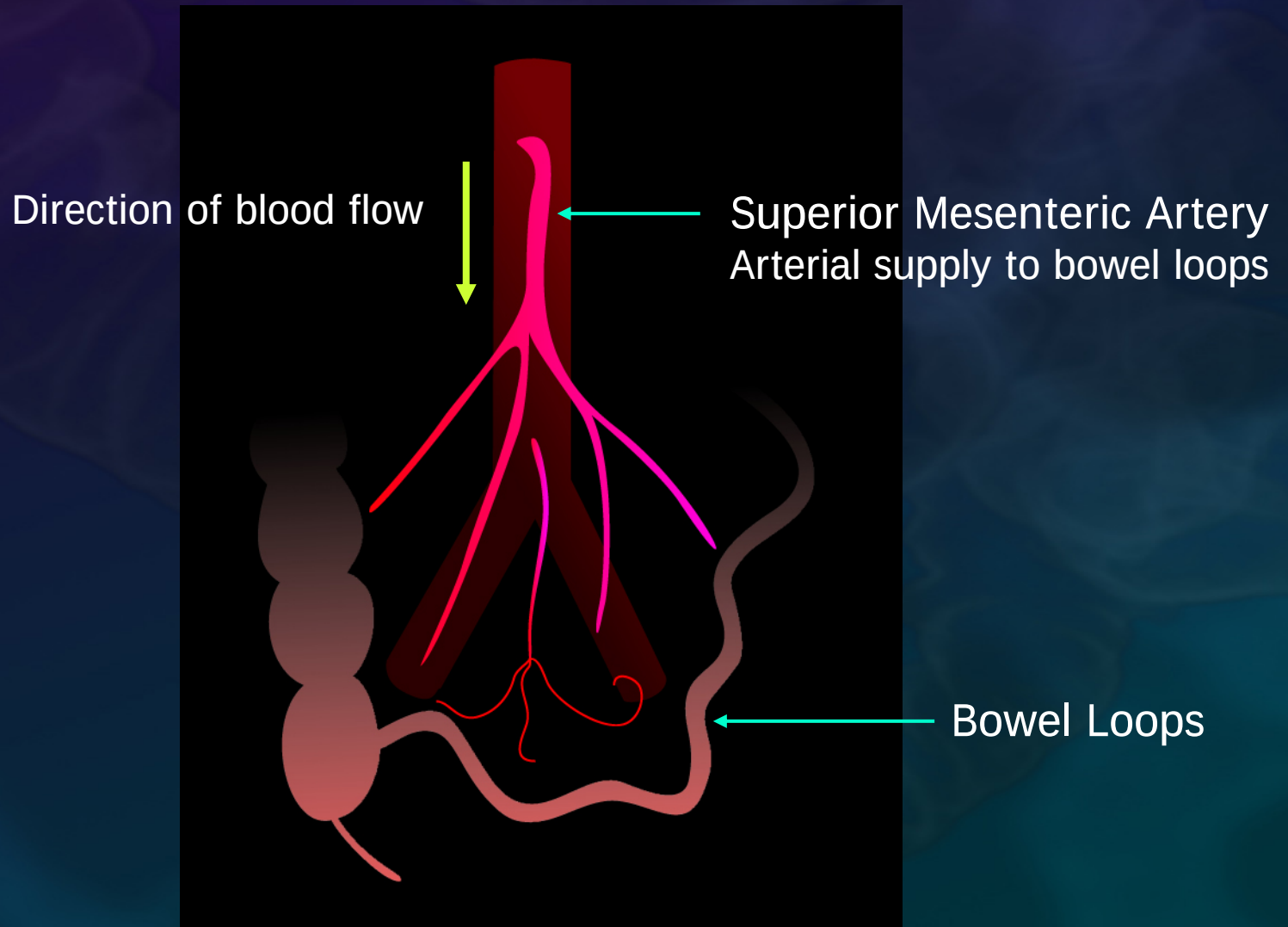


Hepatic Veins

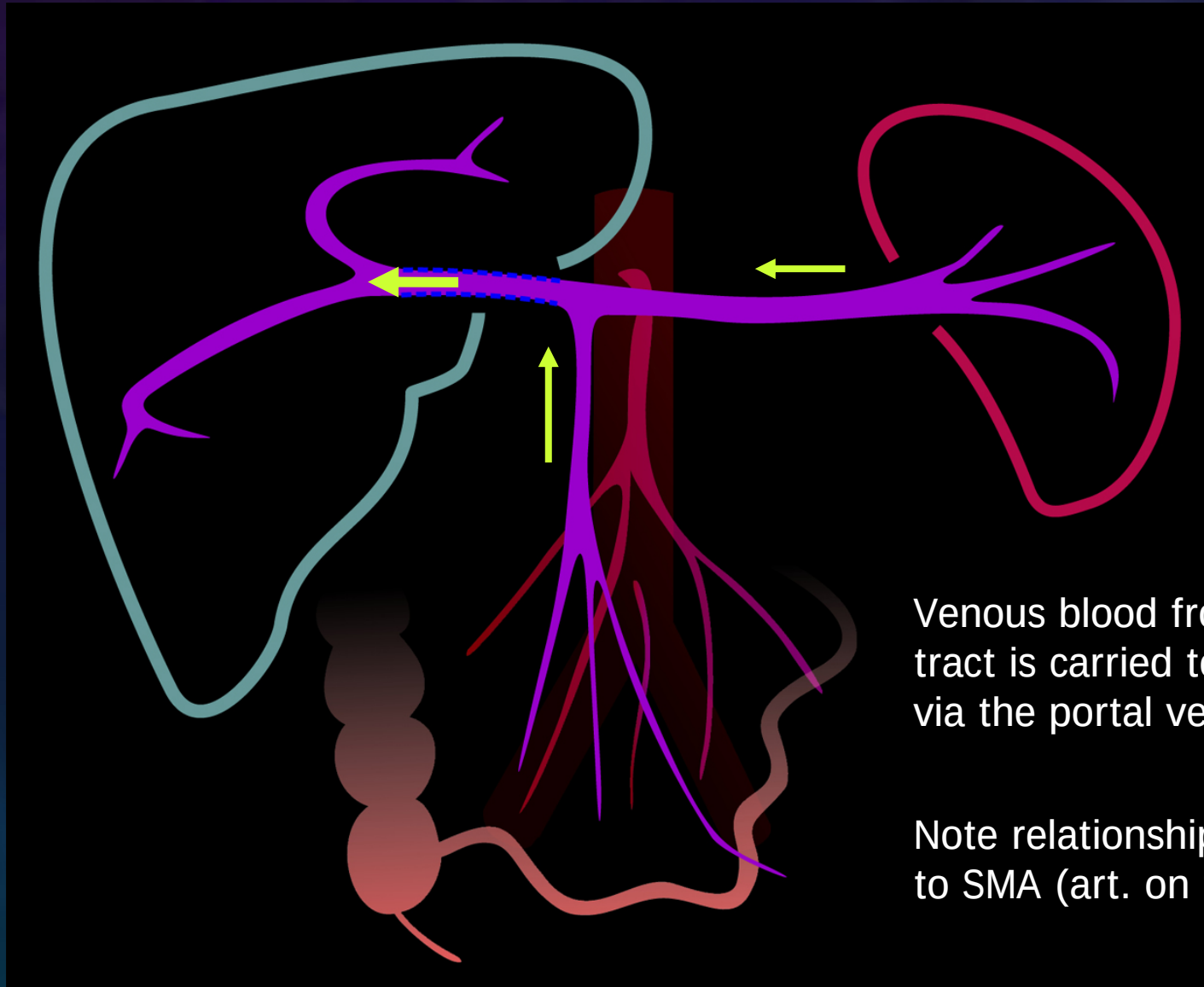
Axial CT Orientation



Mesenteric Vessels and Hepatic Circulation



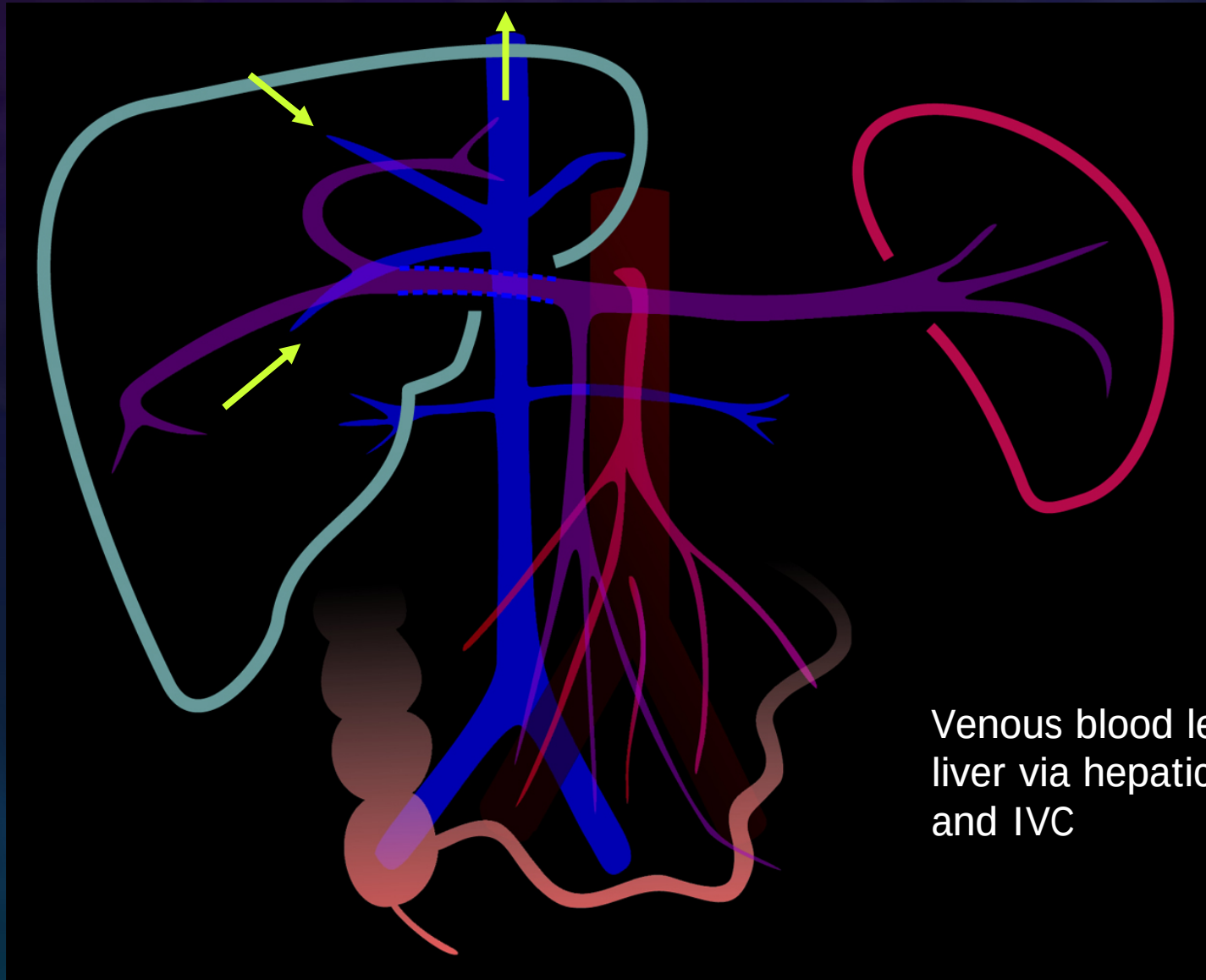
Mesenteric Vessels and Hepatic Circulation



Venous blood from GI tract is carried to the liver via the portal vein

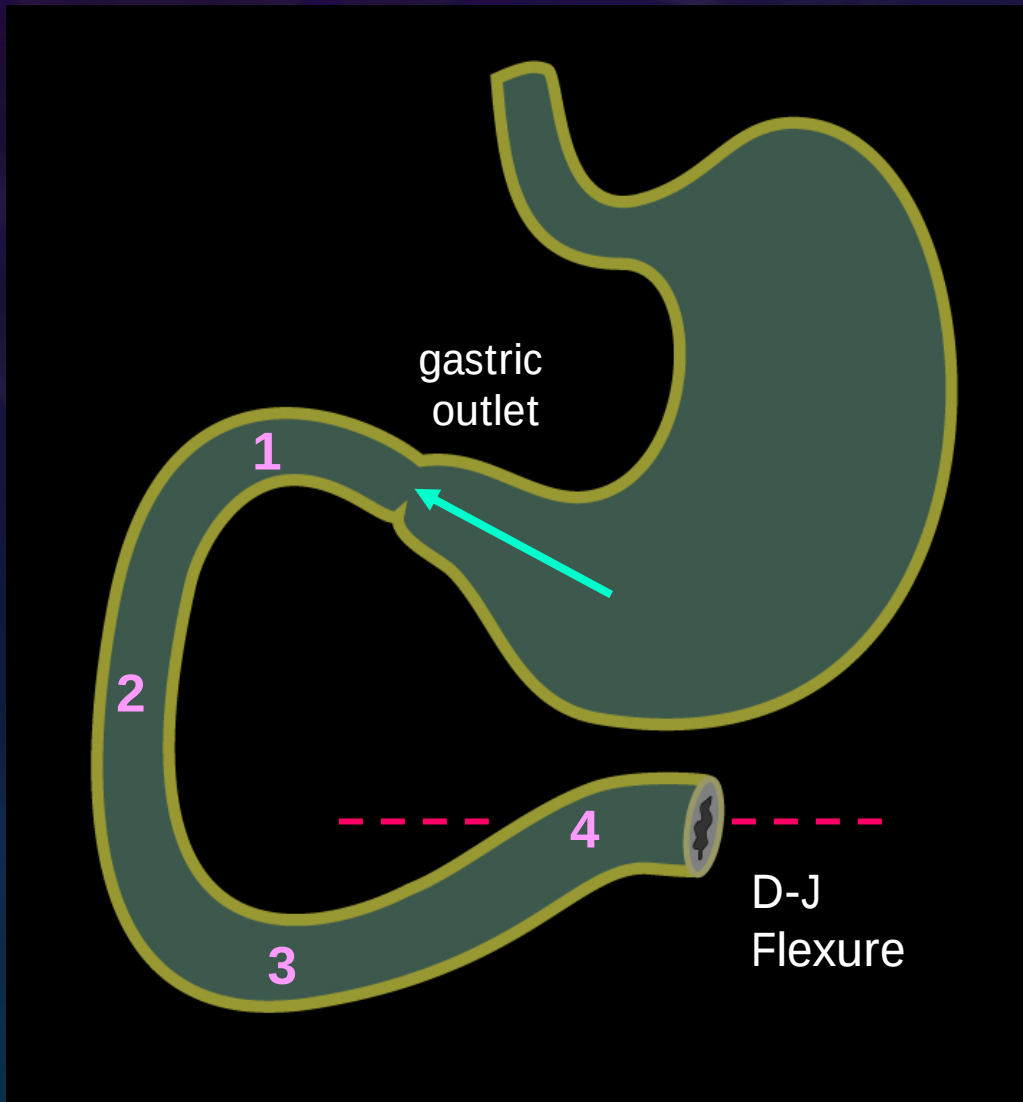
Note relationship of SMV to SMA (art. on the left)

Mesenteric Vessels and Hepatic Circulation



Venous blood leaves the liver via hepatic veins and IVC

Duodenum



4 parts

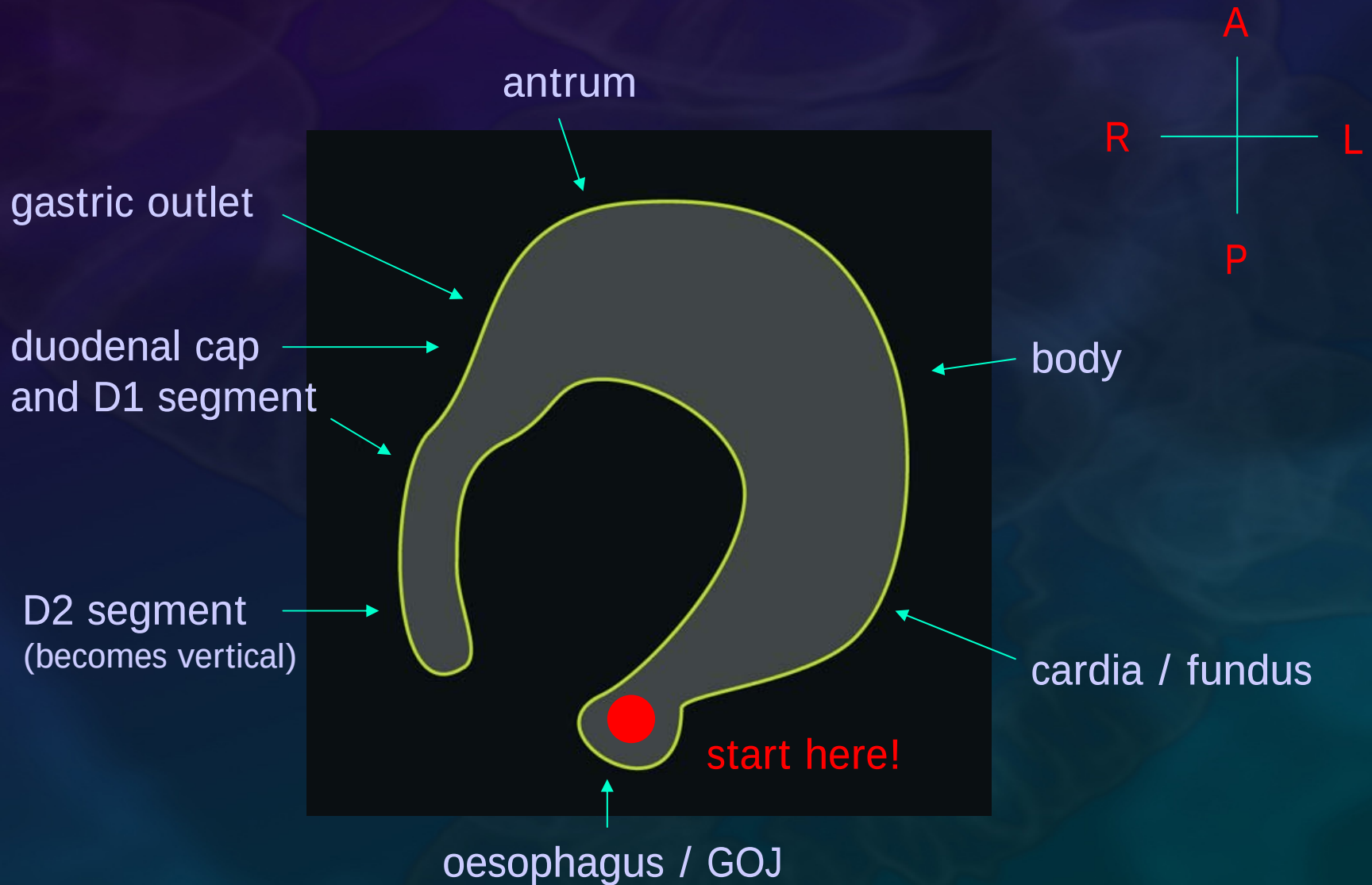
D1 = duodenal cap

D2 has vertical orientation

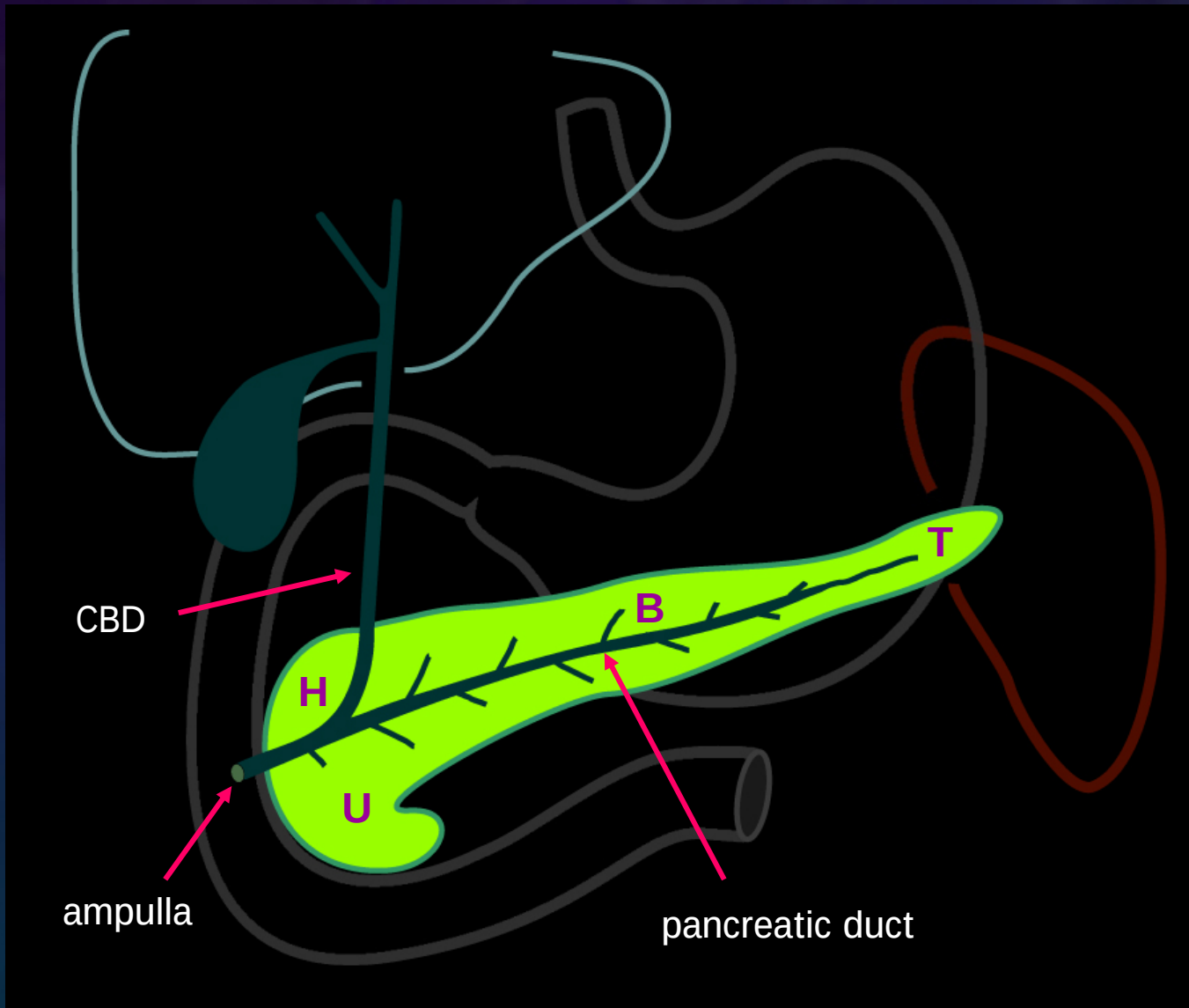
D3 has horizontal oblique orientation

D4 lies at a higher axial level relative to D3 and continues as the D-J flexure

Stomach and Duodenum: Axial orientation



Pancreas



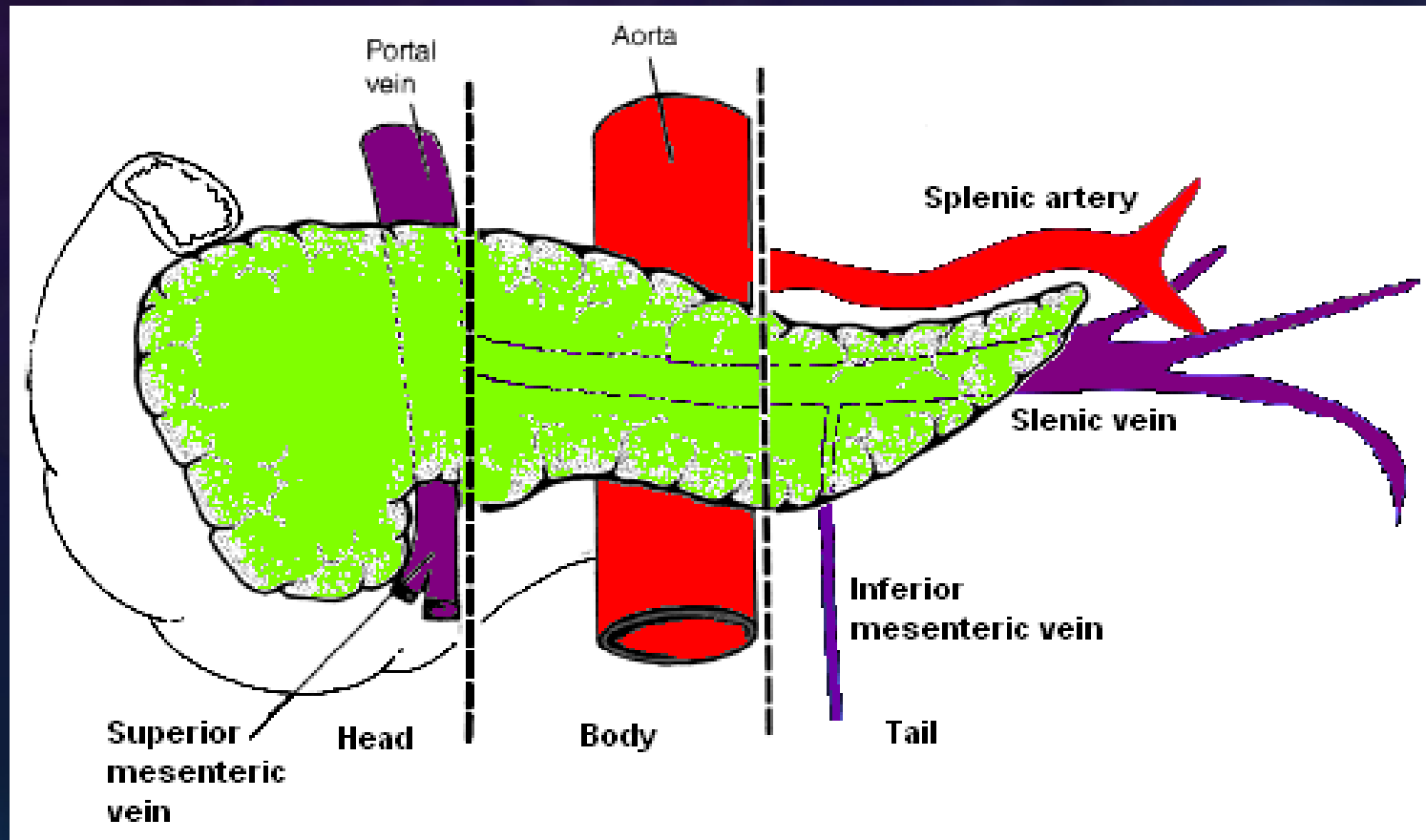
4 parts

- Head
- Body
- Tail
- Uncinate process

Oblique axial orientation

Tail lies at
splenic hilum and
at a higher axial
level relative to
head

Pancreas



In front of portal/ SMV is head of pancreas.

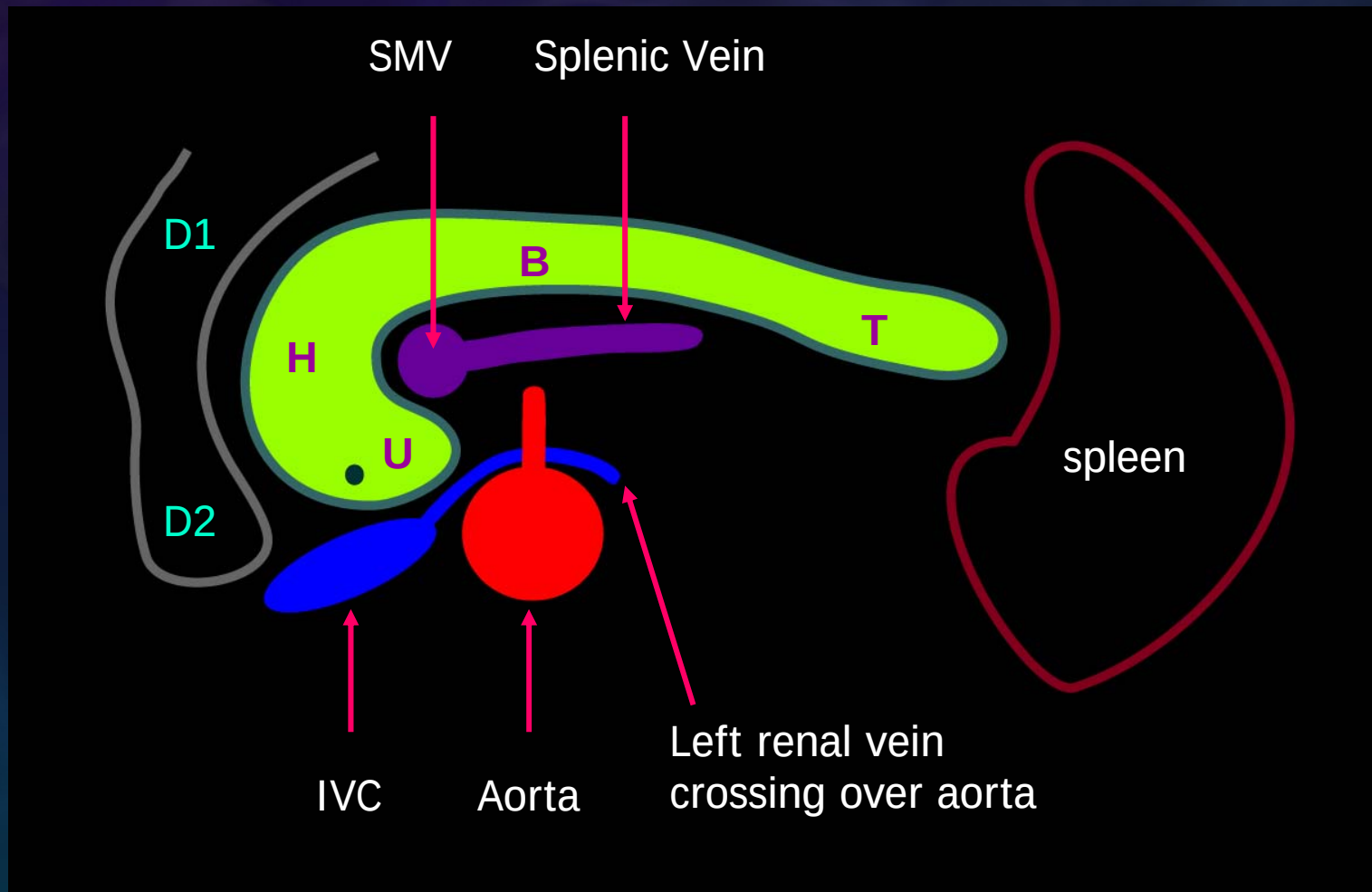
Behind the SM vessels is uncinate process.

In front of aorta is the body of pancreas & the rest is the tail.

Pancreas

Axial CT orientation

Need to assess over multiple slices due to oblique long axis



Adrenals

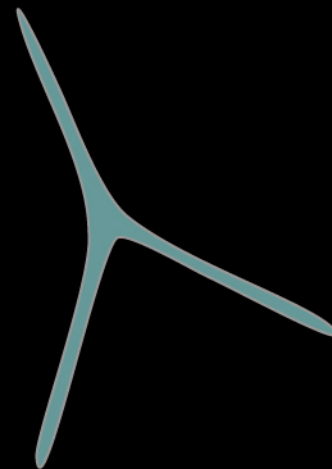
Axial CT appearance

Left and right adrenal have slightly differing shapes



RIGHT SIDE

Inverted narrow V-shape

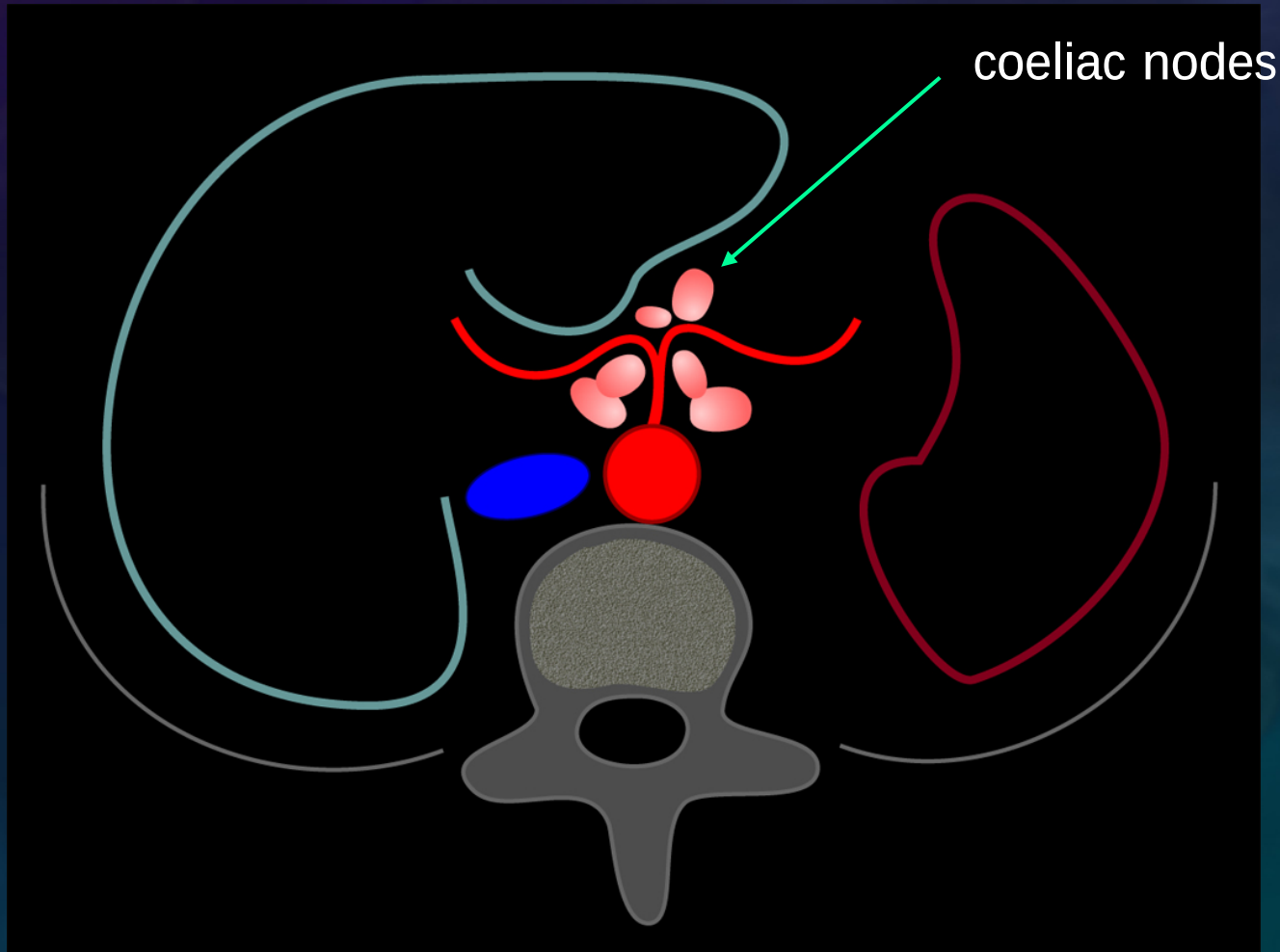


LEFT SIDE

Inverted Y-shape

Lymph nodes

Described in accordance with anatomical location

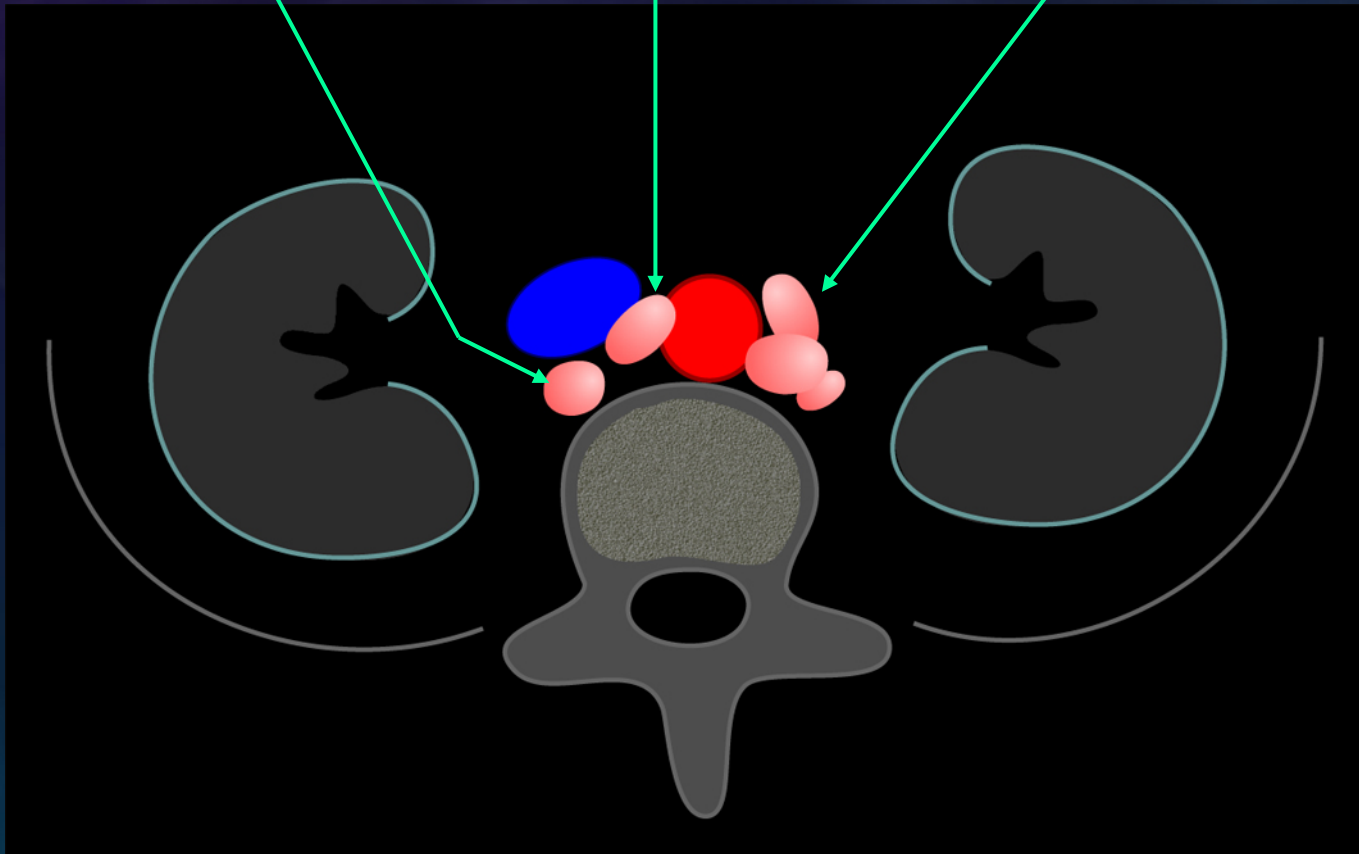


Lymph nodes

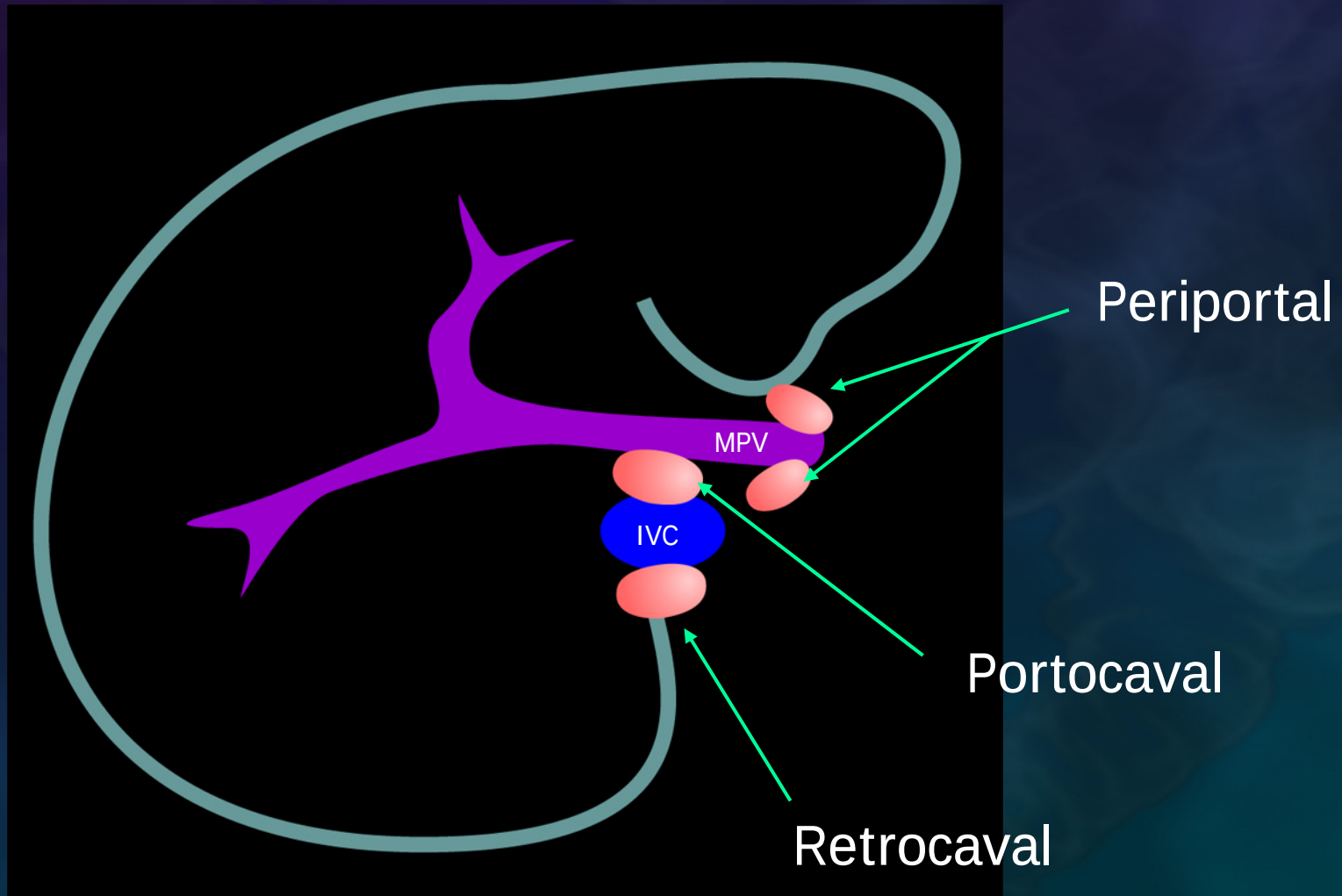
Retrocaval

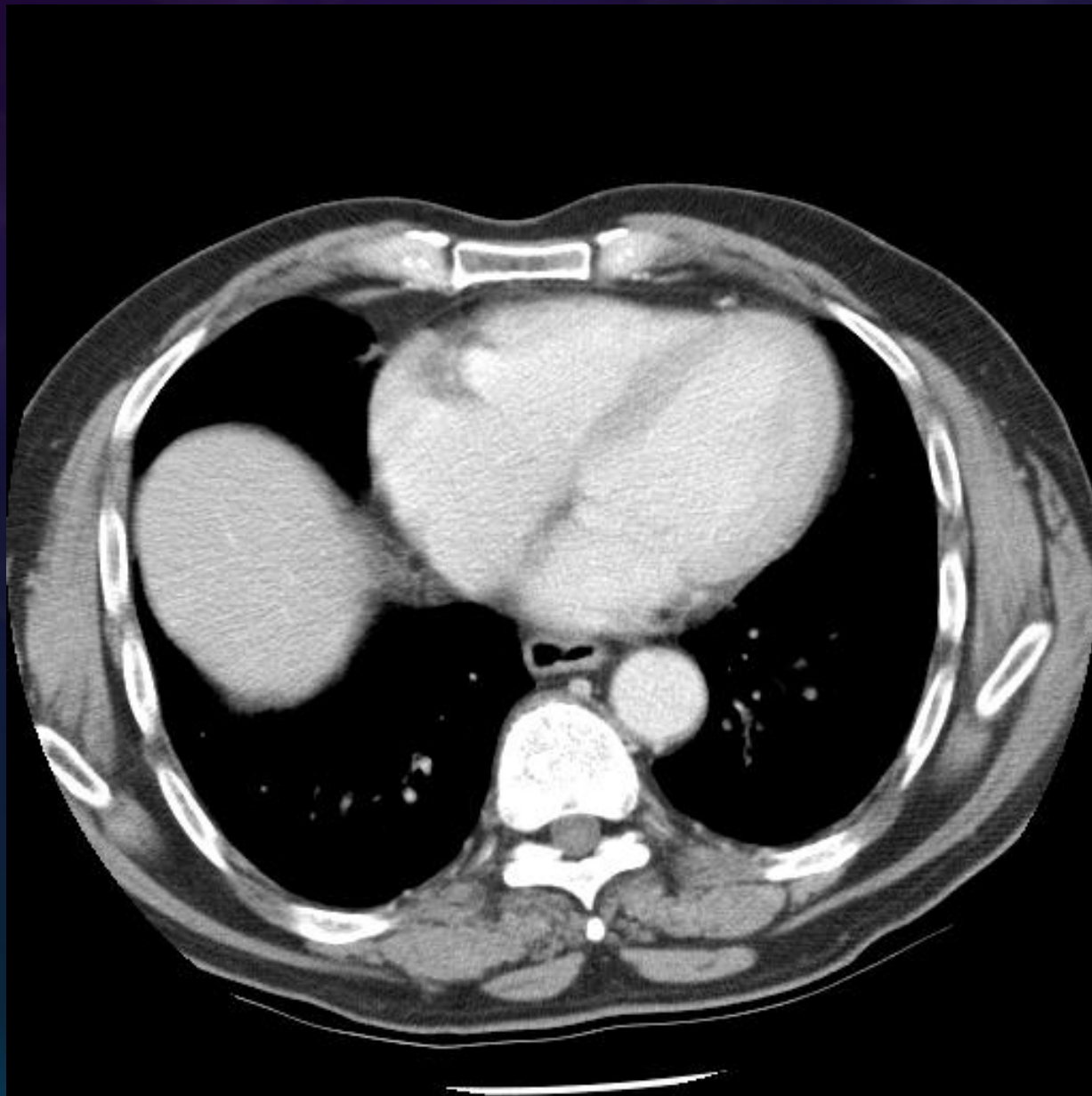
Aortocaval

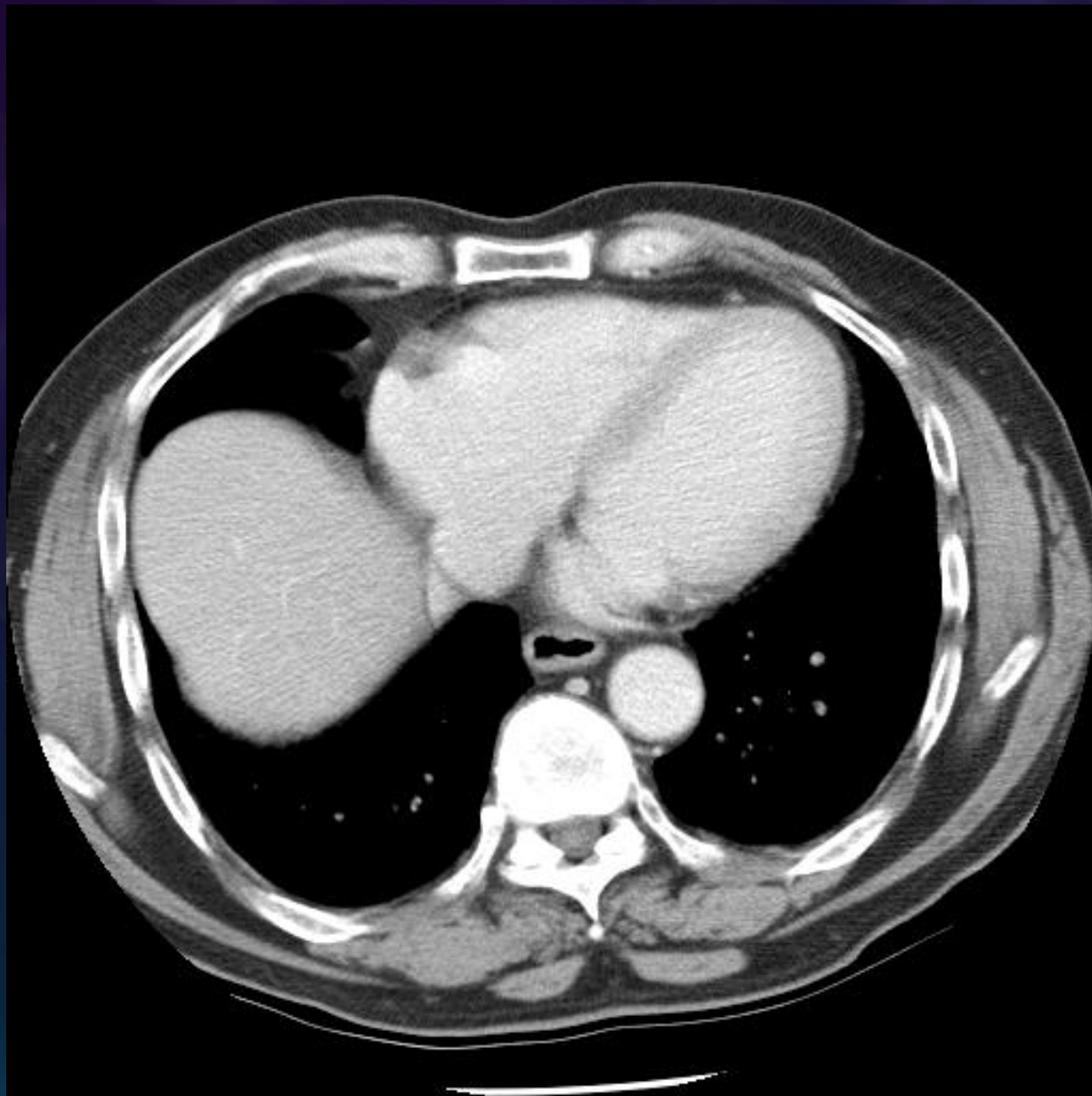
Para-aortic

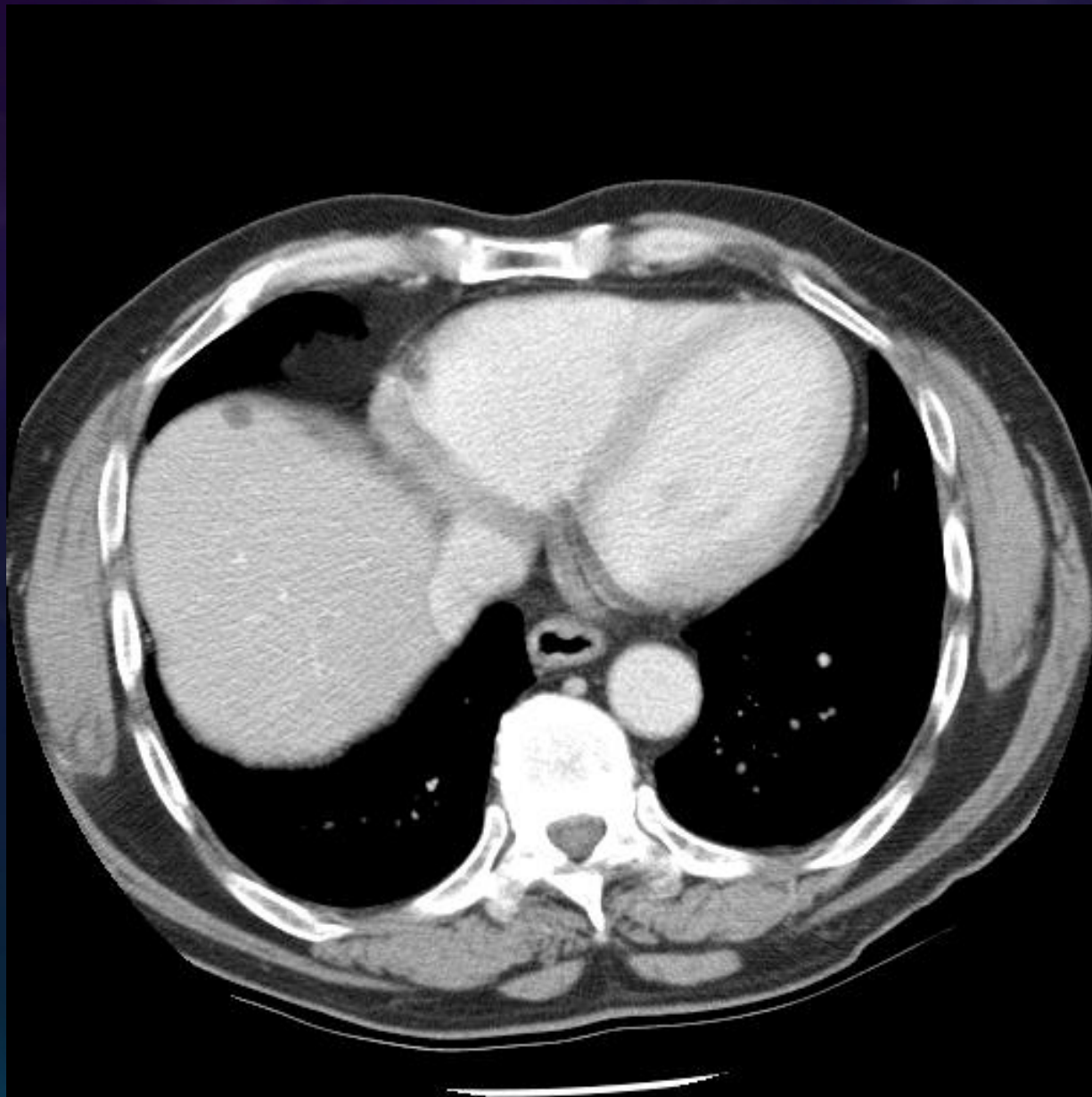


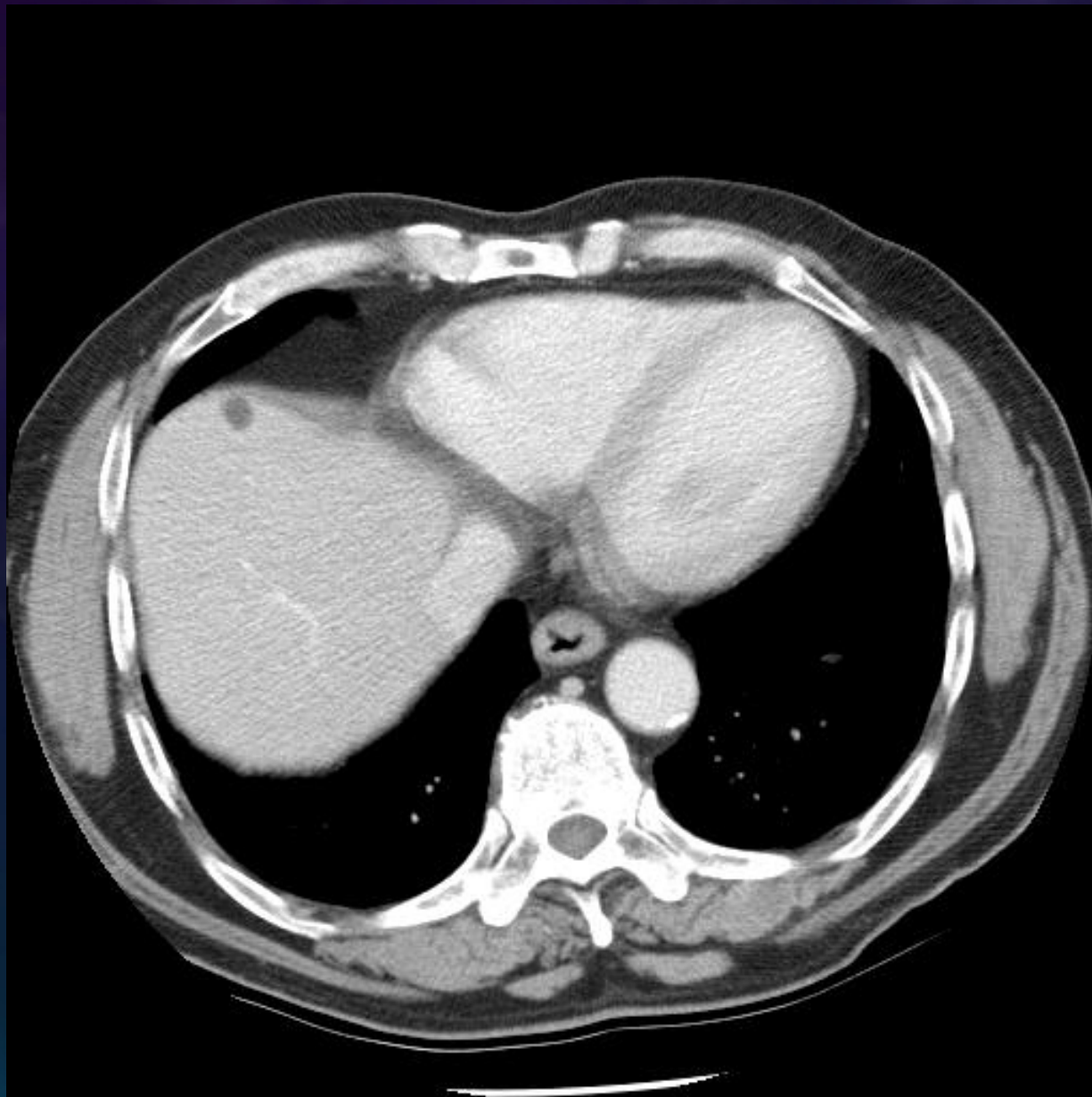
Lymph nodes

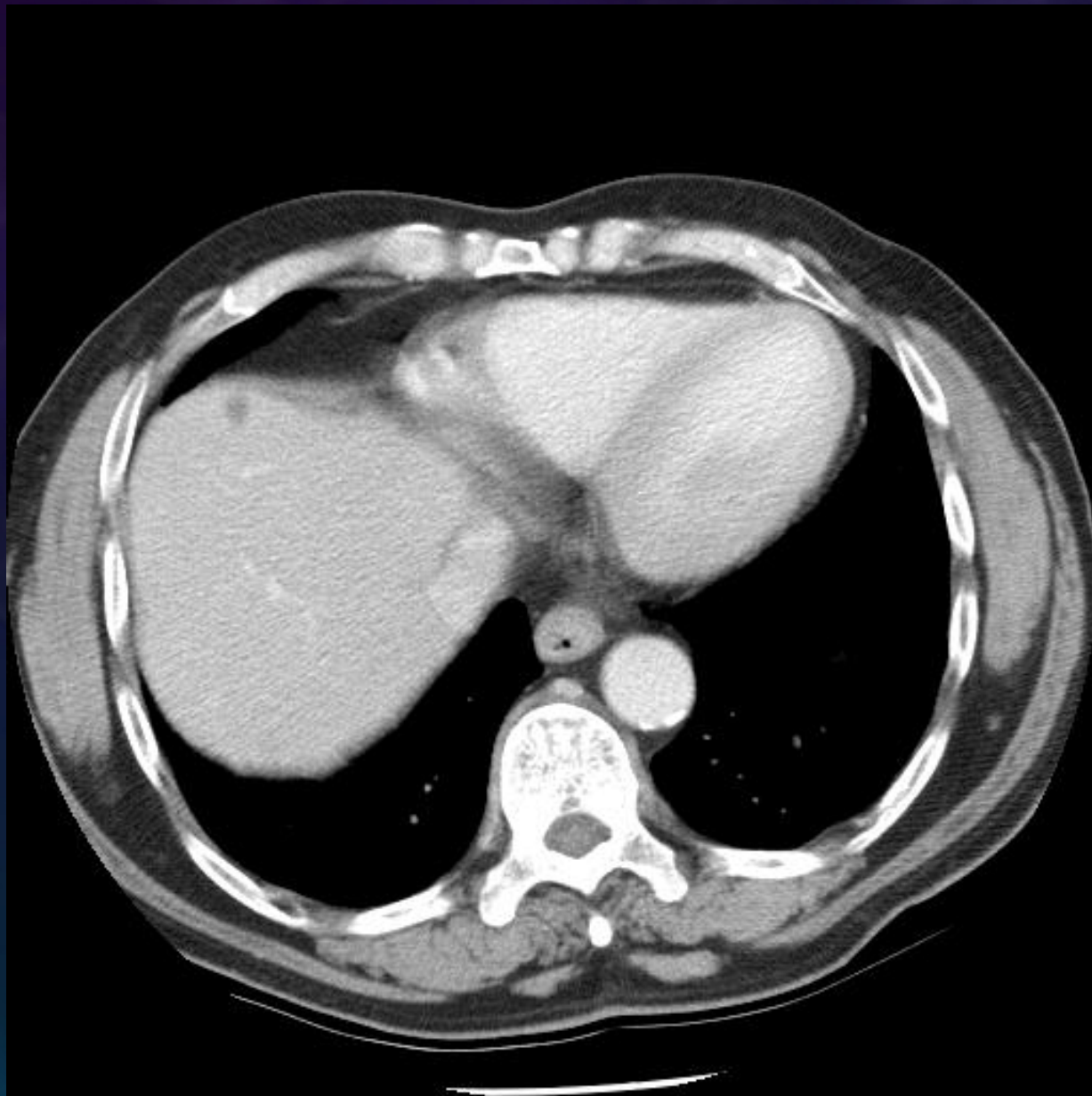


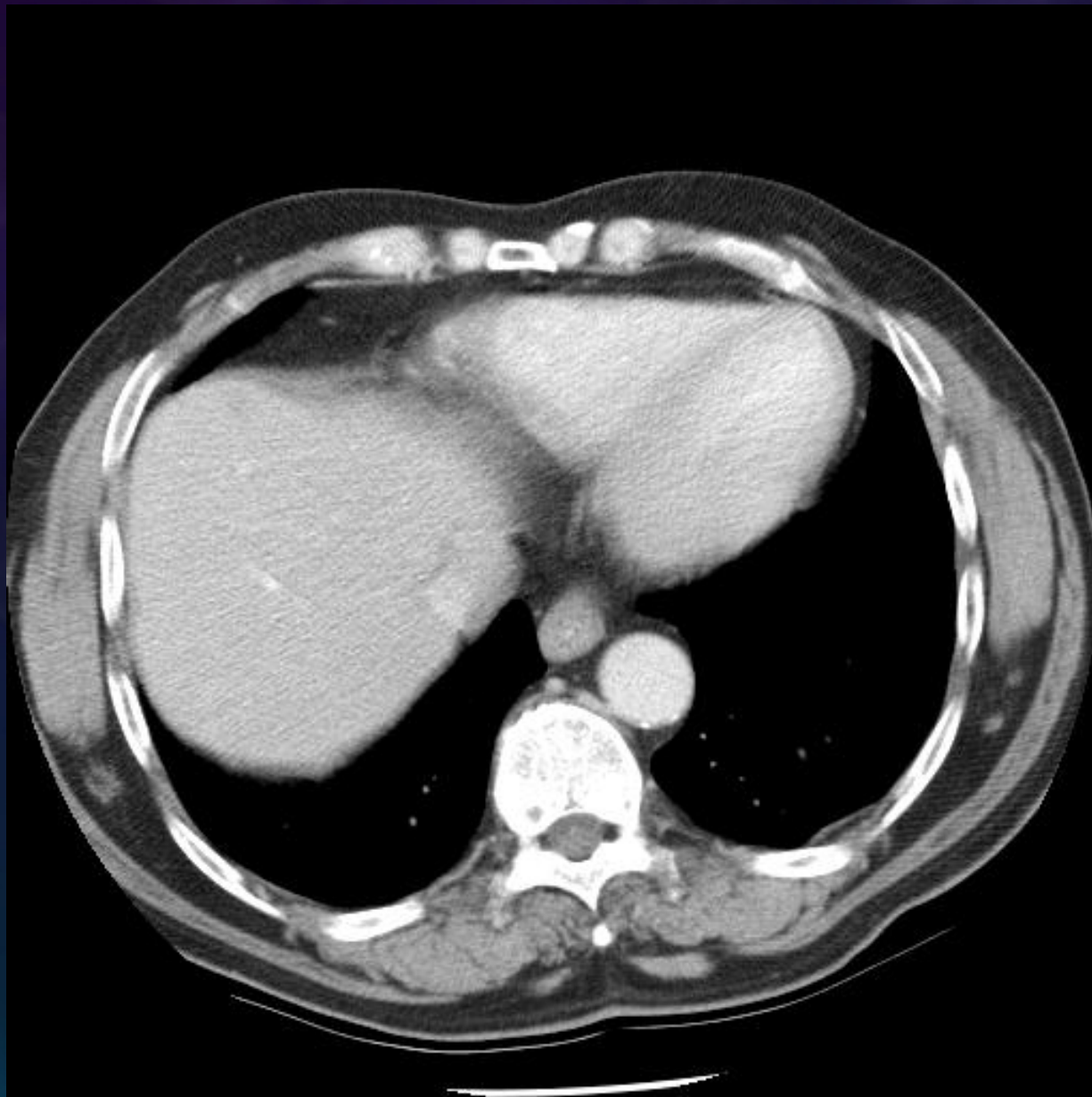


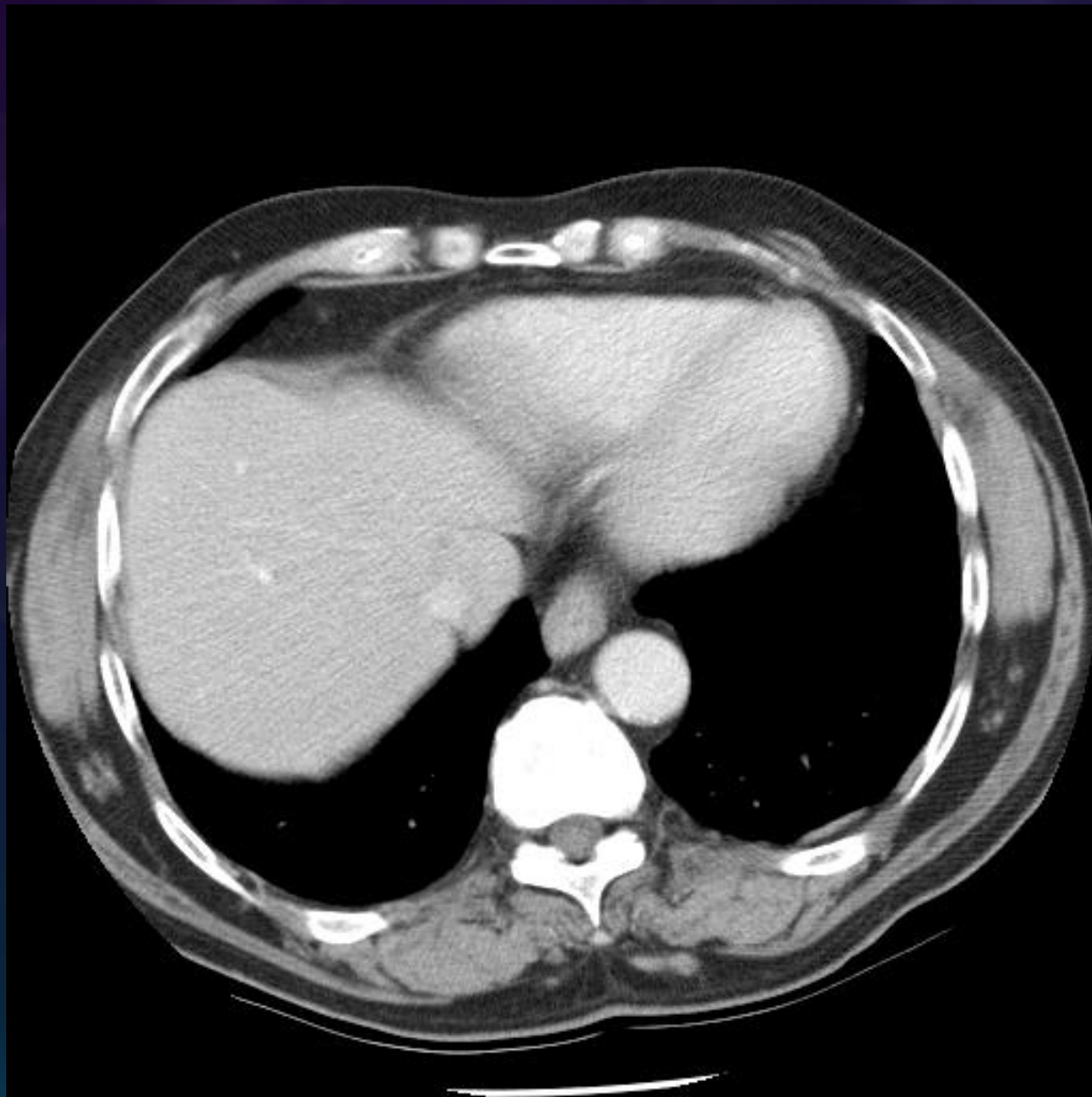






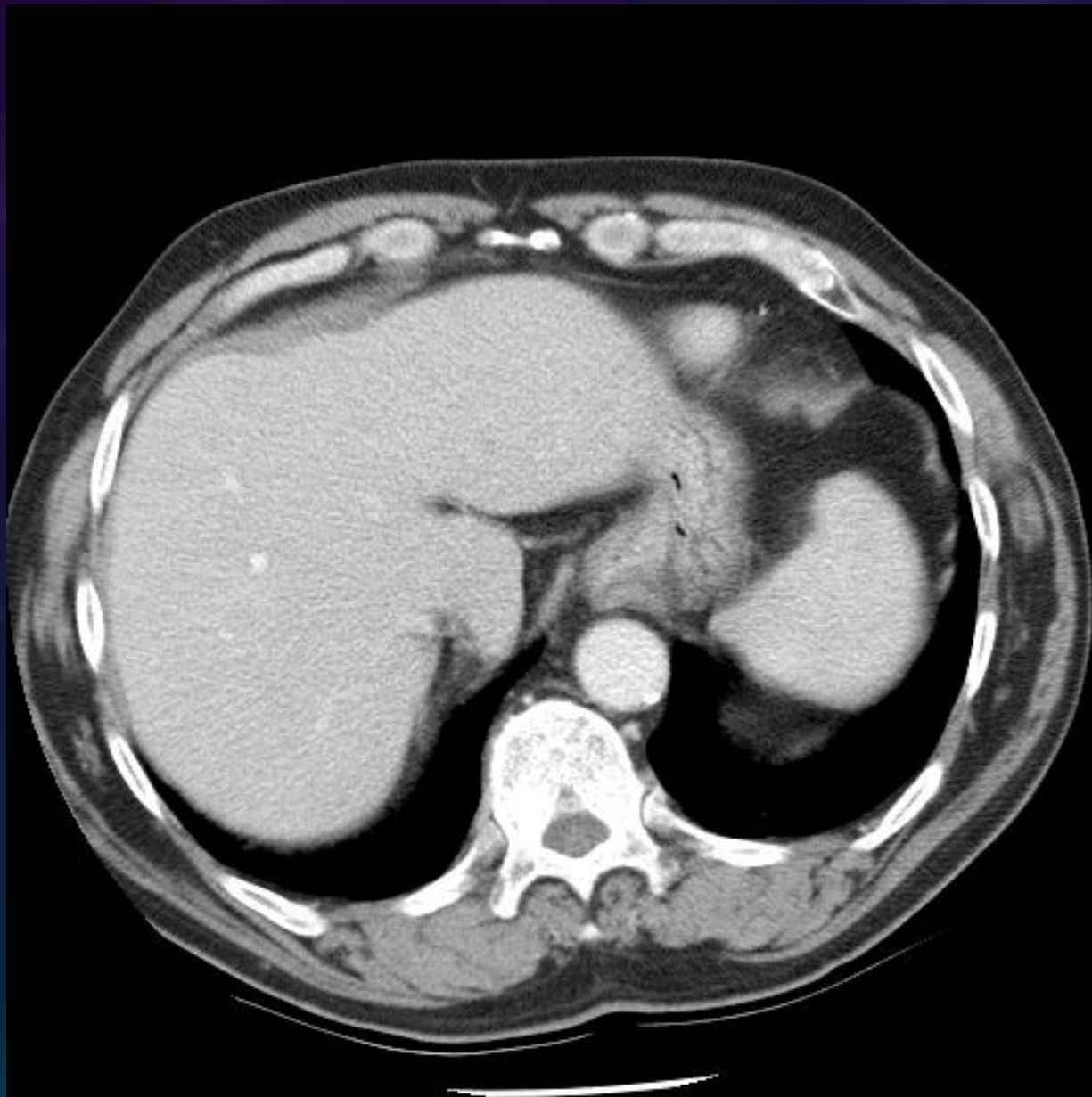


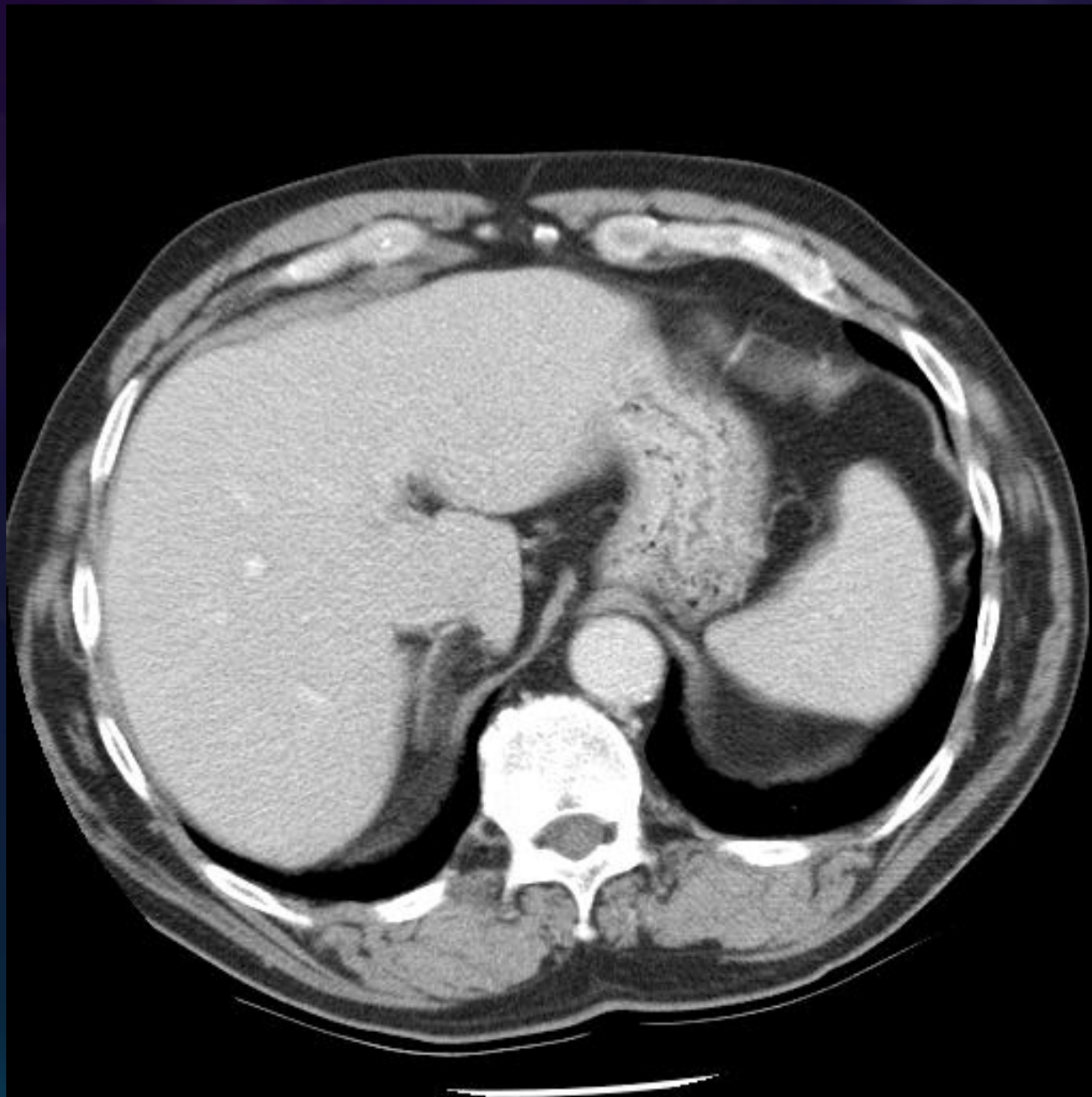


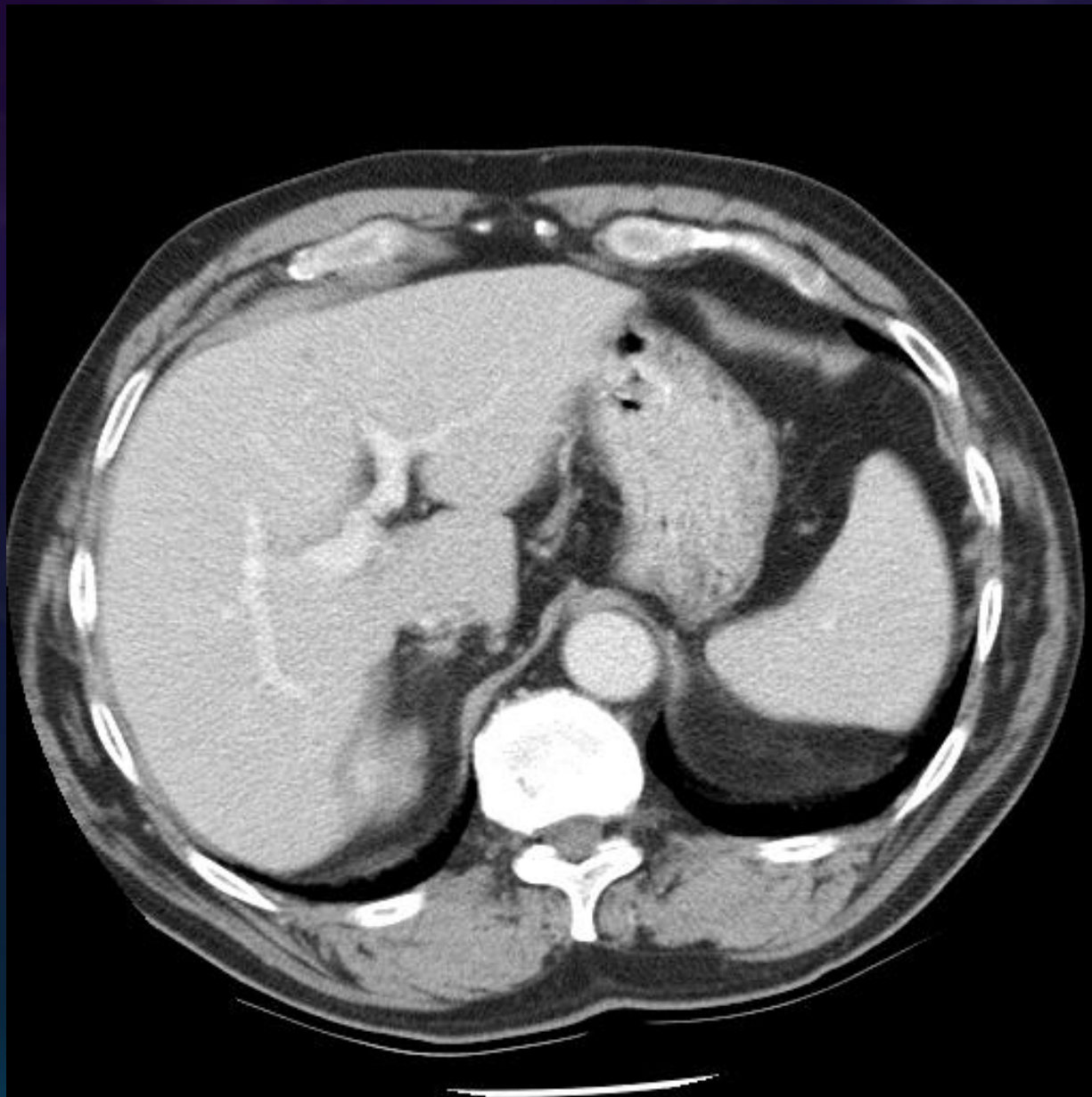


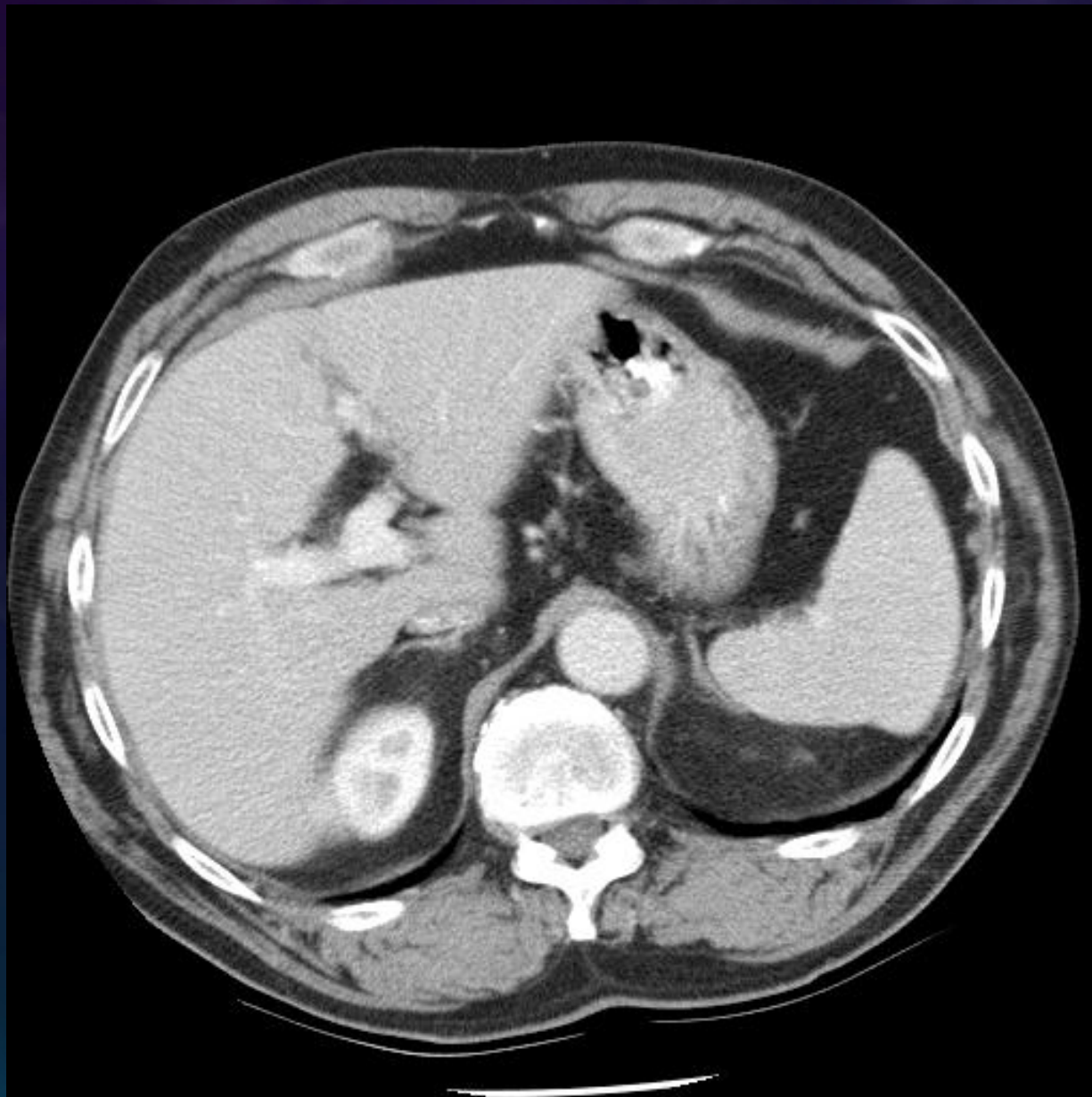




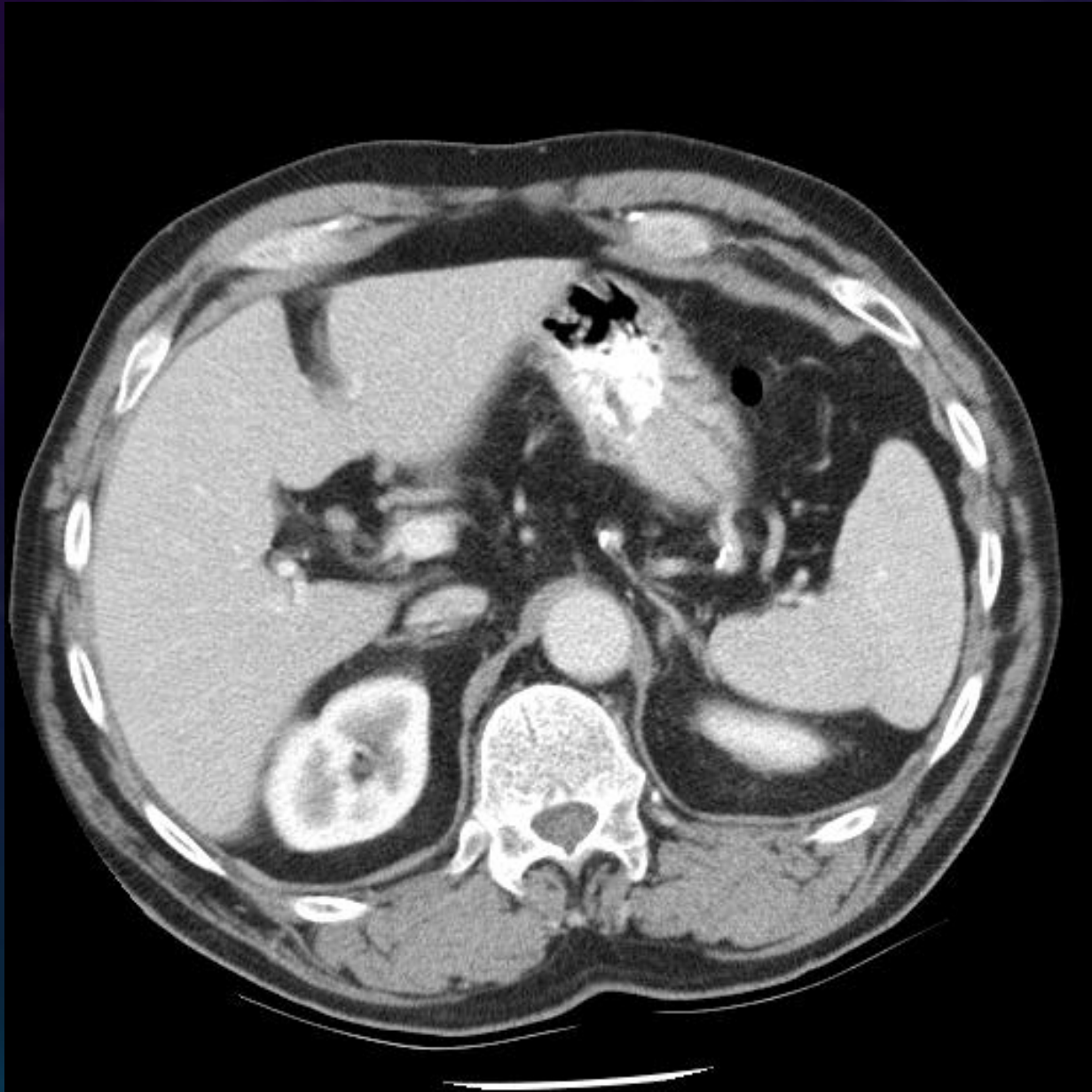




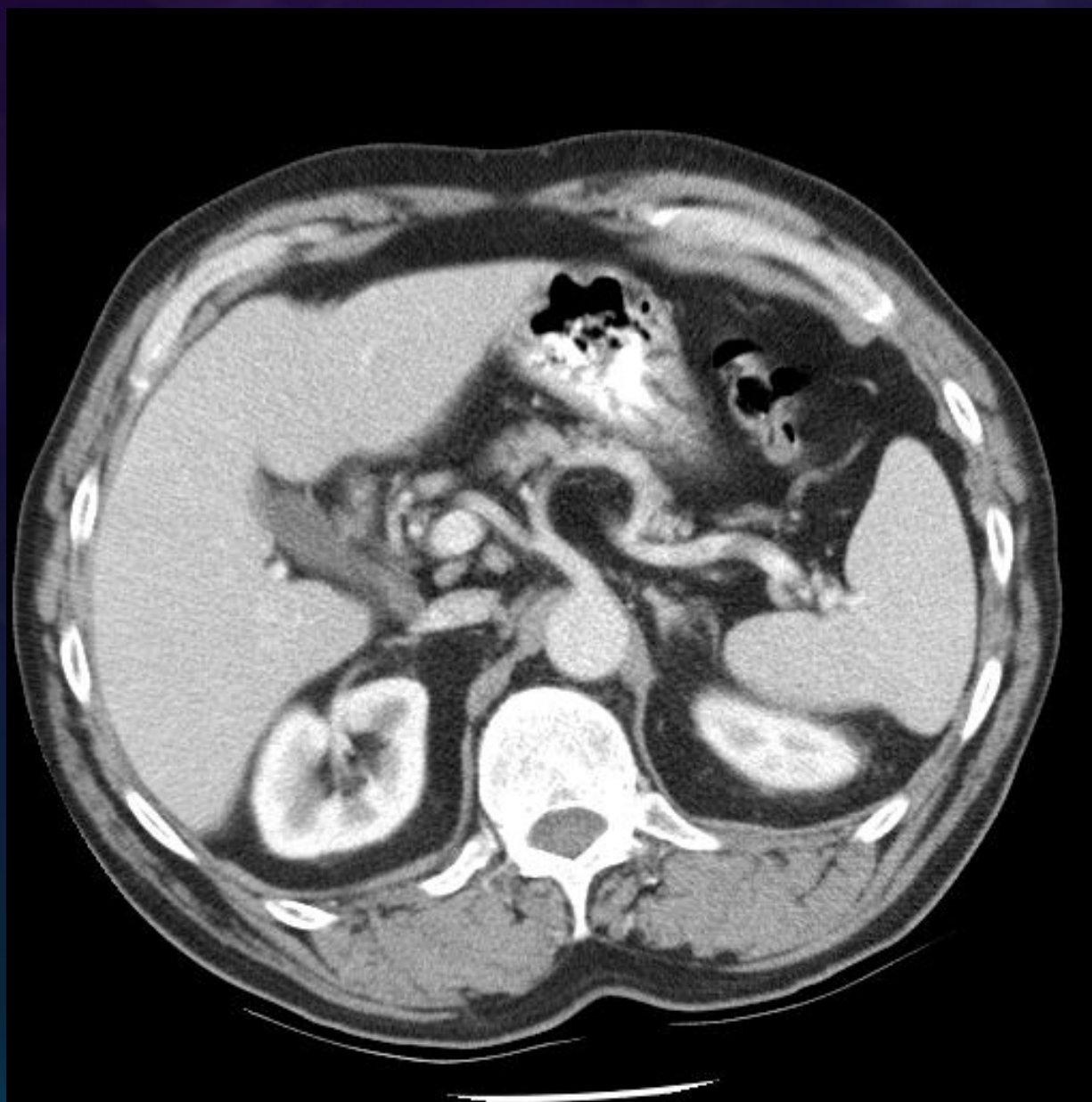




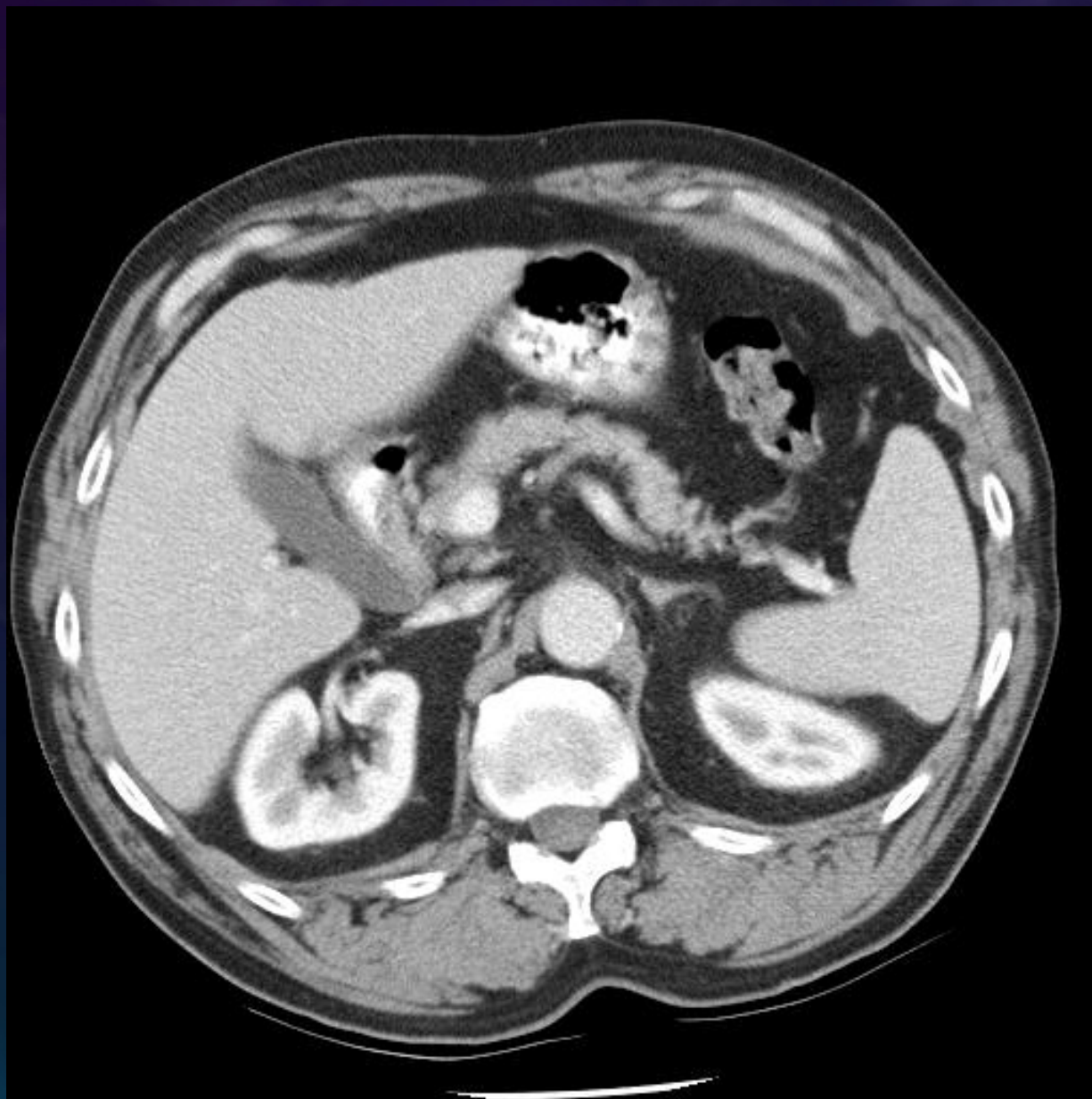


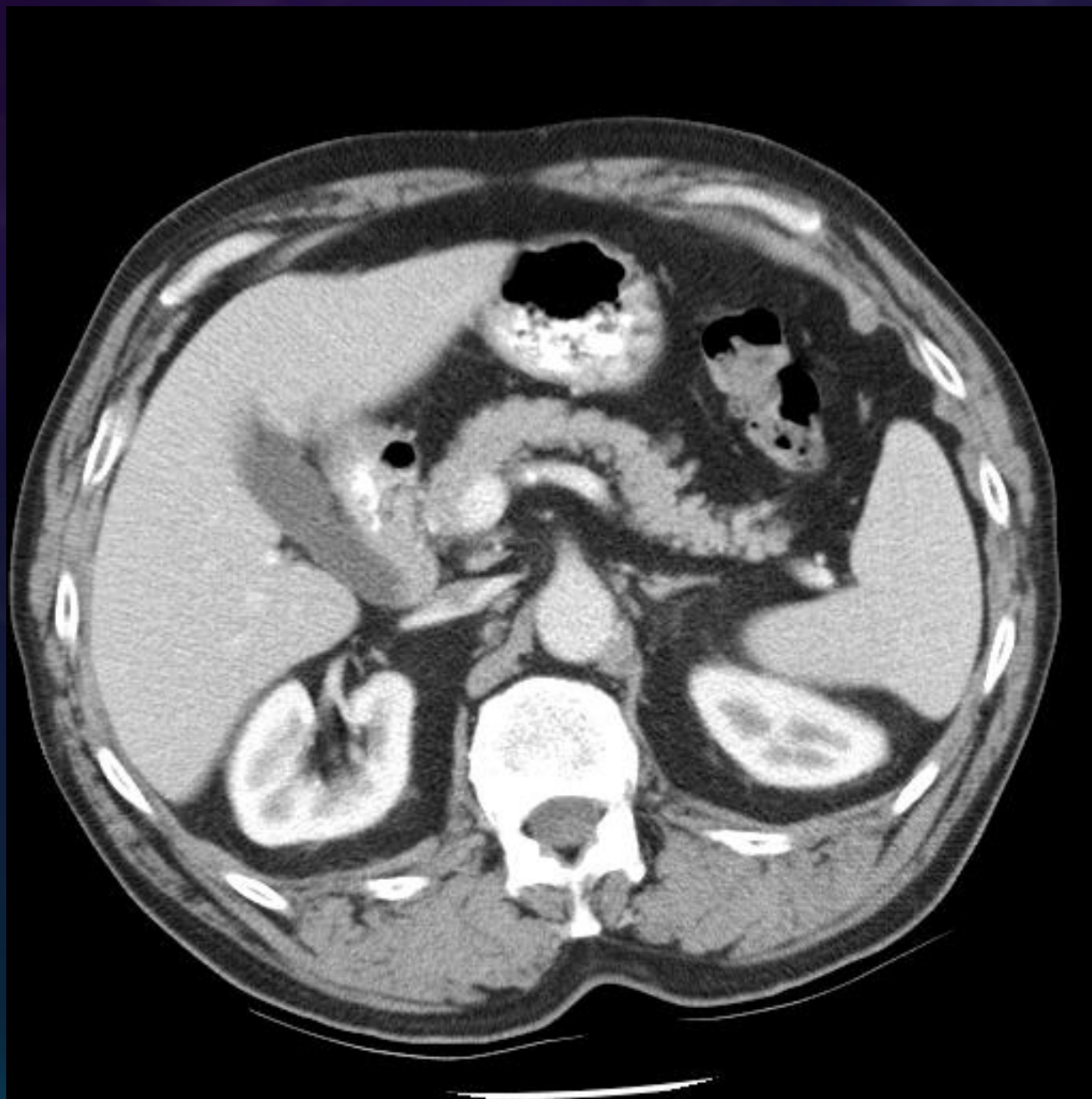




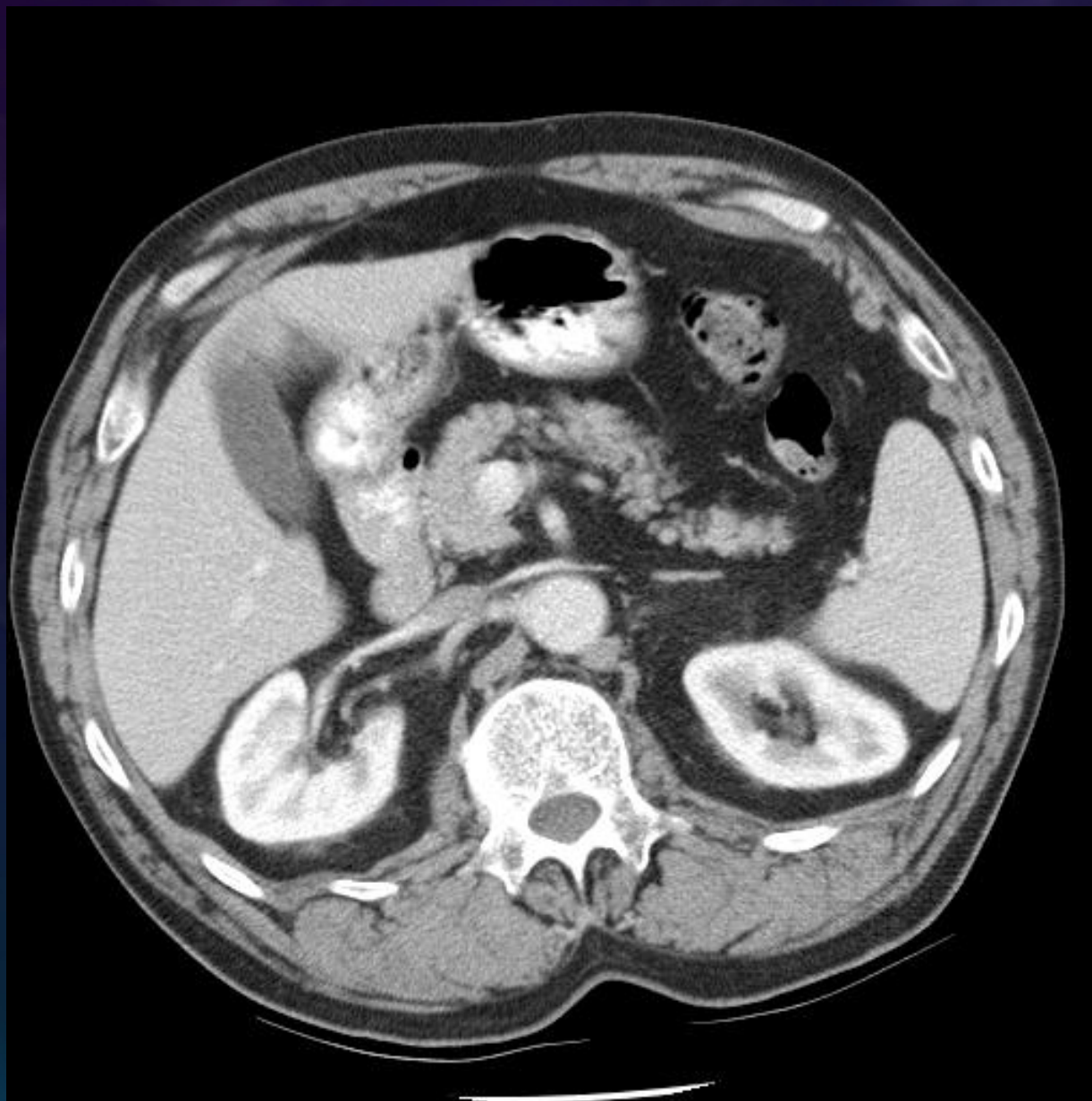


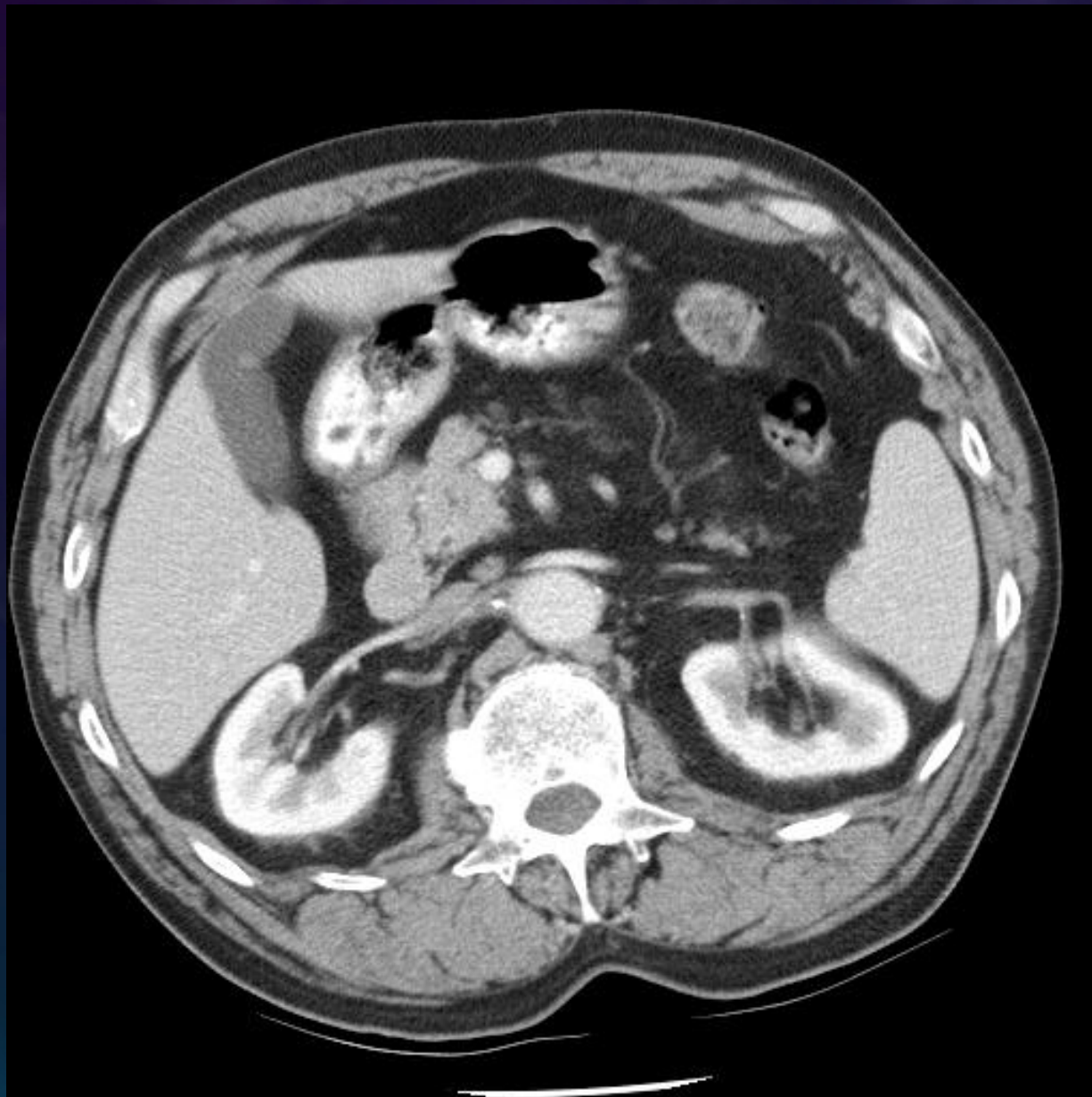


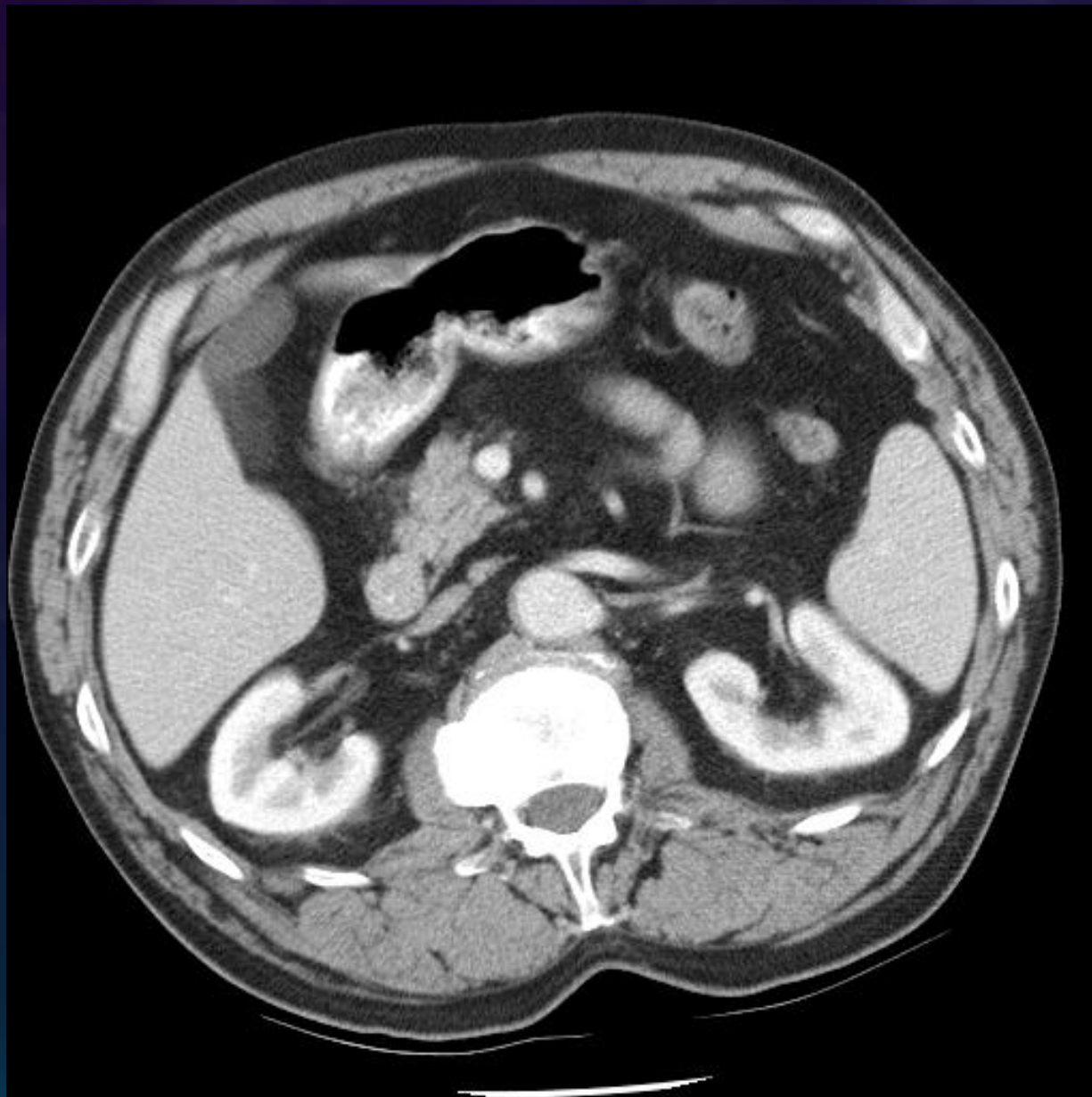


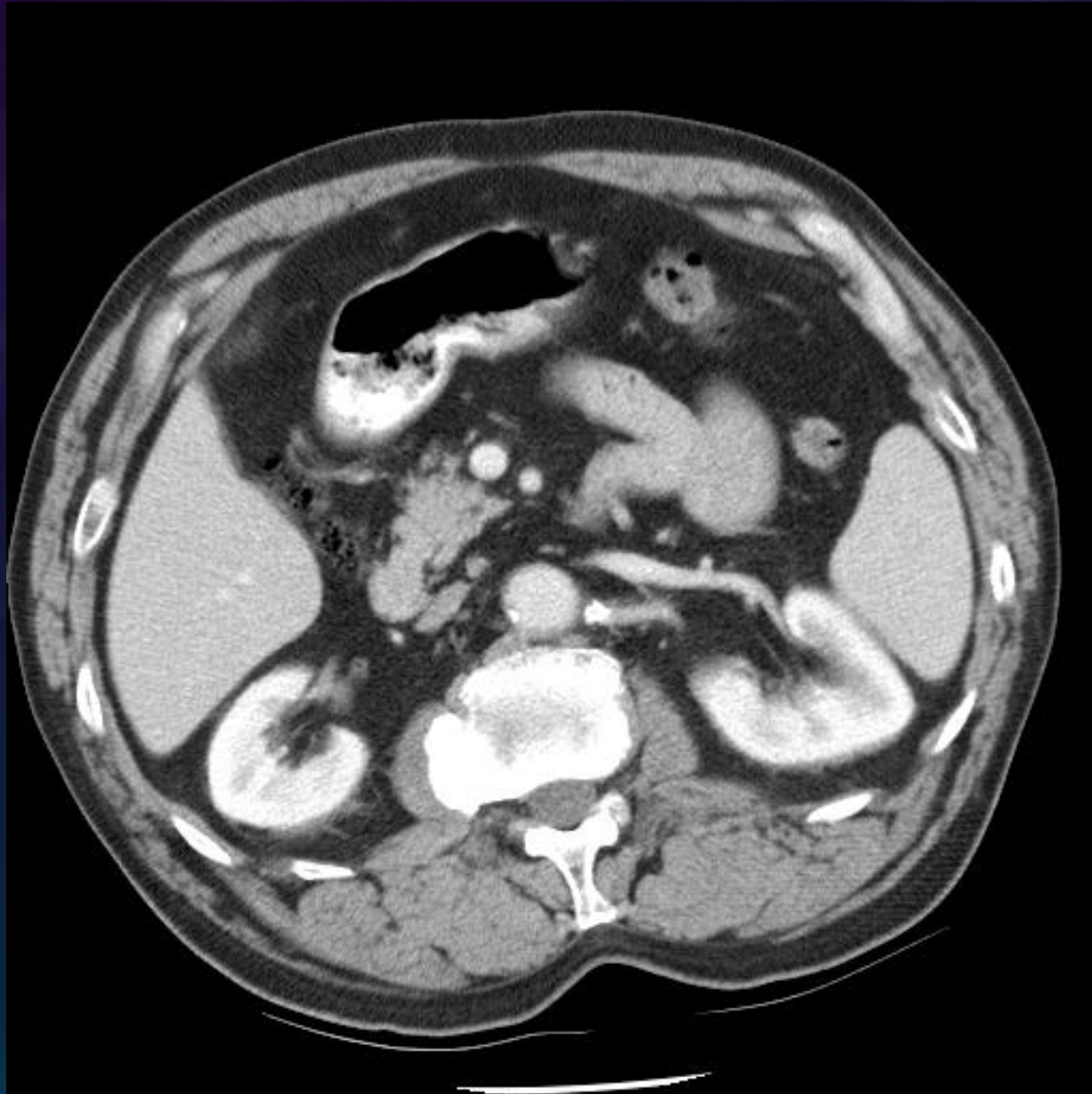








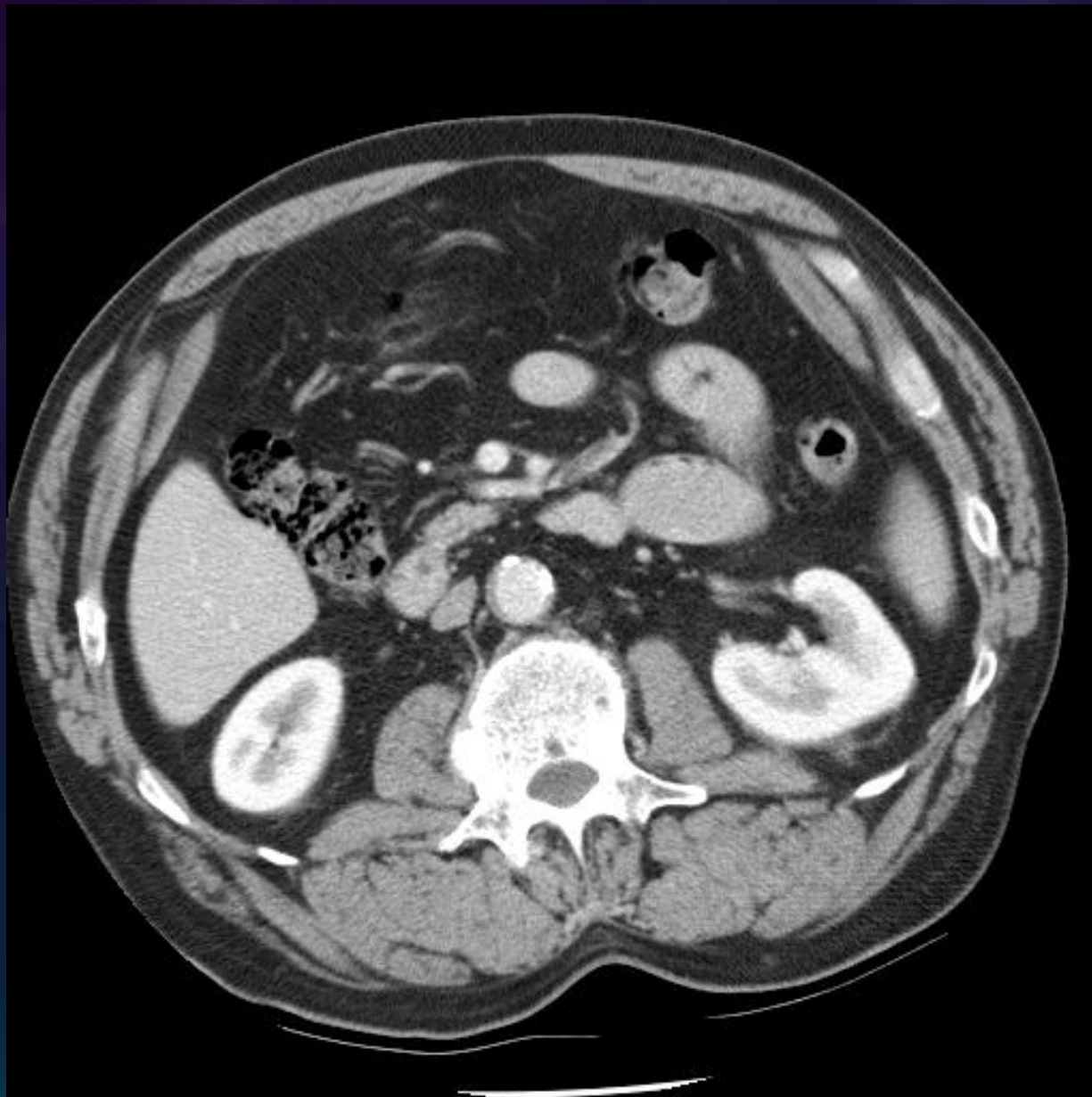




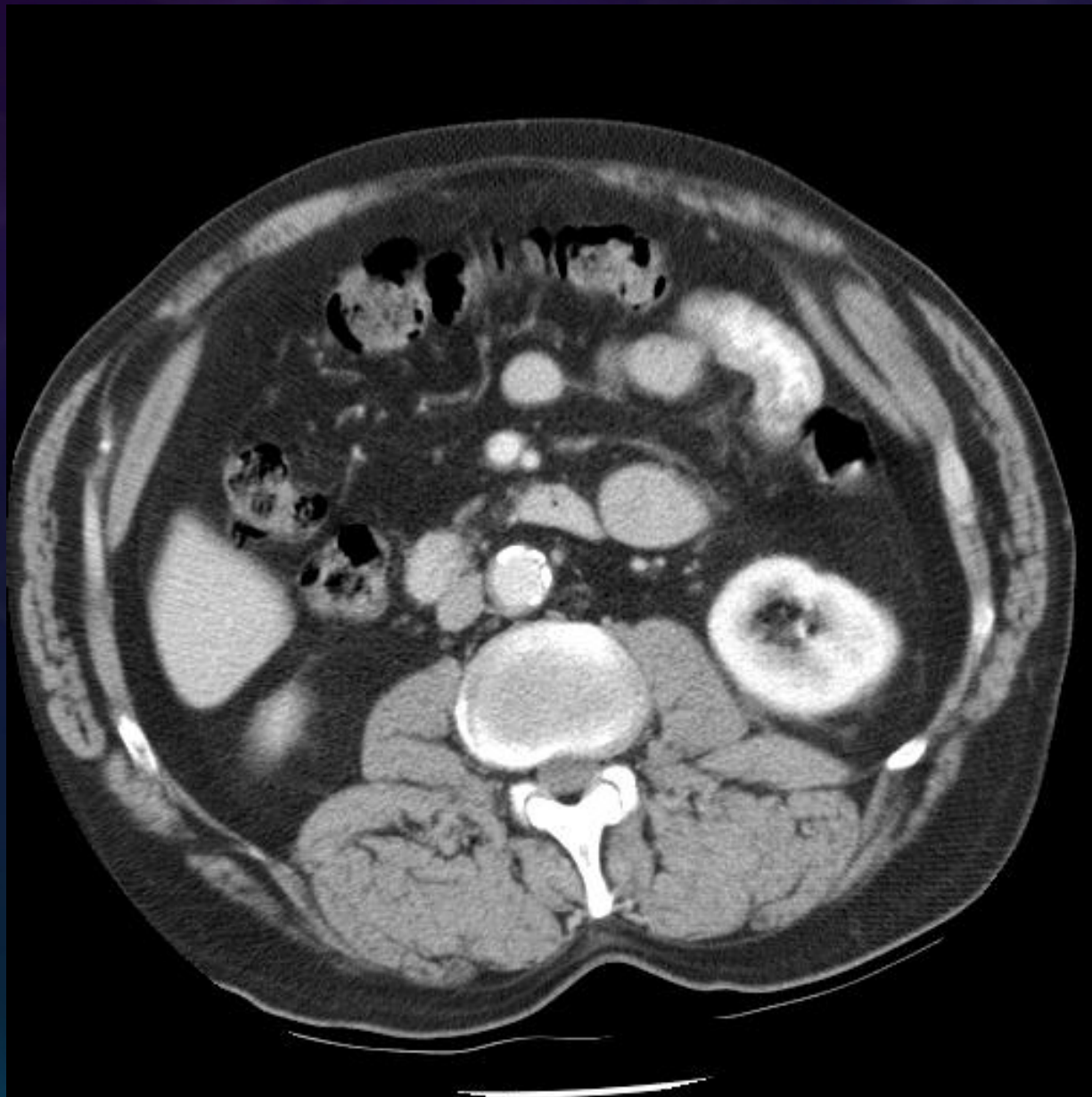












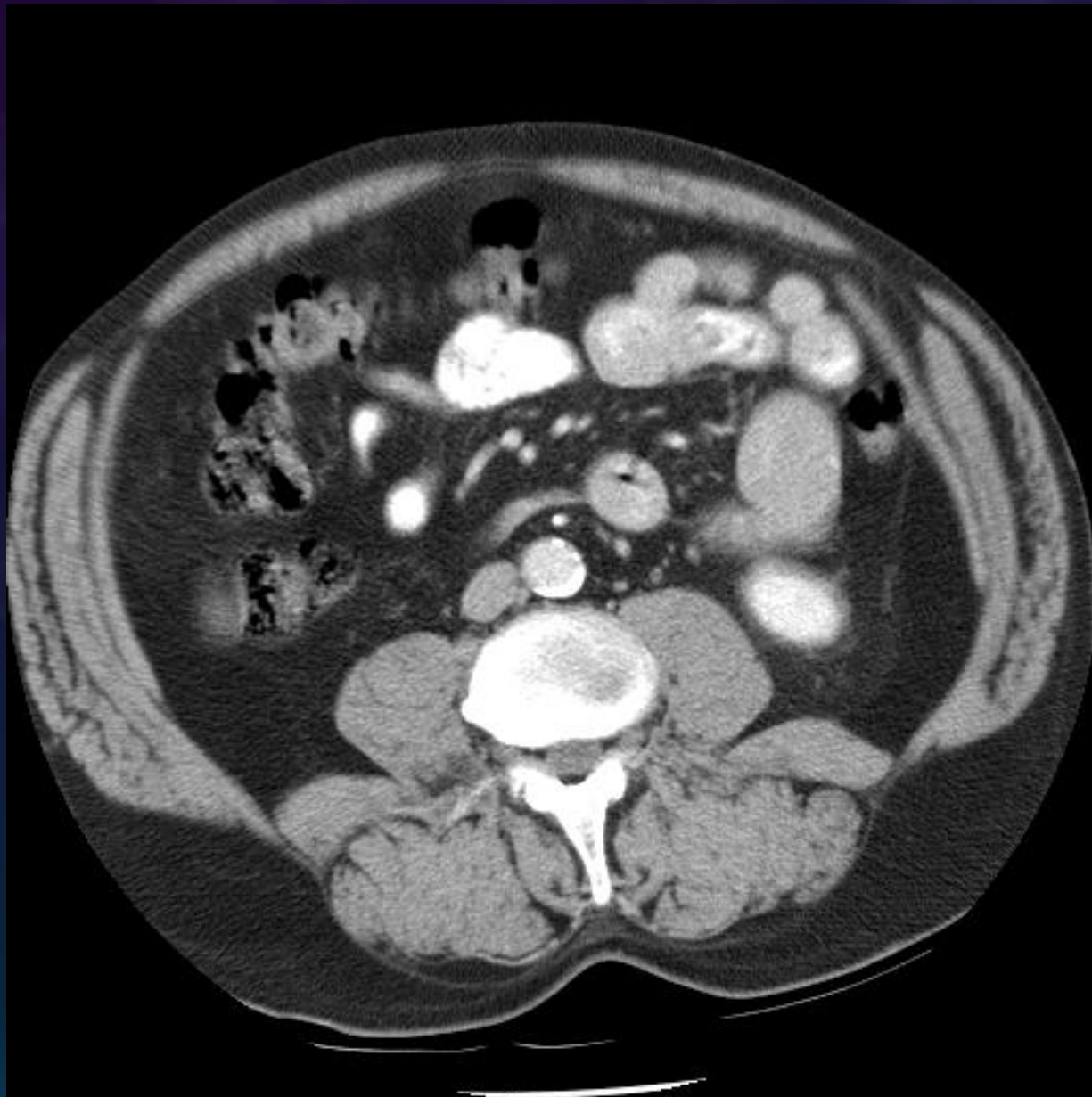


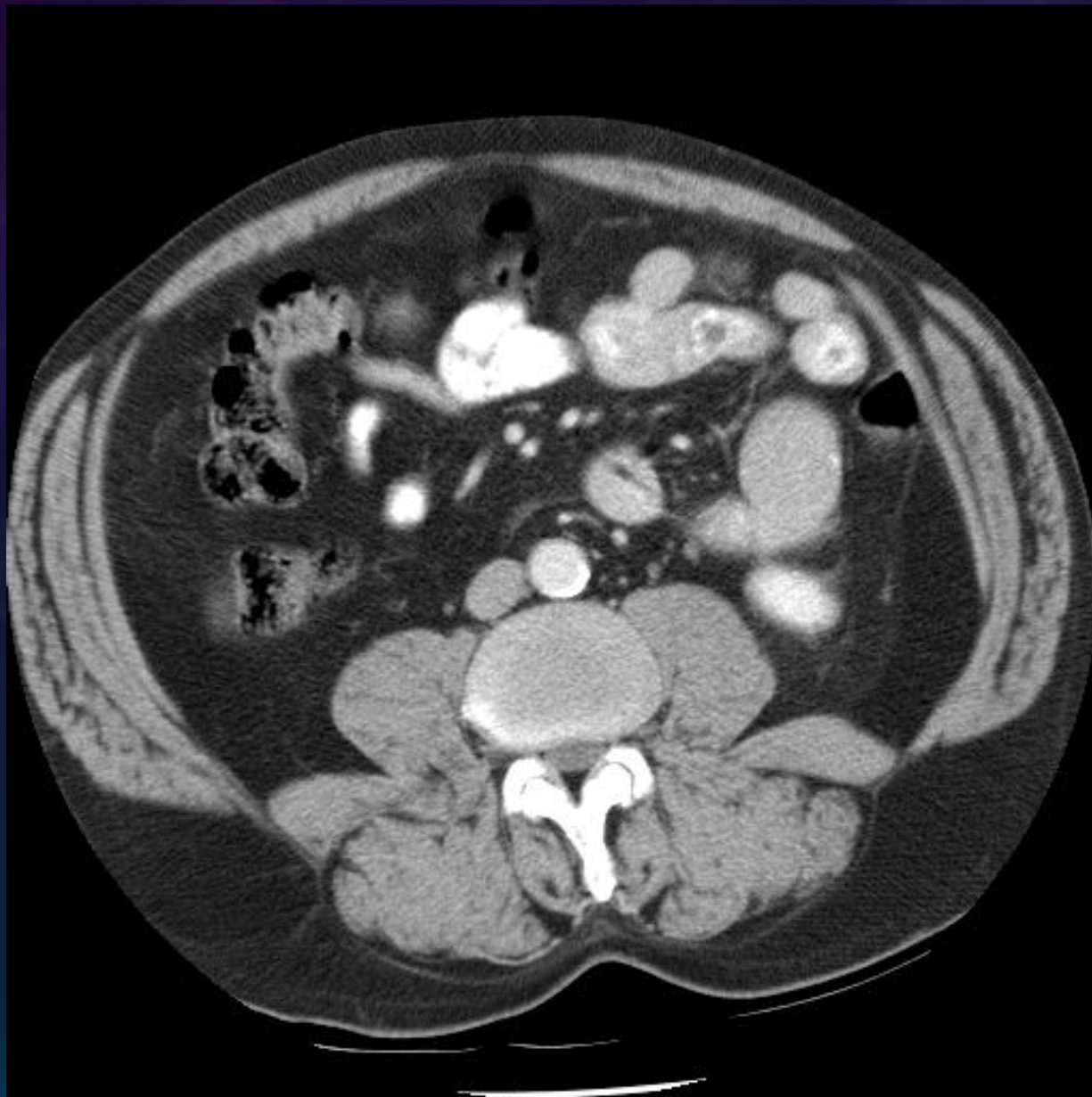






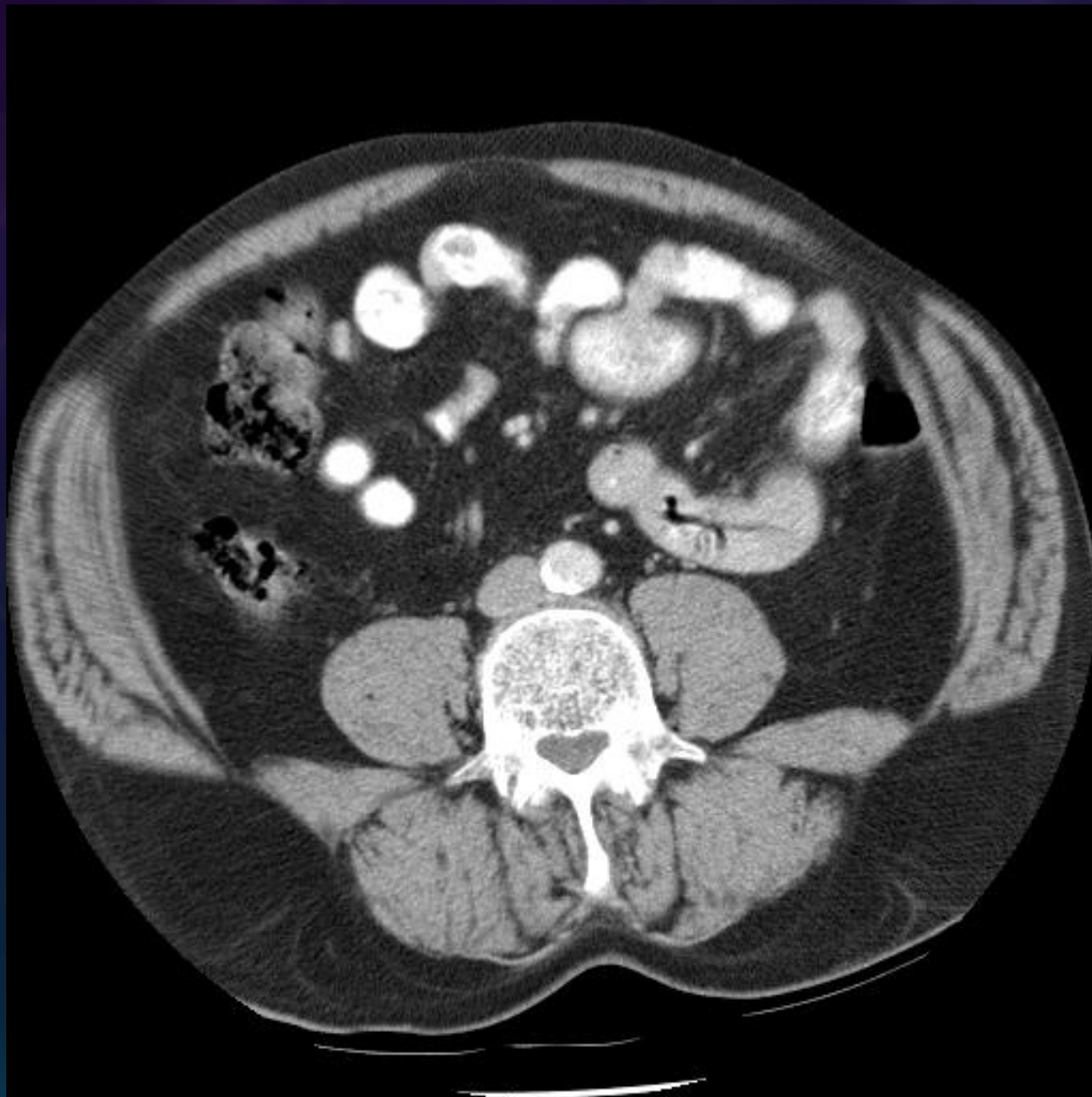












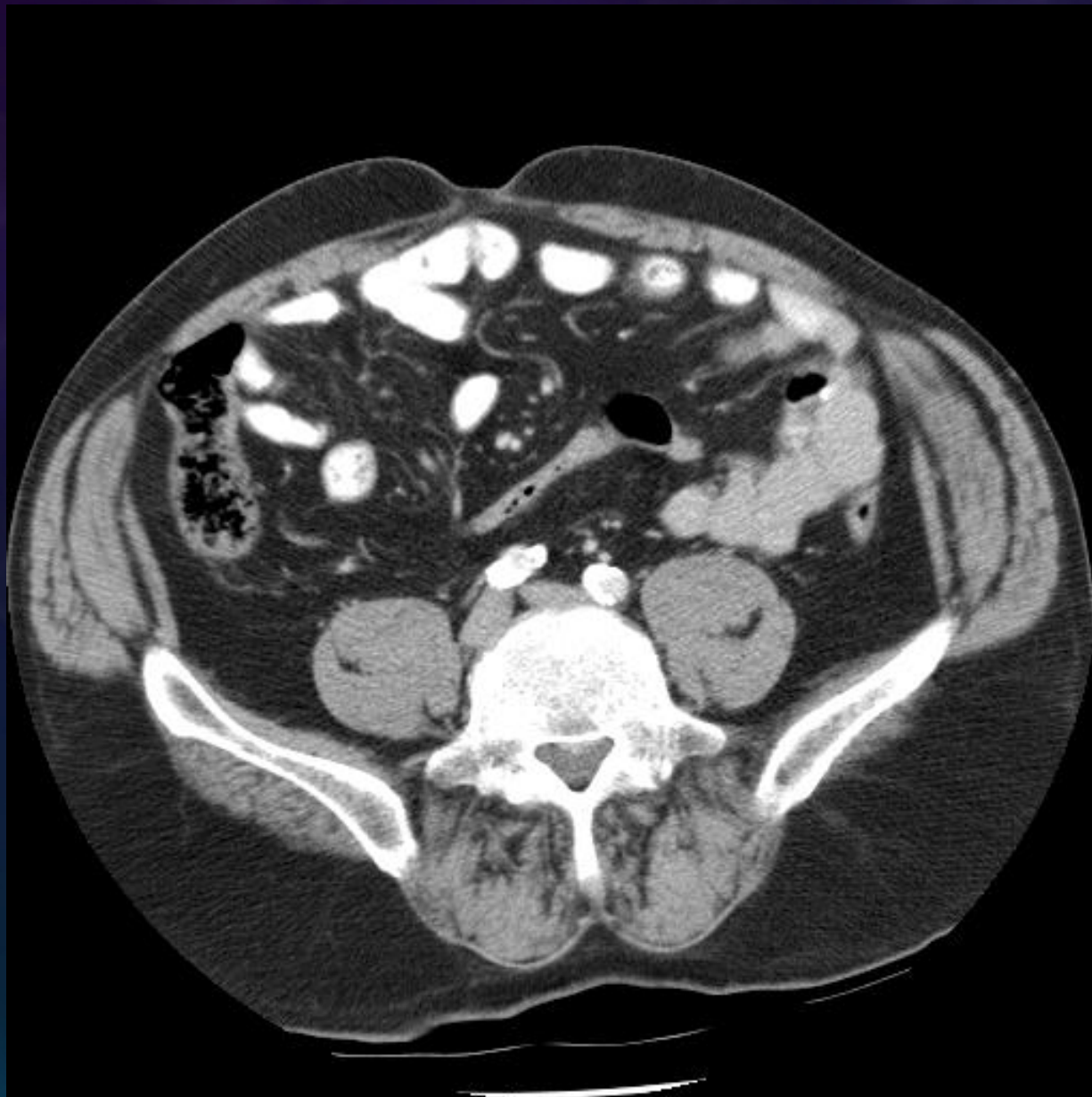
















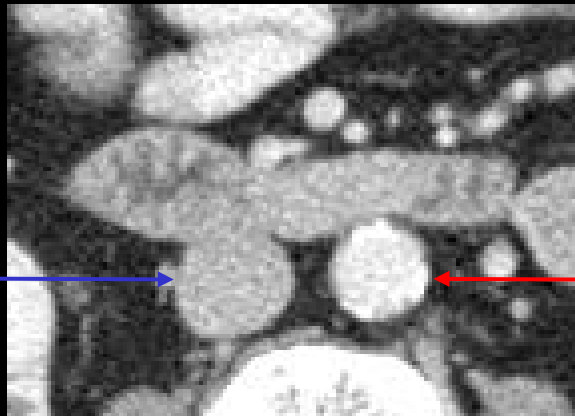




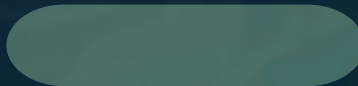
Duodenal Third Part (“D3”)

“SKATEBOARD” appearance!
Arises at approximately L3 level

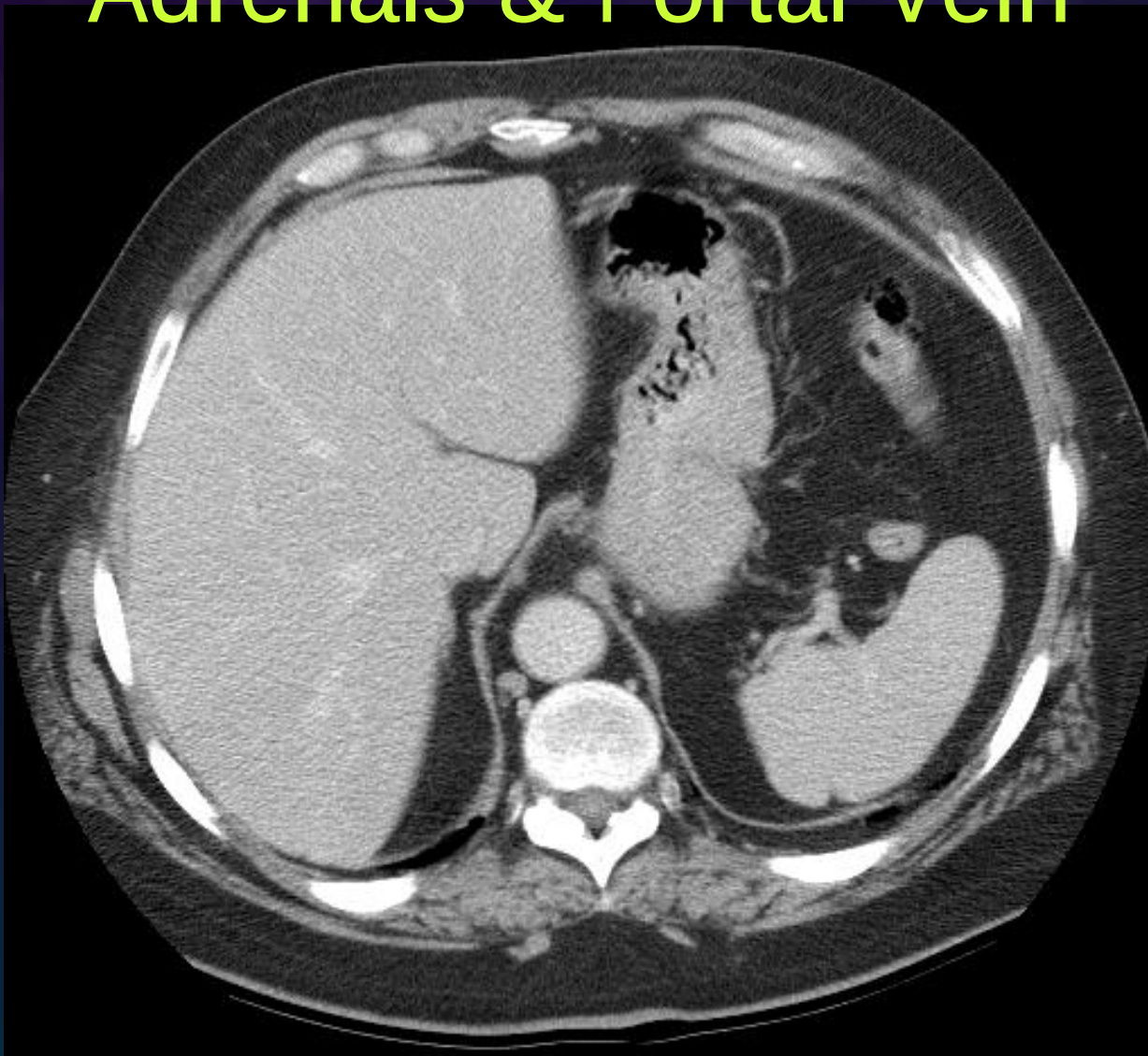
IVC

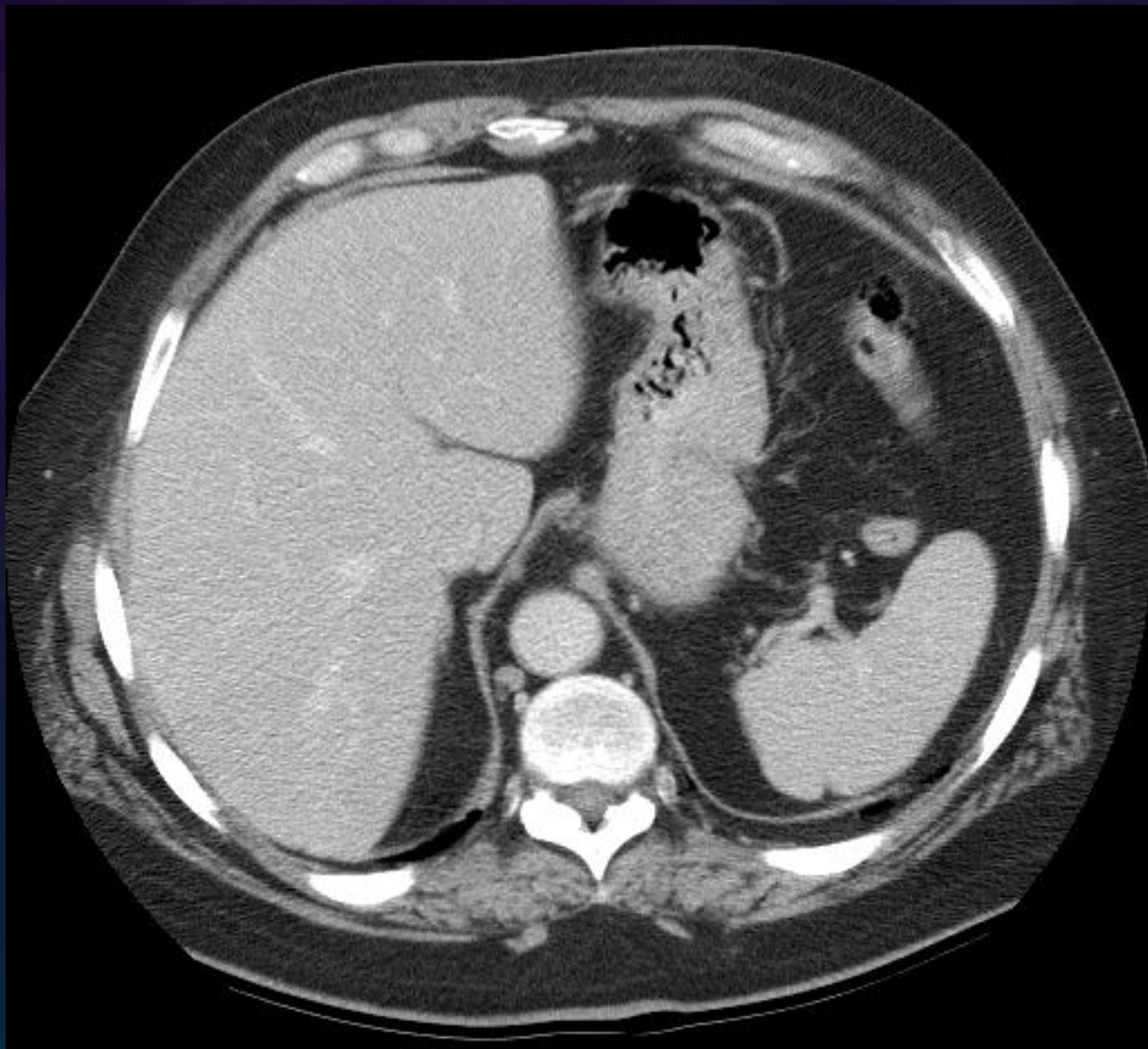


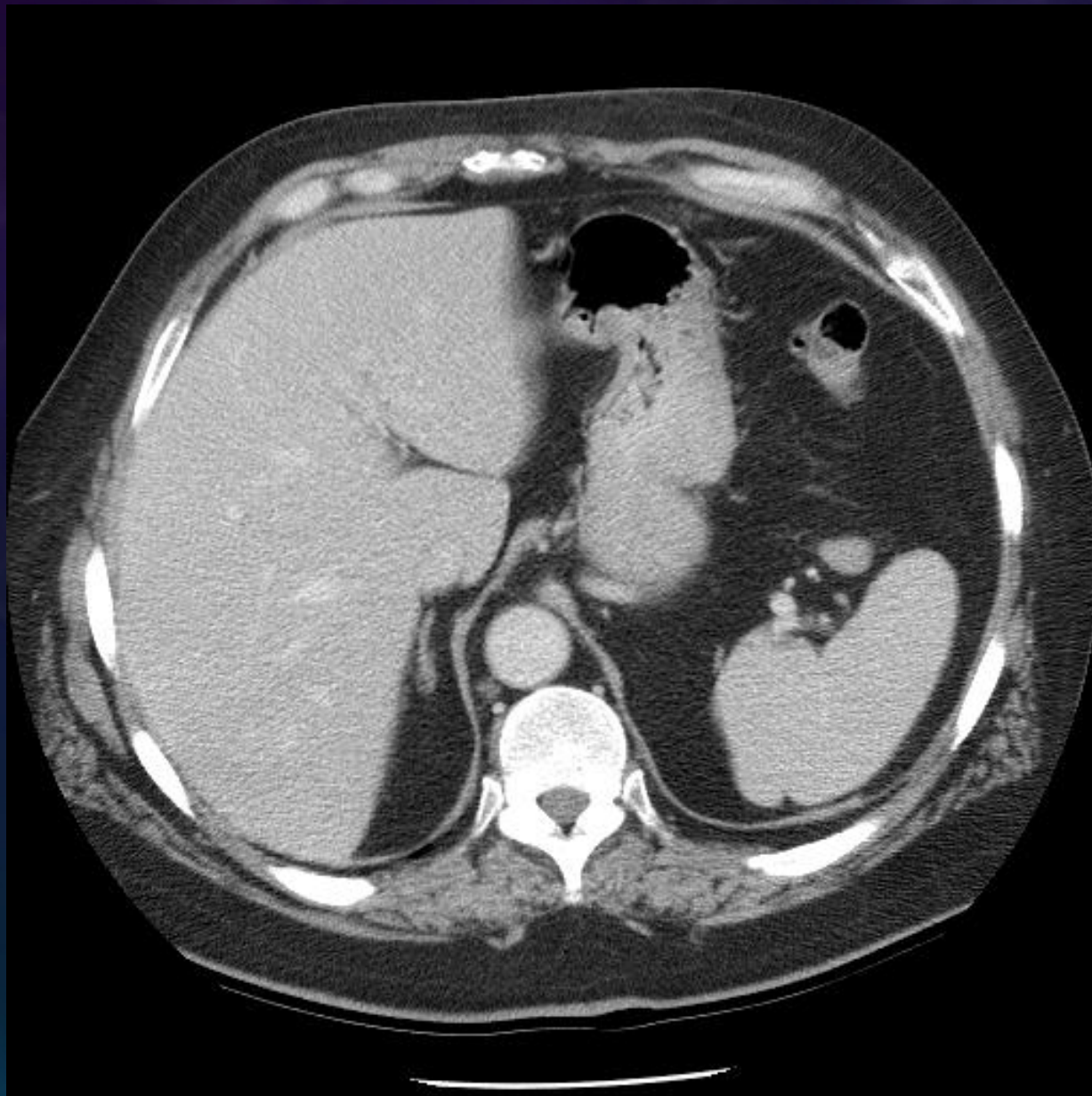
Aorta

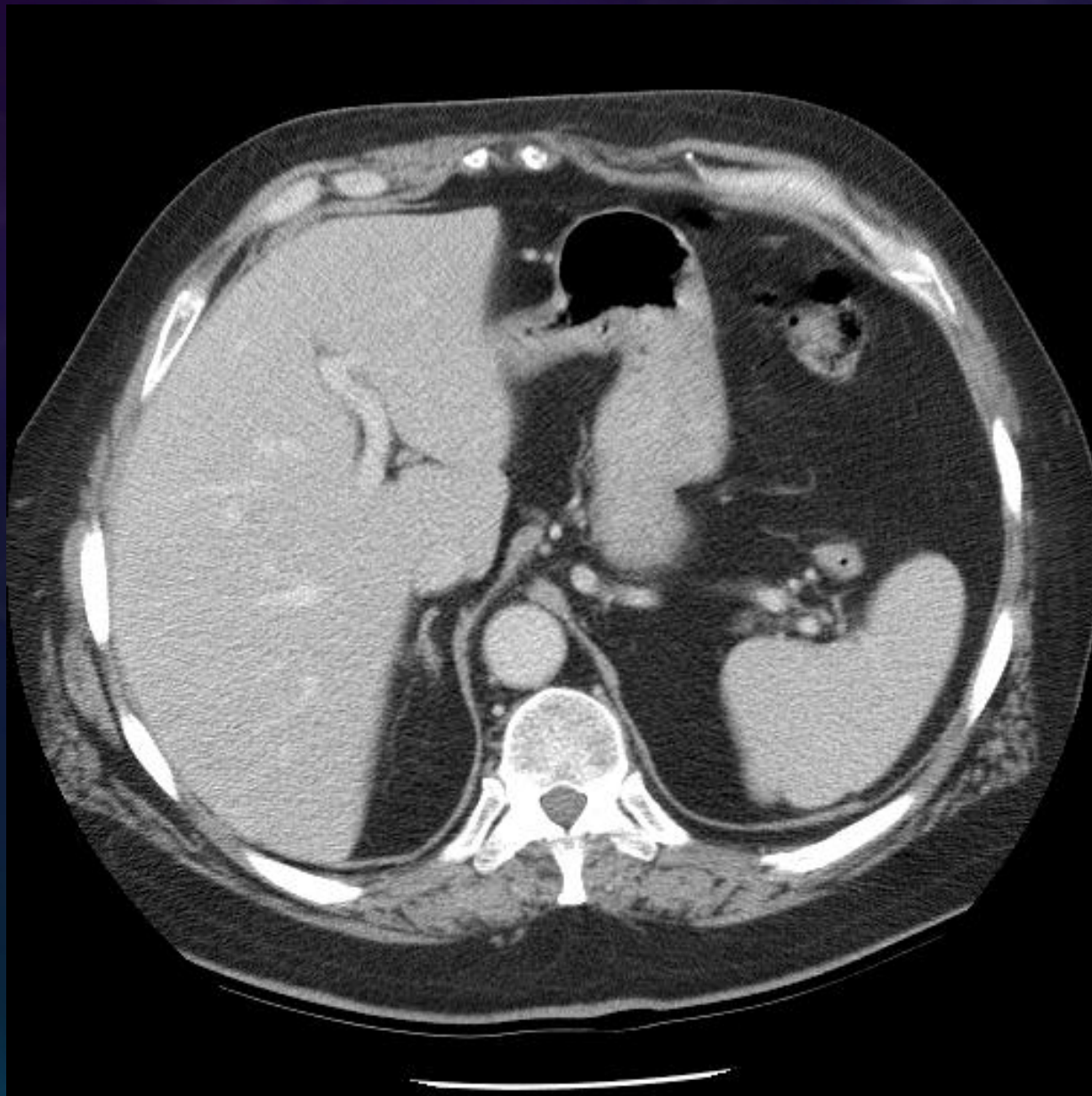


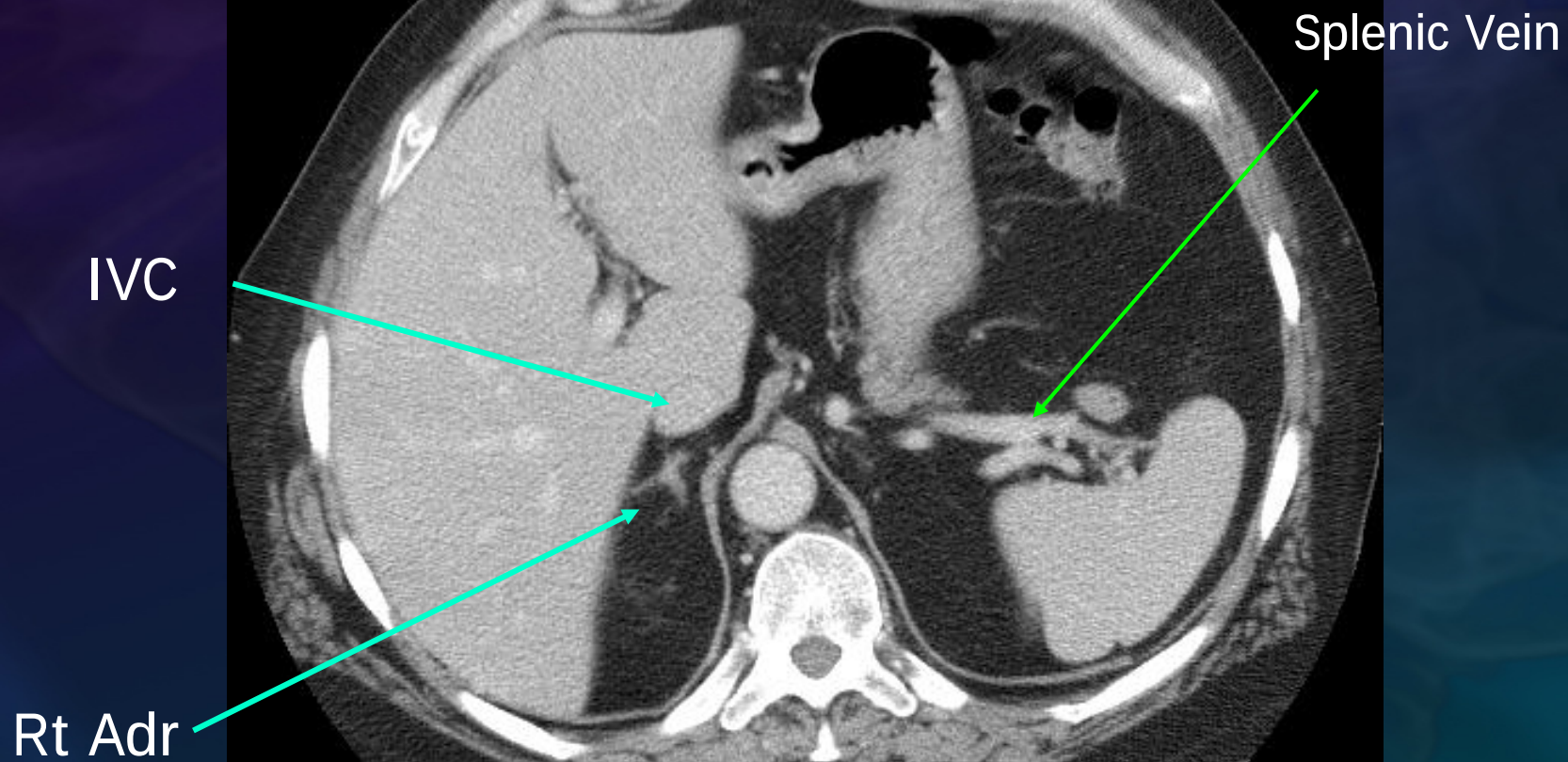
Adrenals & Portal Vein





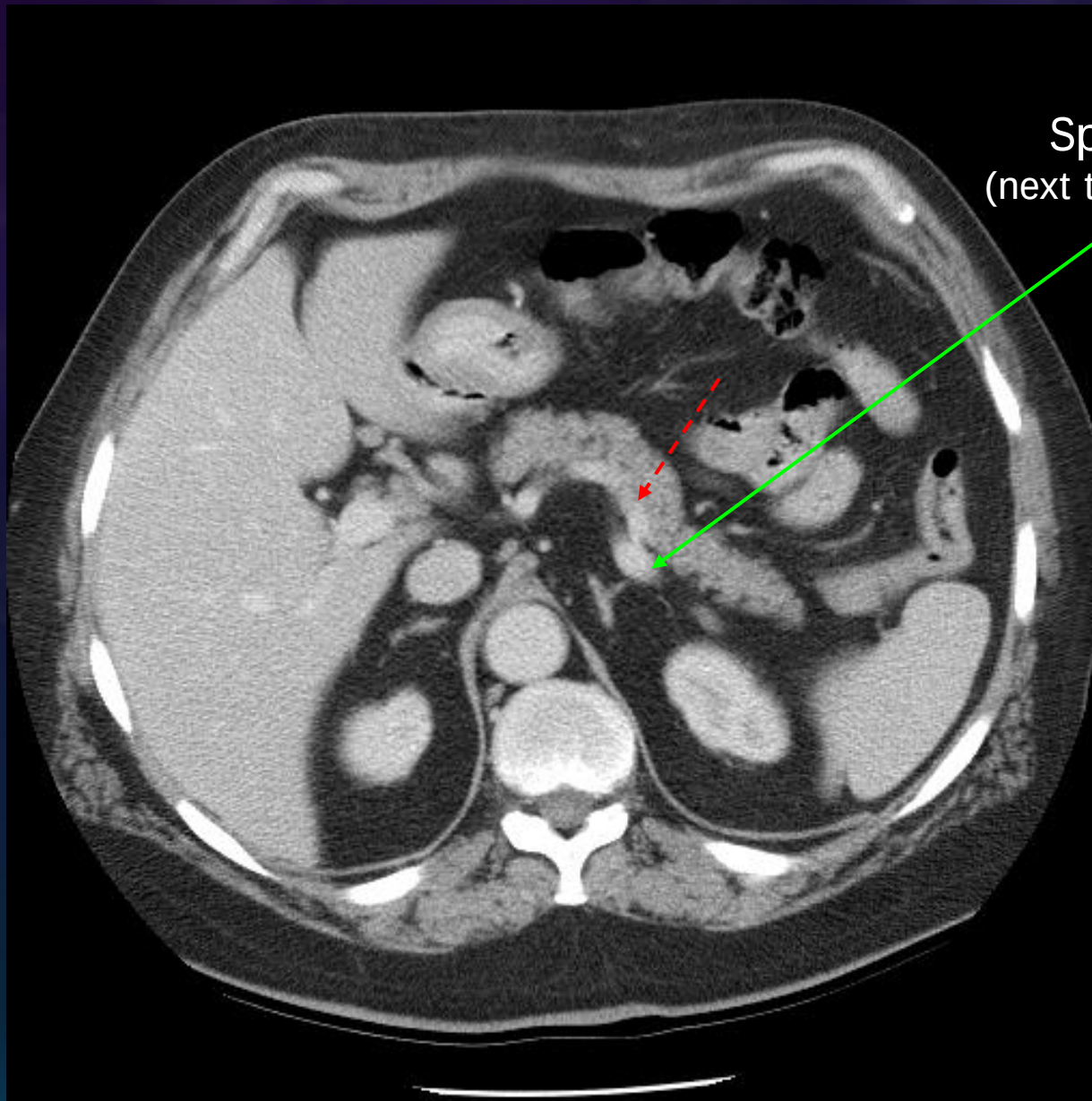




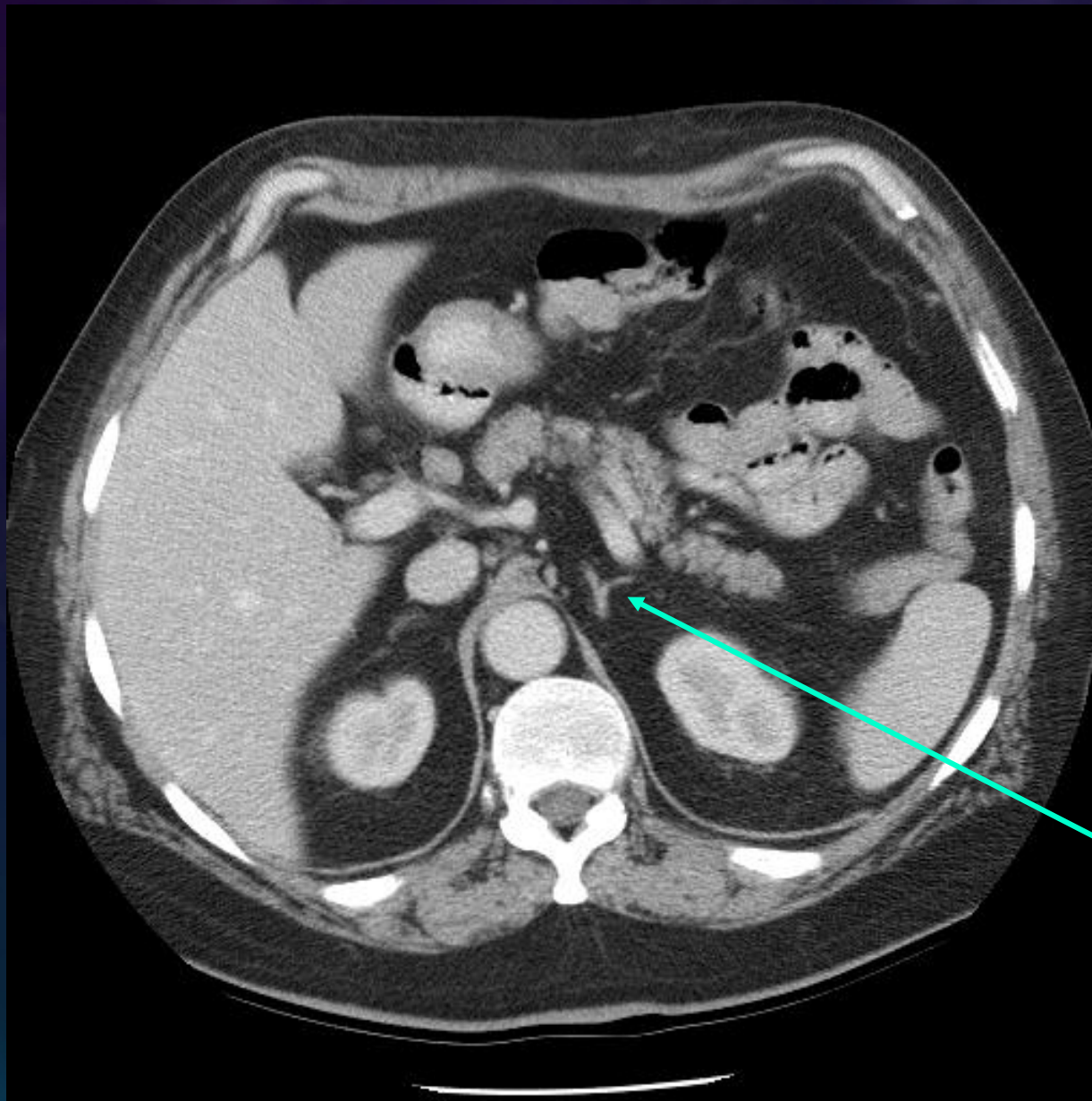






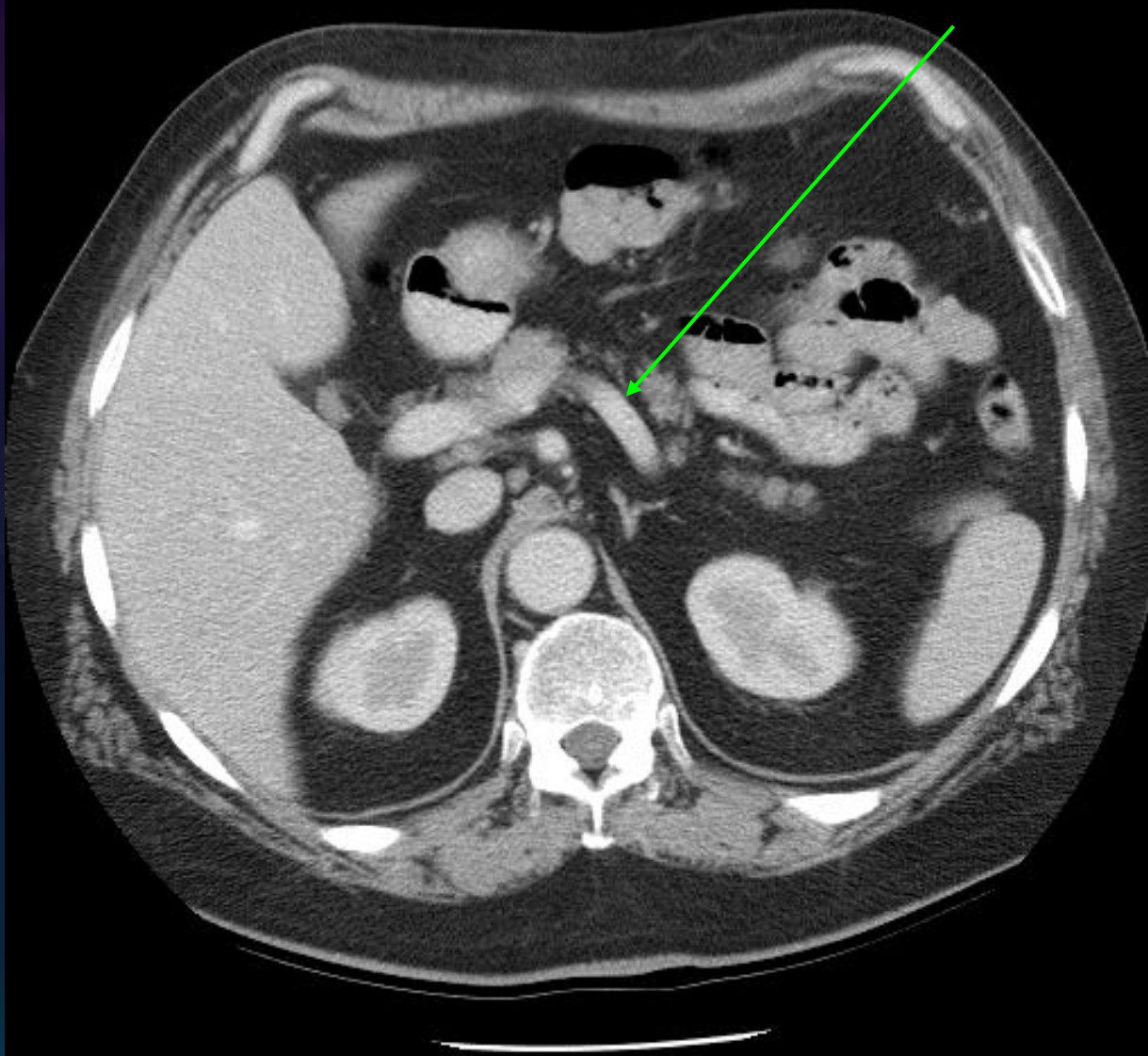


Splenic Vein
(next to splenic artery)

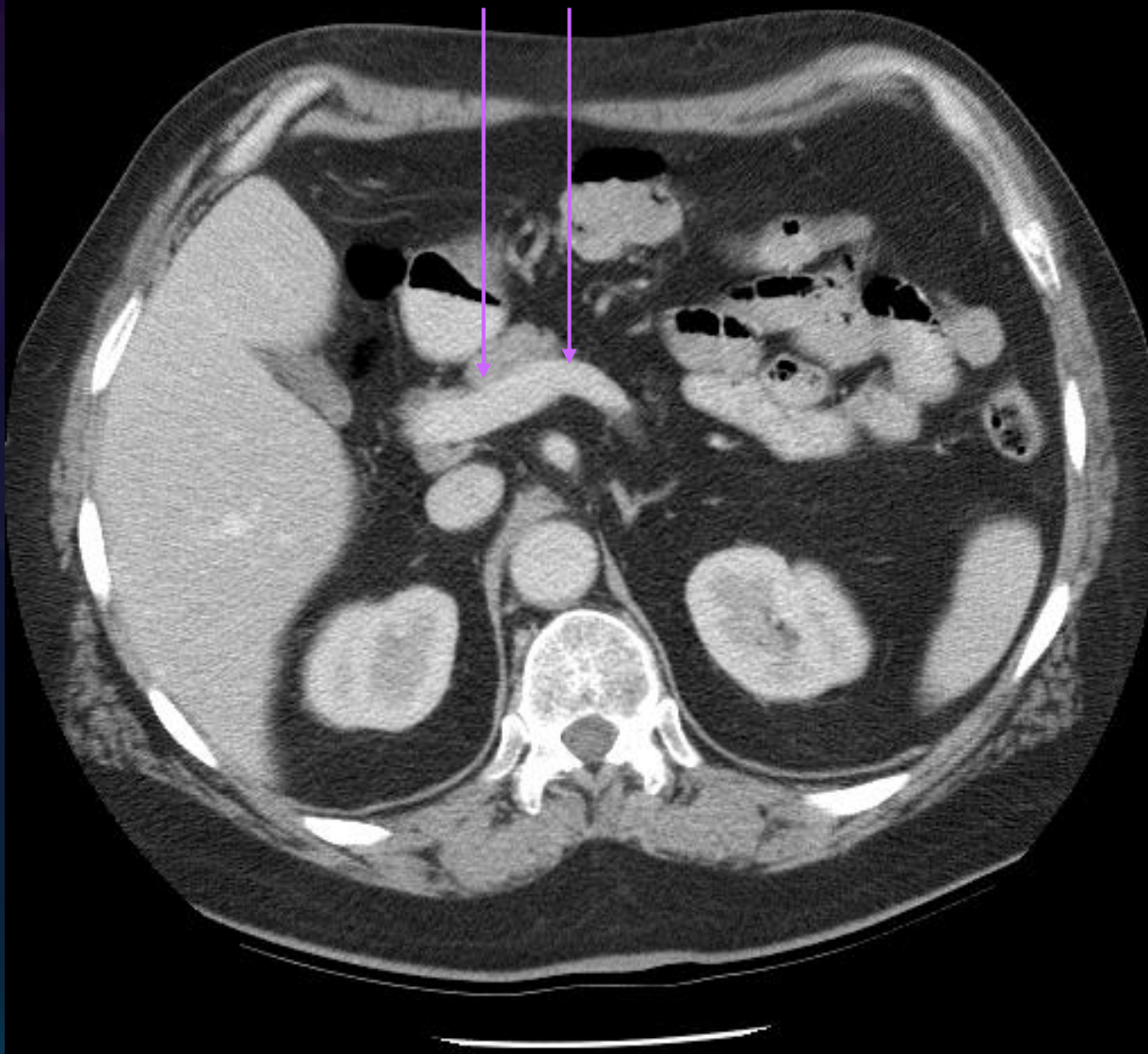


Lt Adr

Splenic Vein



Main Portal Vein



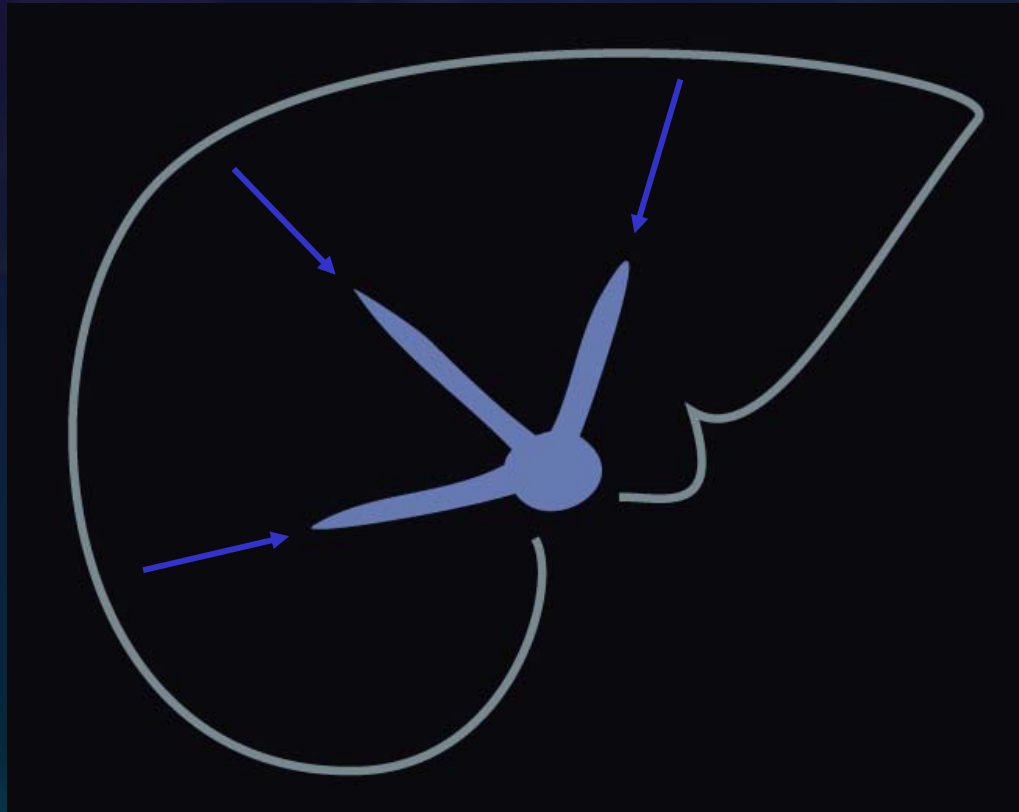


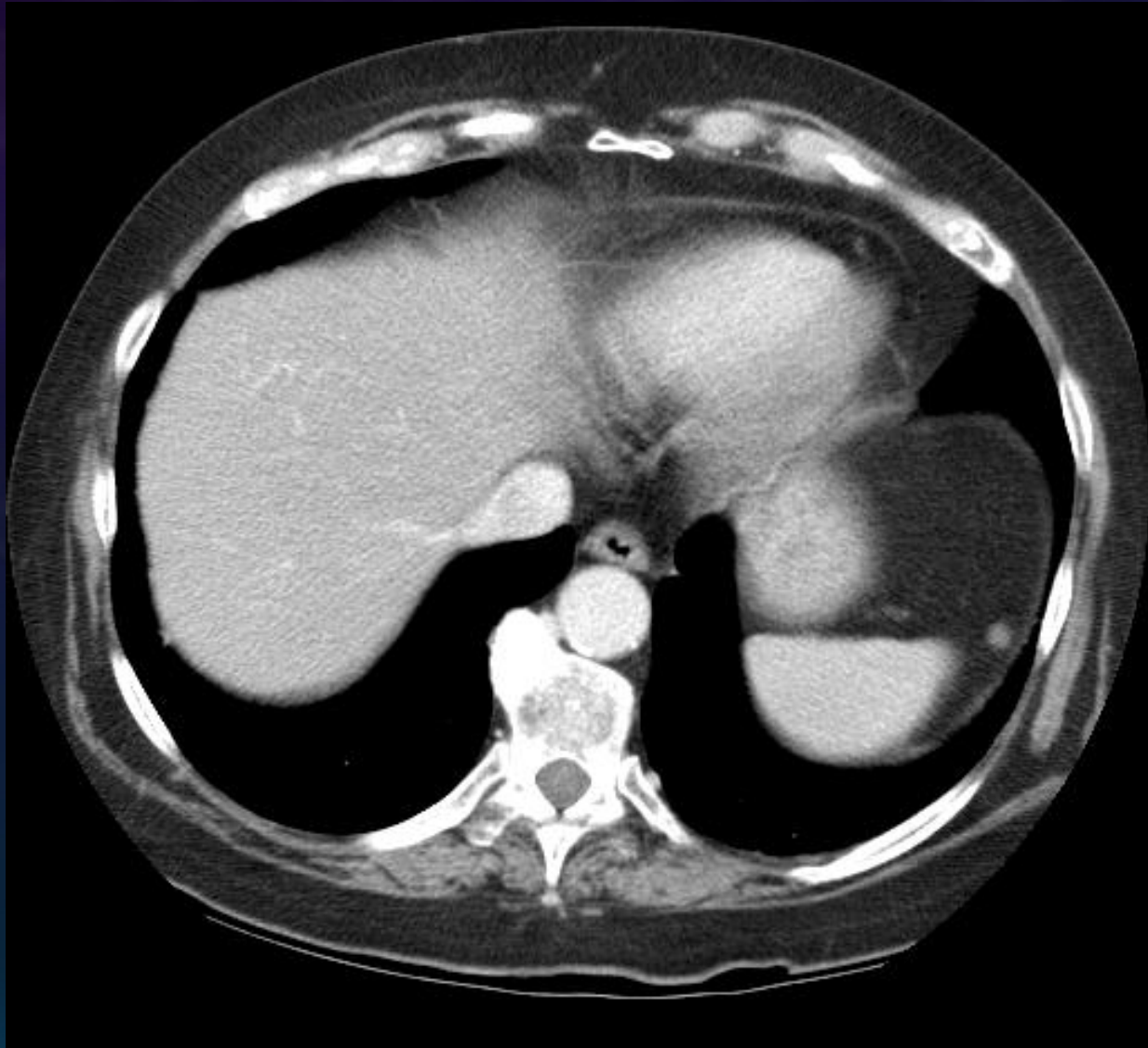


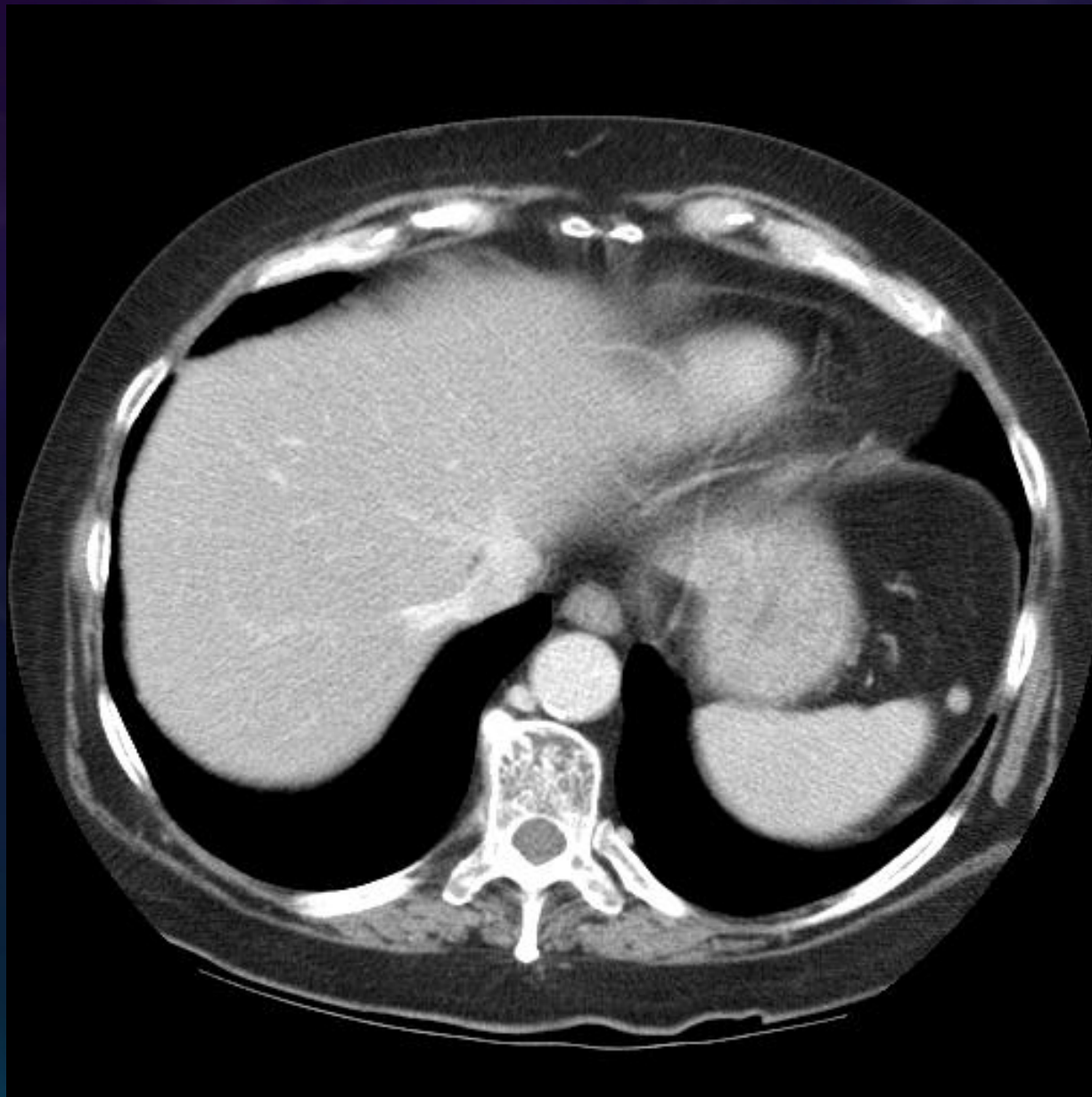


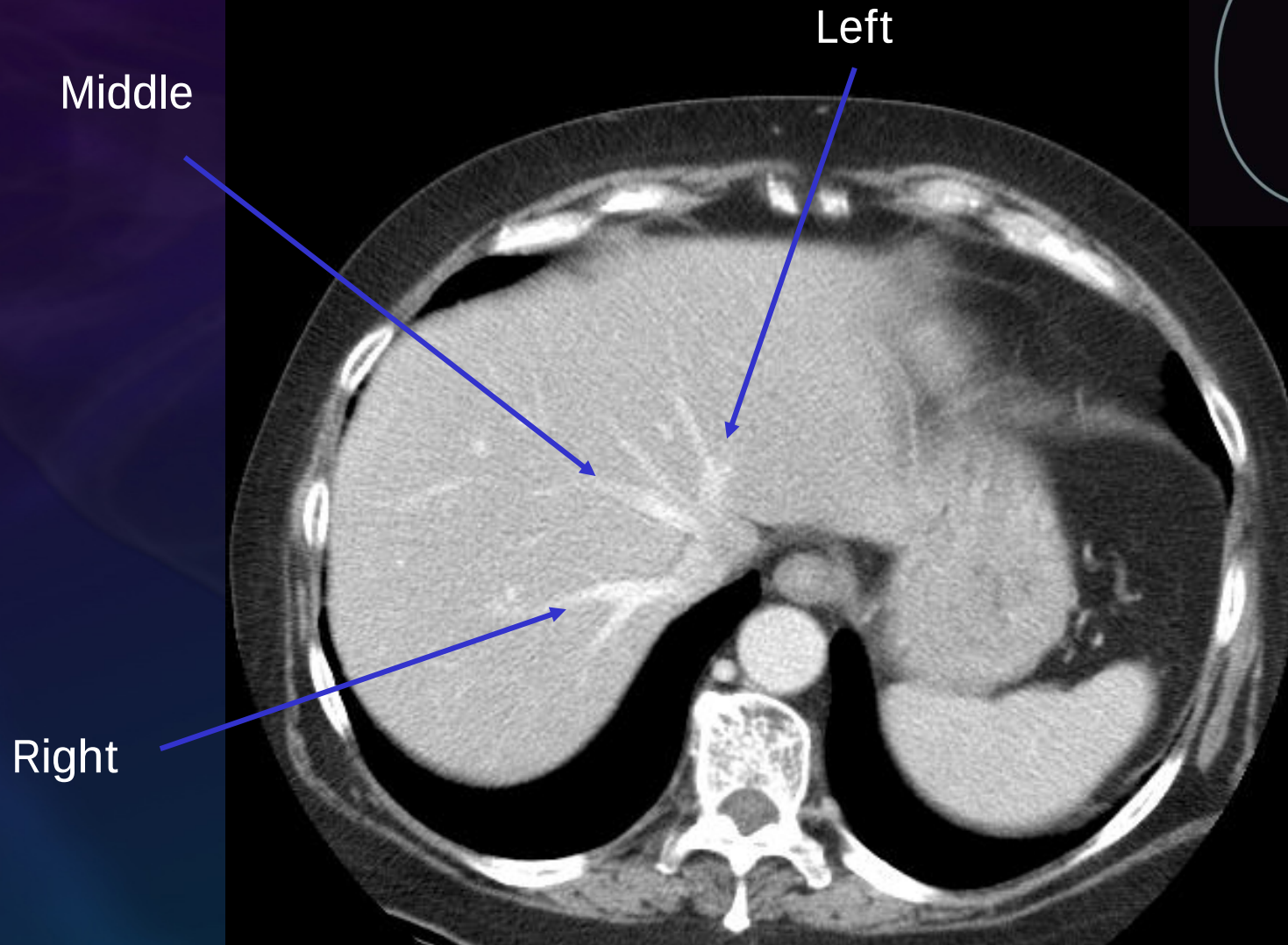
Hepatic Veins

- Only visible following **IV contrast**
- Appearance is highly dependent on the timing of the contrast
- 3 veins drain into the IVC **high** within the liver, near the diaphragm







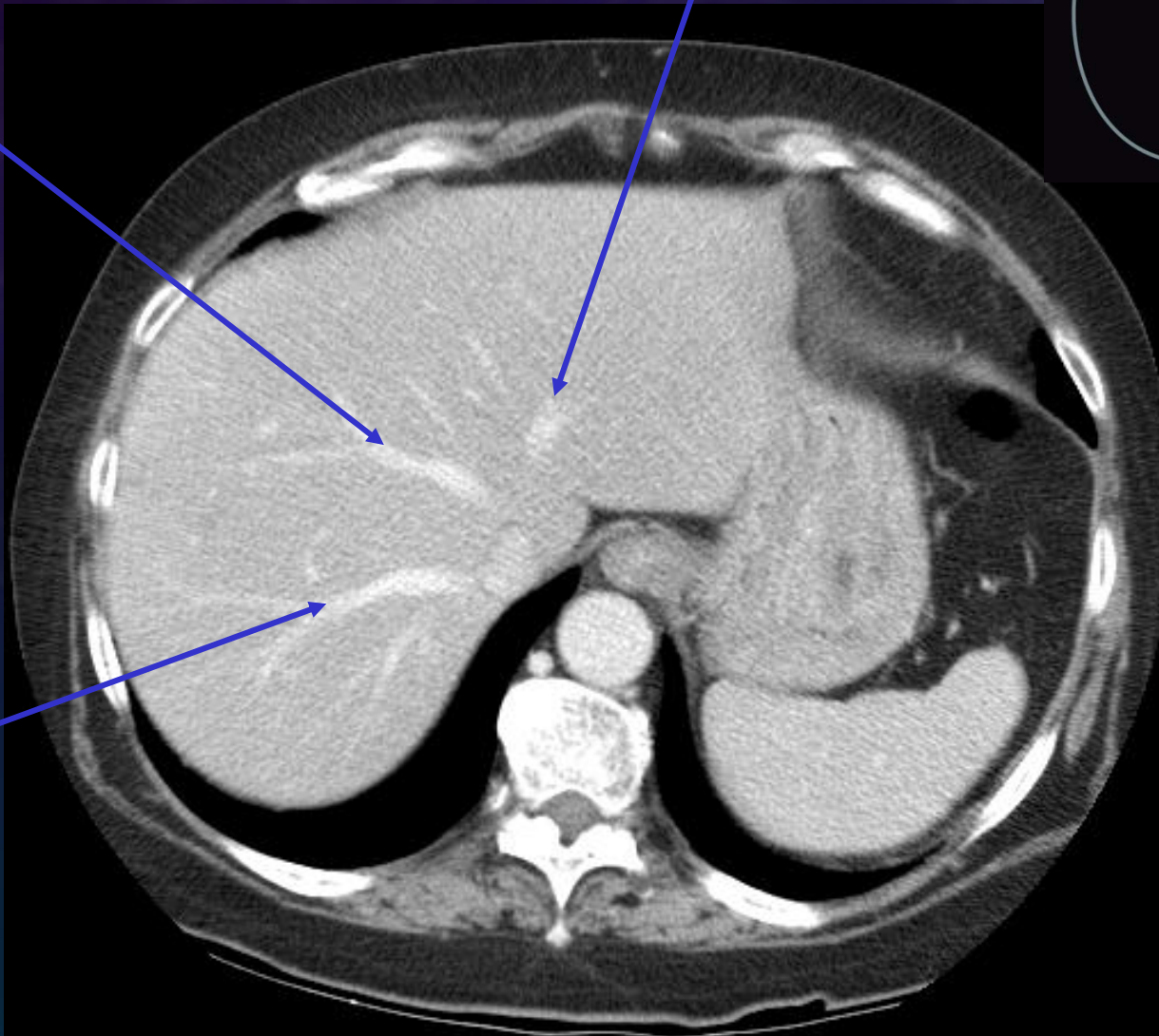


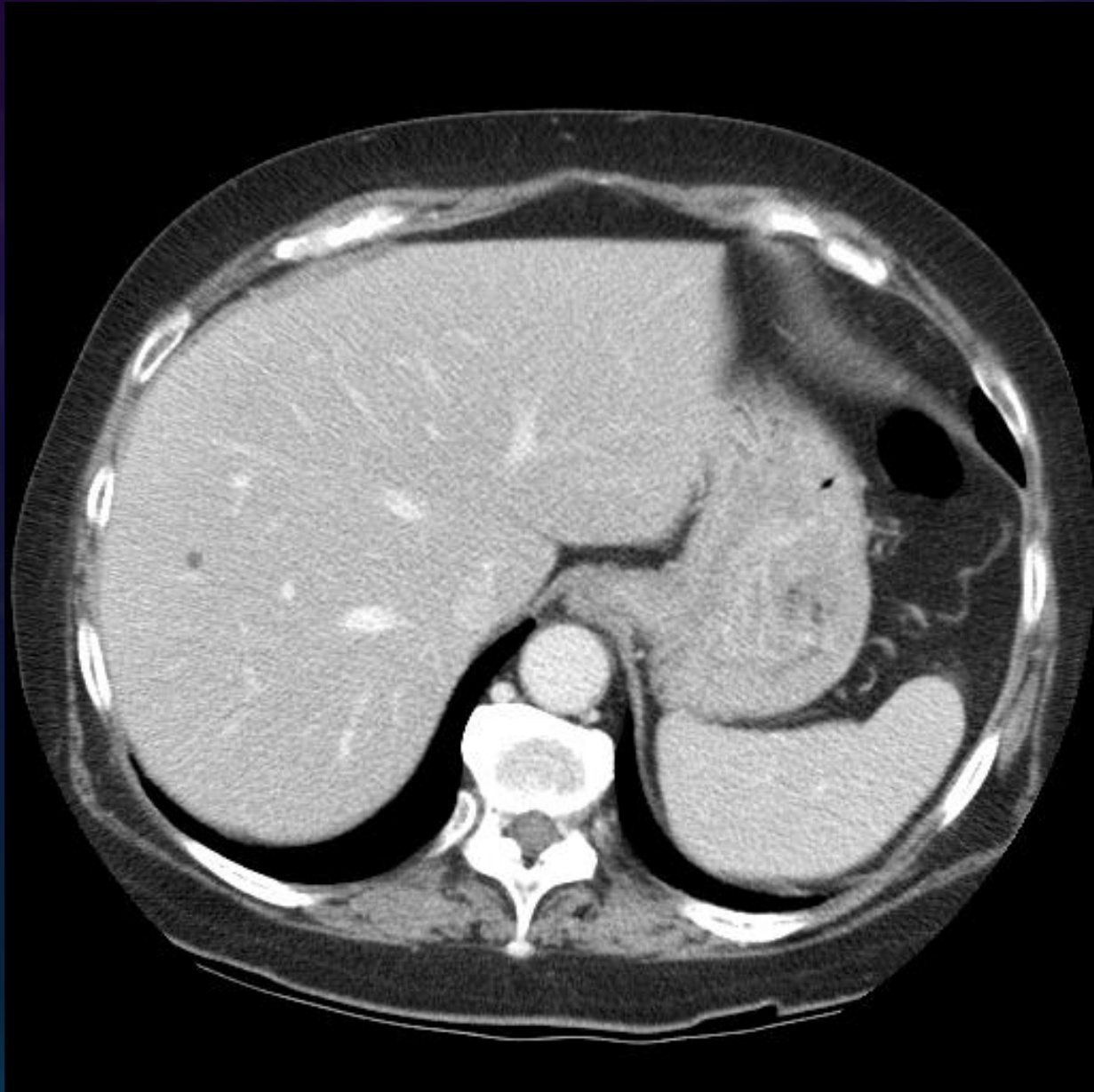
Hepatic Veins x 3

Left

Middle

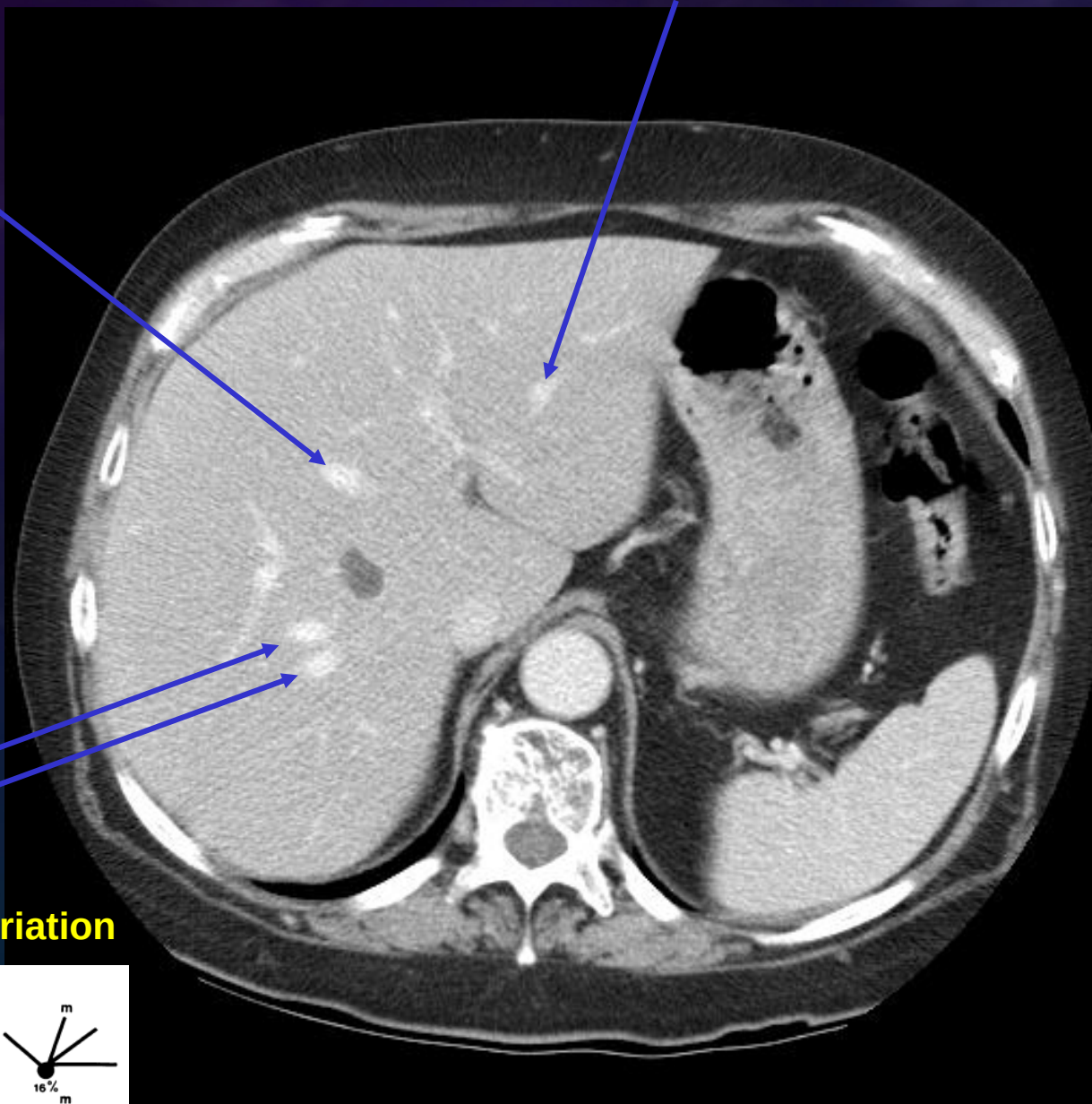
Right



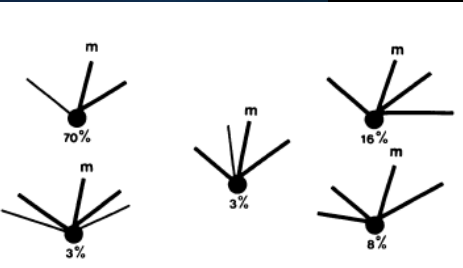




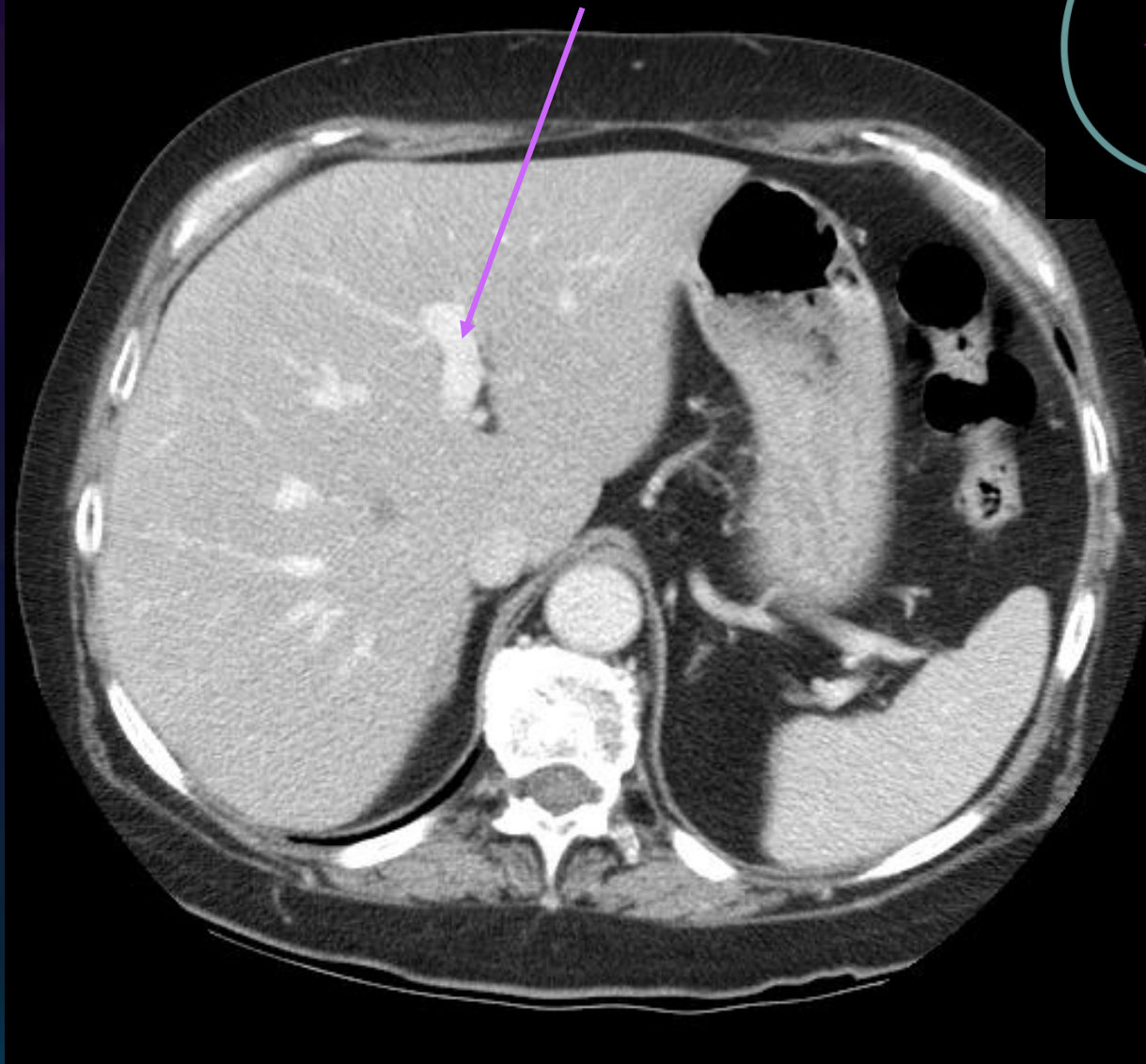




Hepatic Vein Variation

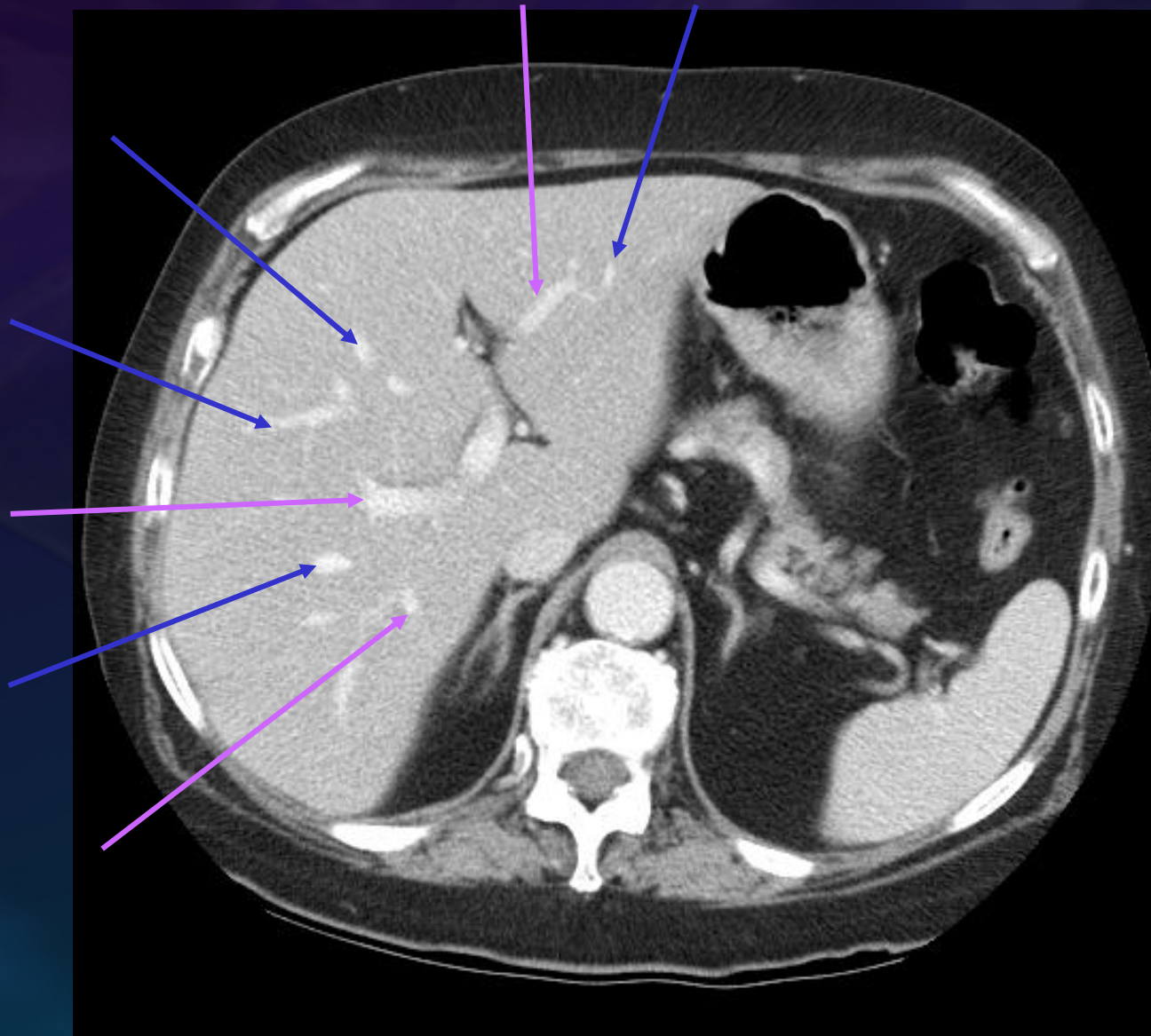


Lt Portal Vein Branch

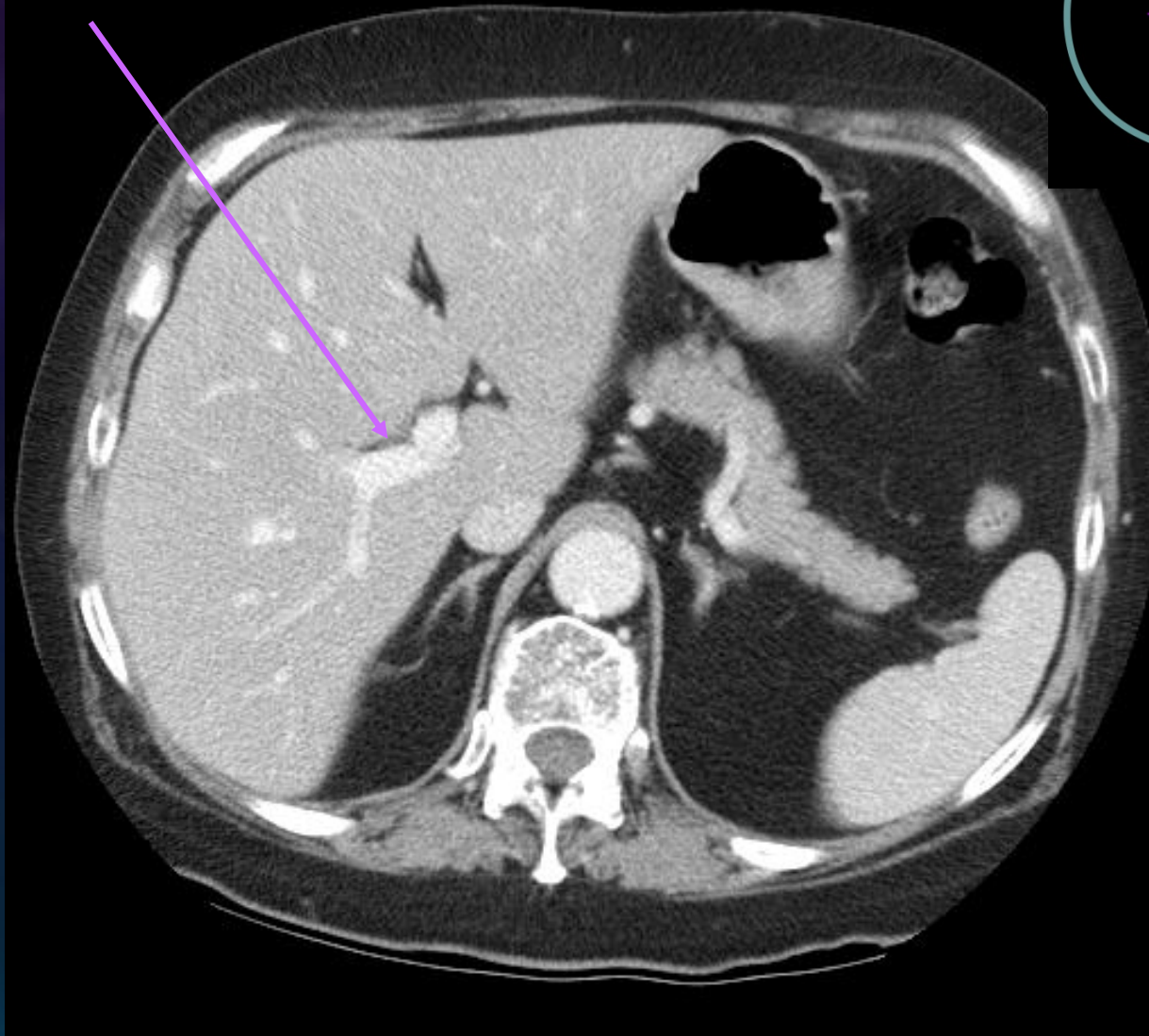
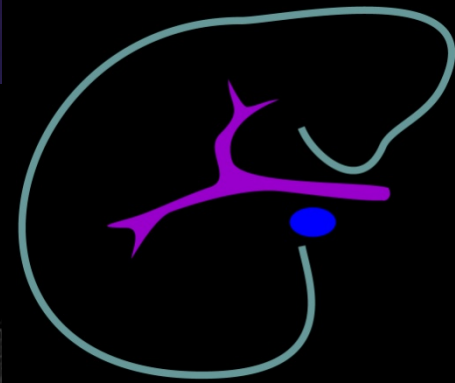


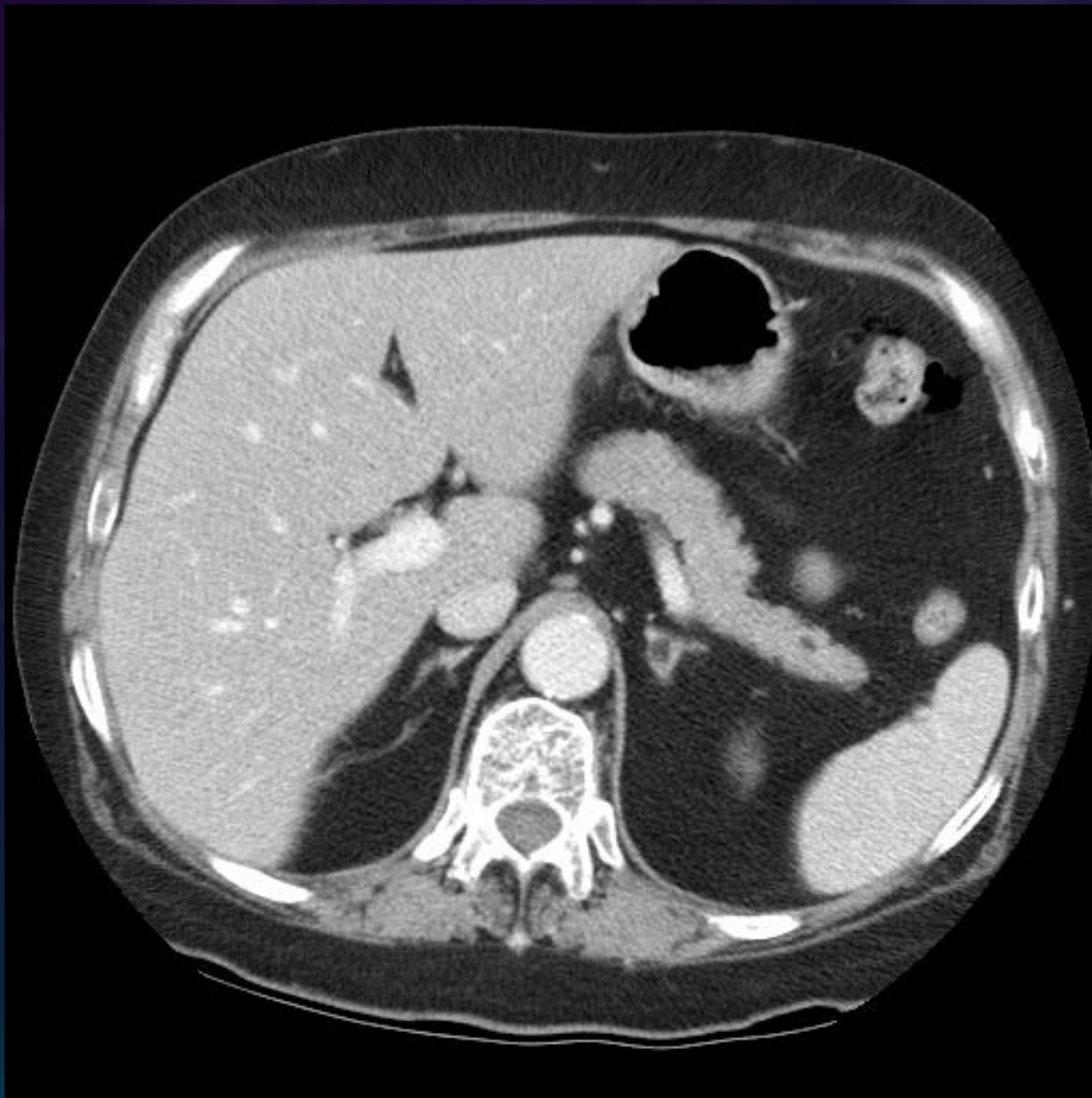


Combination of Portal and Hepatic Vein Branches



Rt Portal Vein Branch

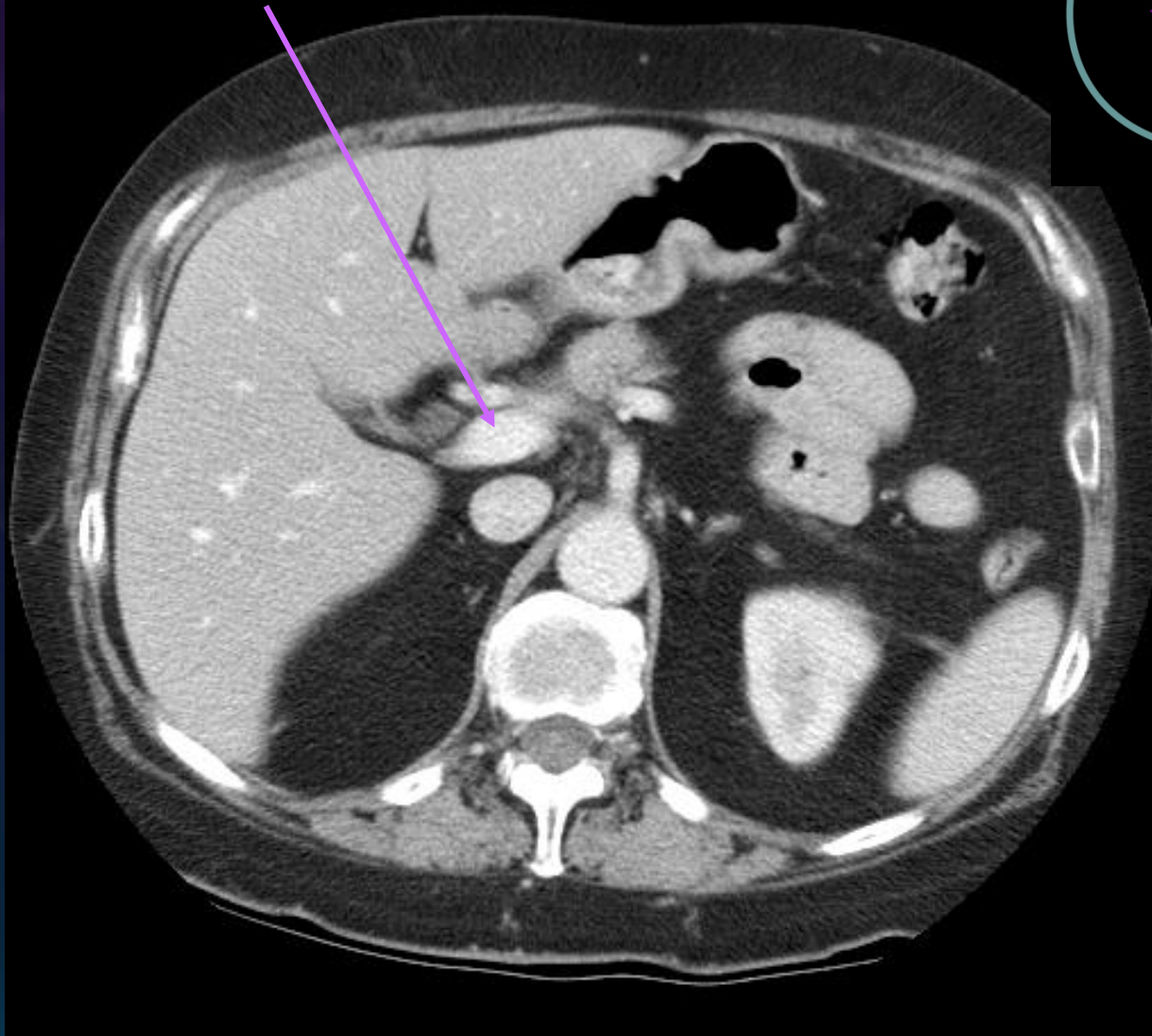
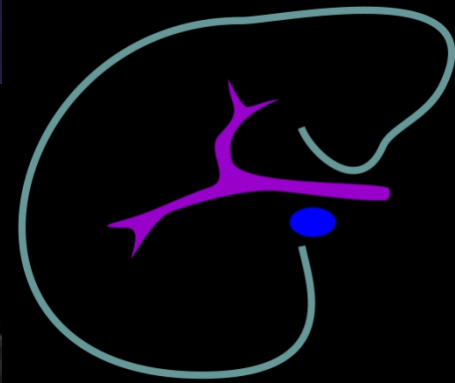








Main Portal Vein

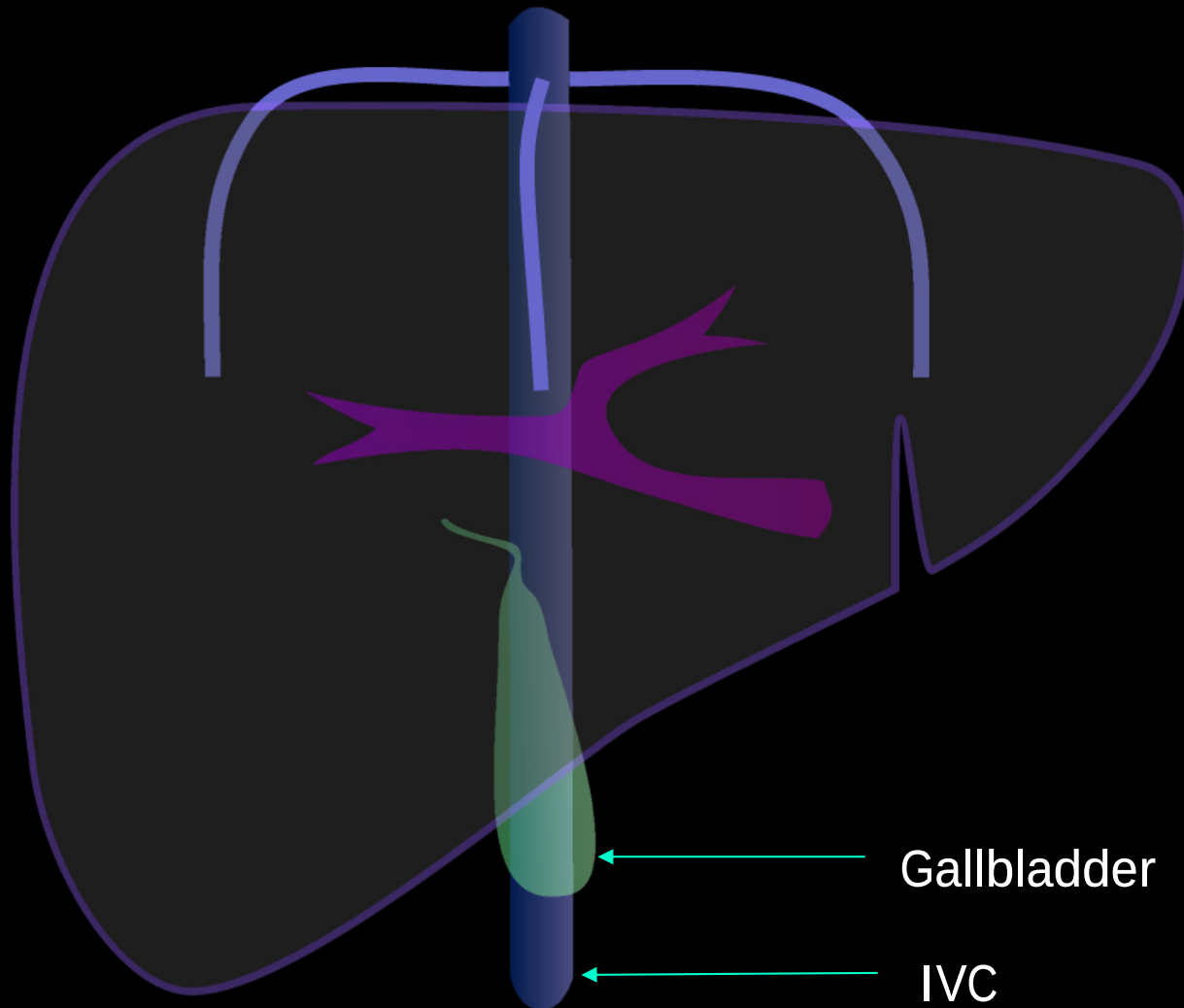




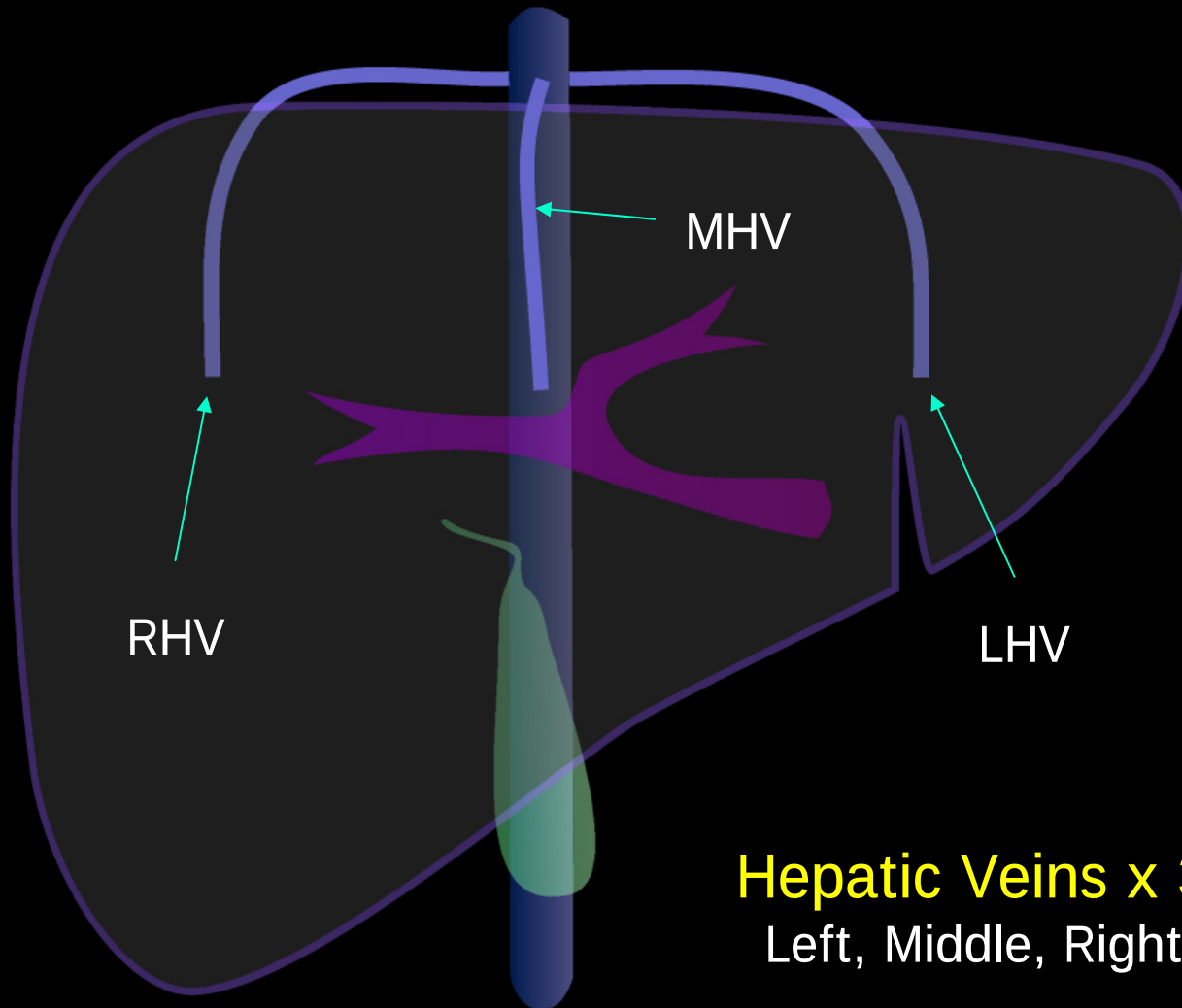
Segmental Liver Anatomy

- The liver is subdivided into 8 anatomically and functionally independent segments, each with its own blood supply, venous and biliary drainage (Couinaud classification)
- Particularly important when planning hepatic surgery
- Fortunately, the segments are identifiable on CT using simple landmarks

Liver Segments: Landmarks (1)



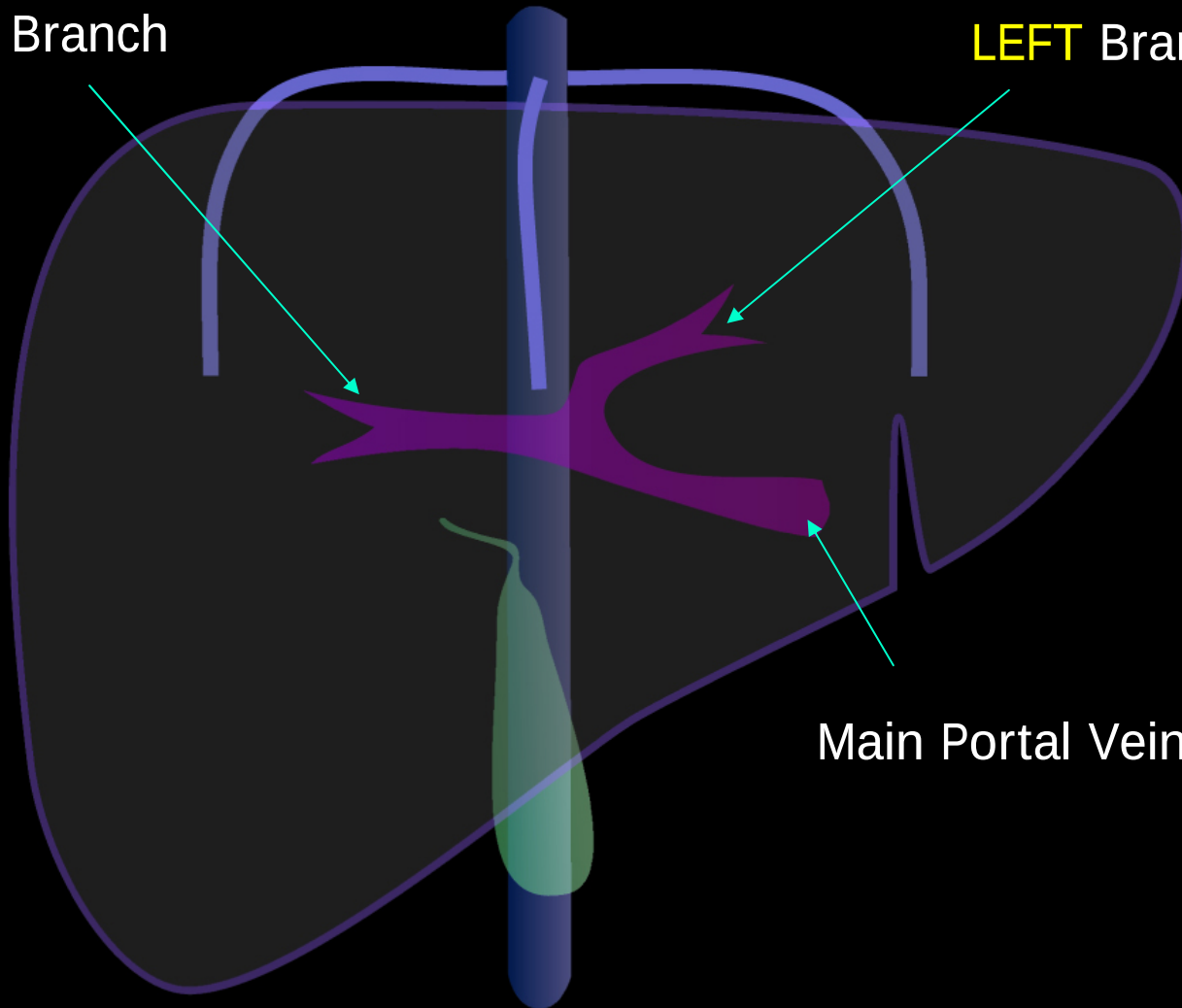
Liver Segments: Landmarks (2)



Liver Segments: Landmarks (3)

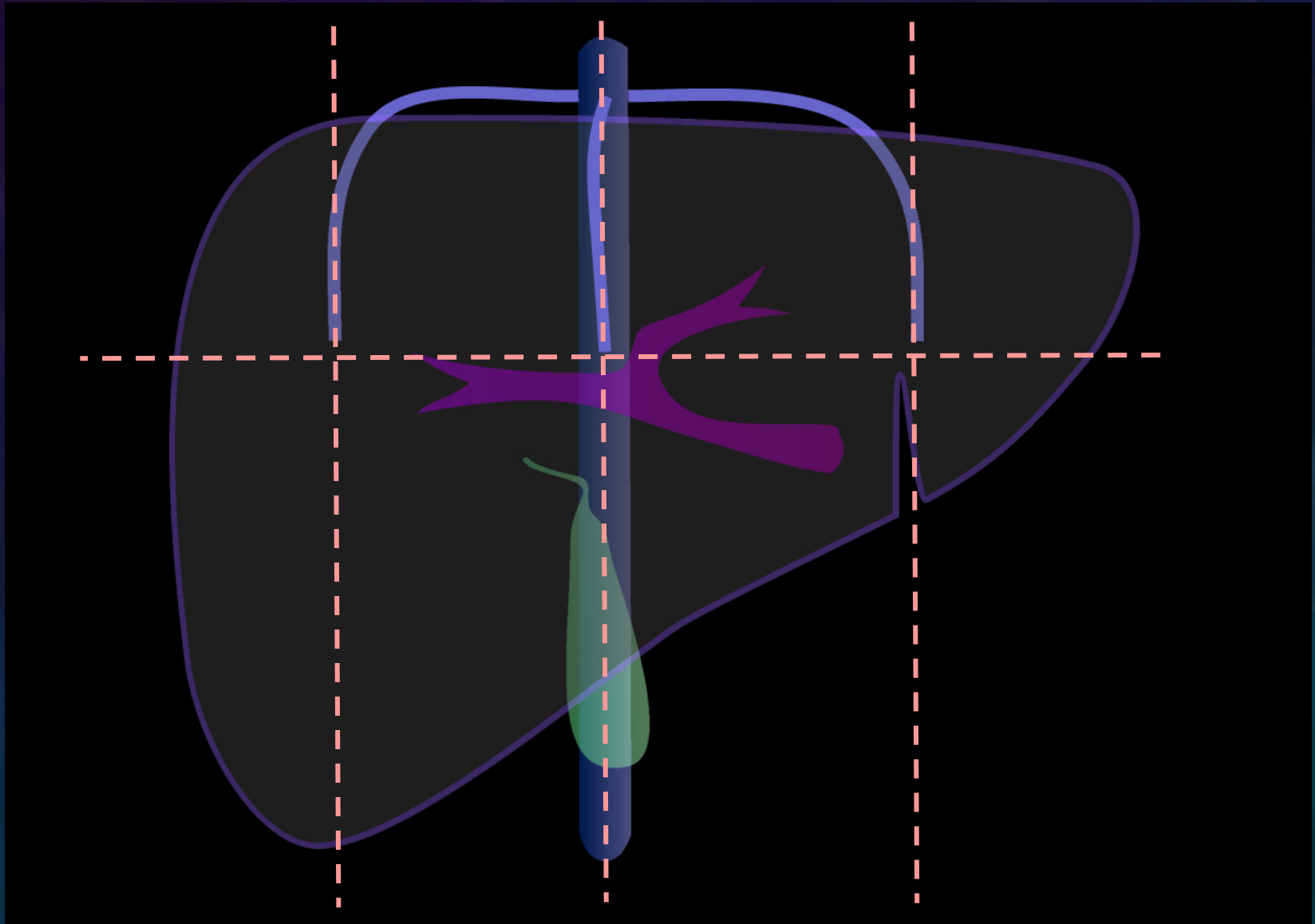
RIGHT Branch

LEFT Branch

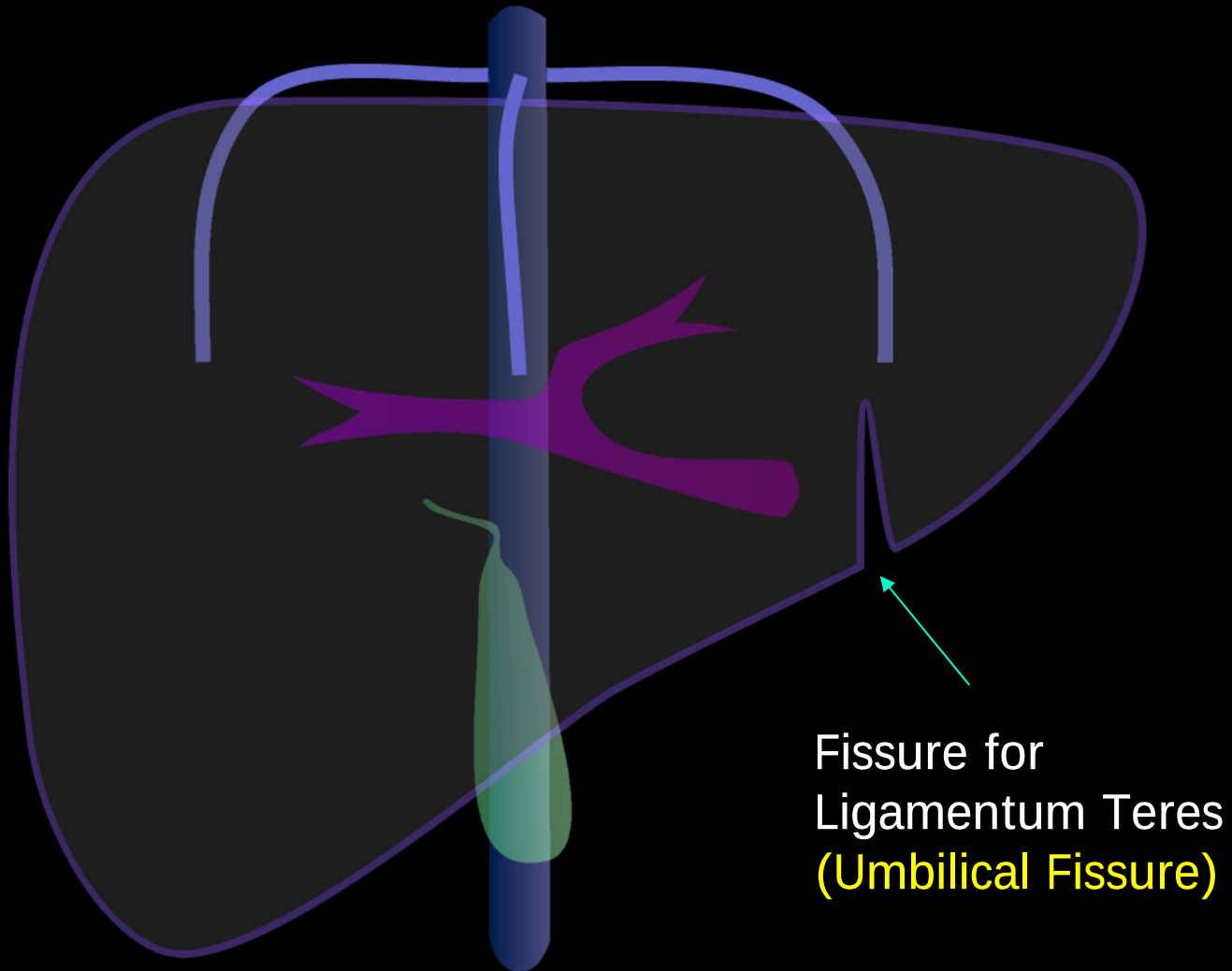


Main Portal Vein

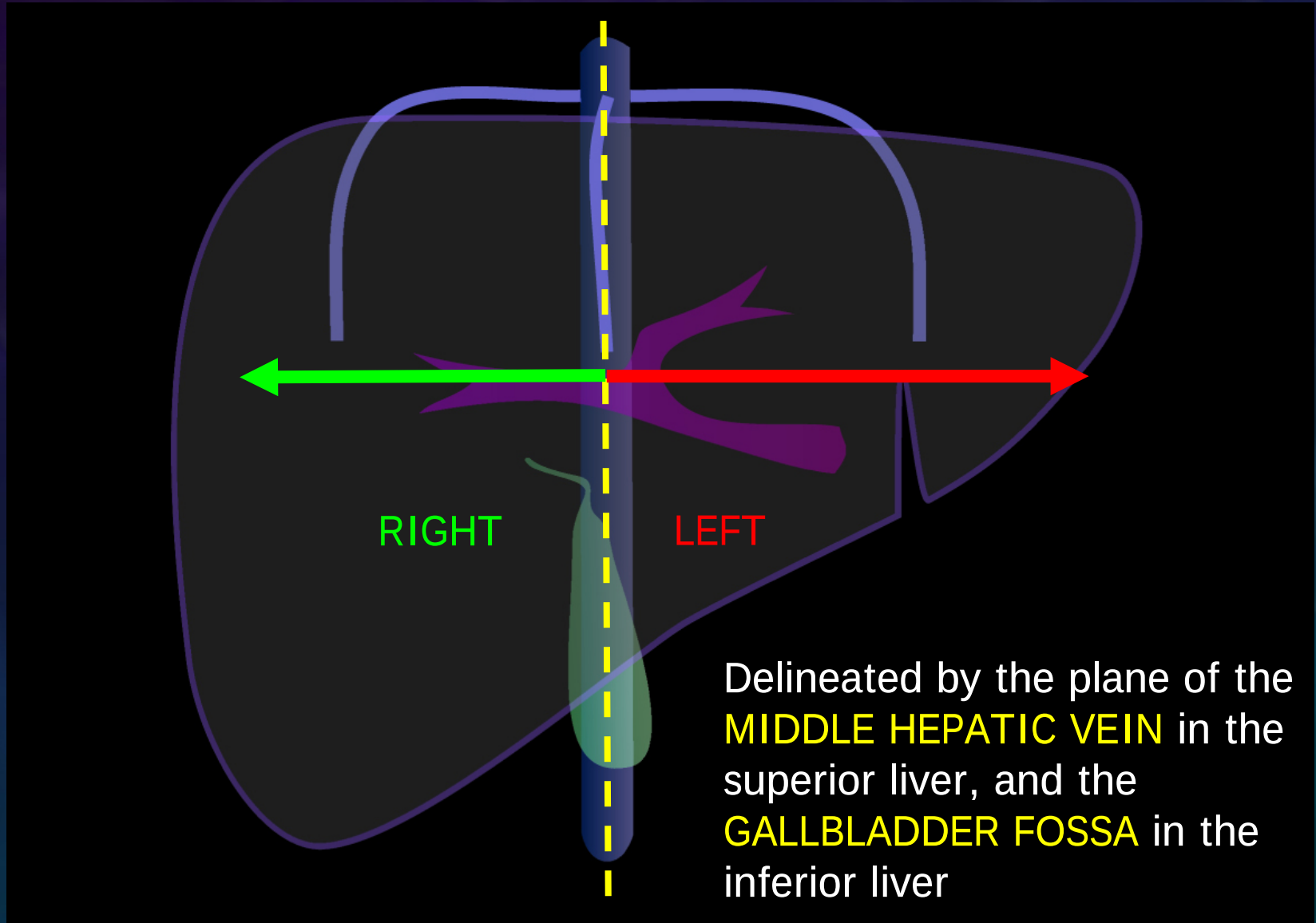
Liver Segments: Landmarks (4)



Liver Segments: Landmarks (5)

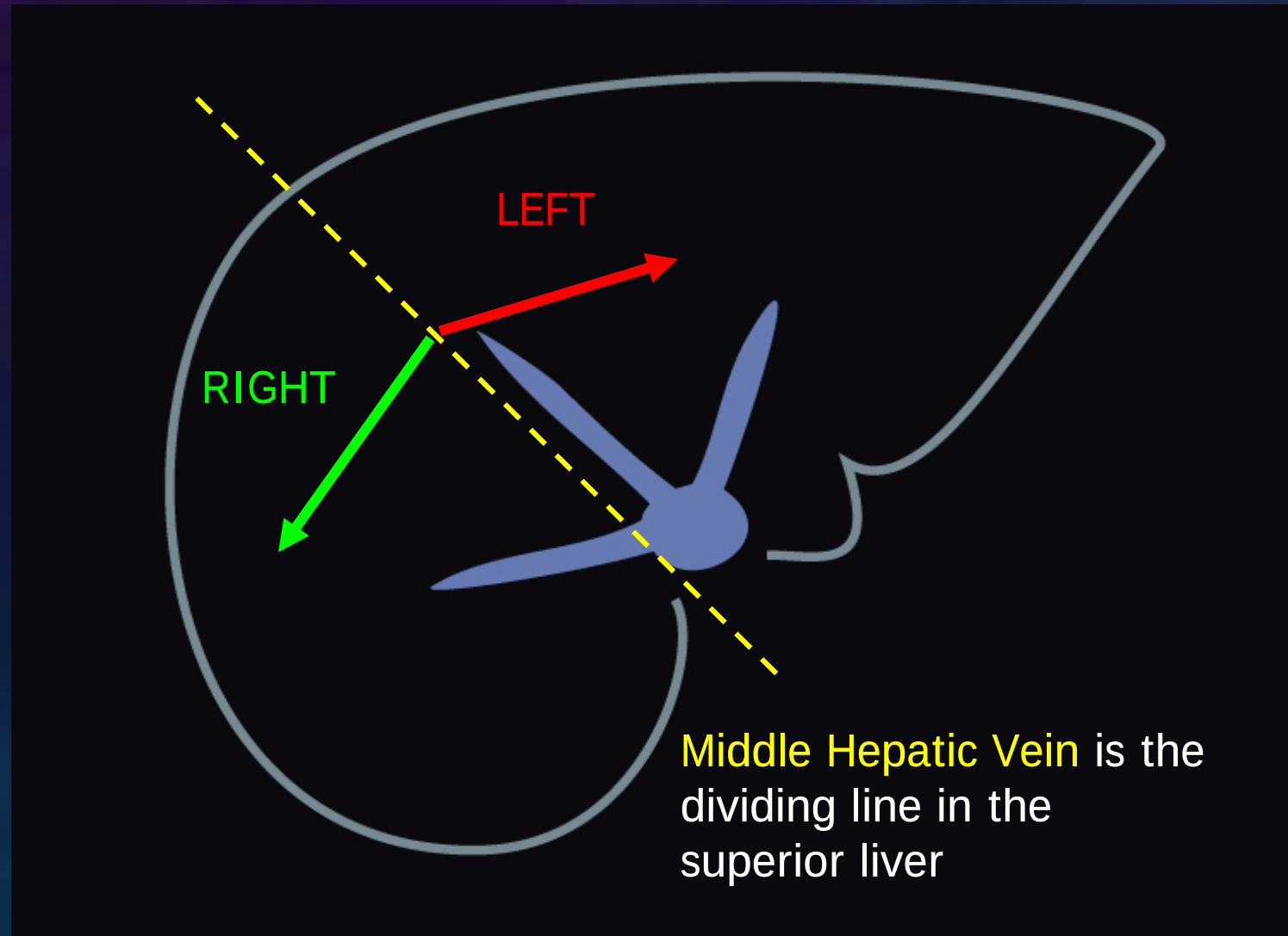


Right vs Left Lobe: Coronal Schematic



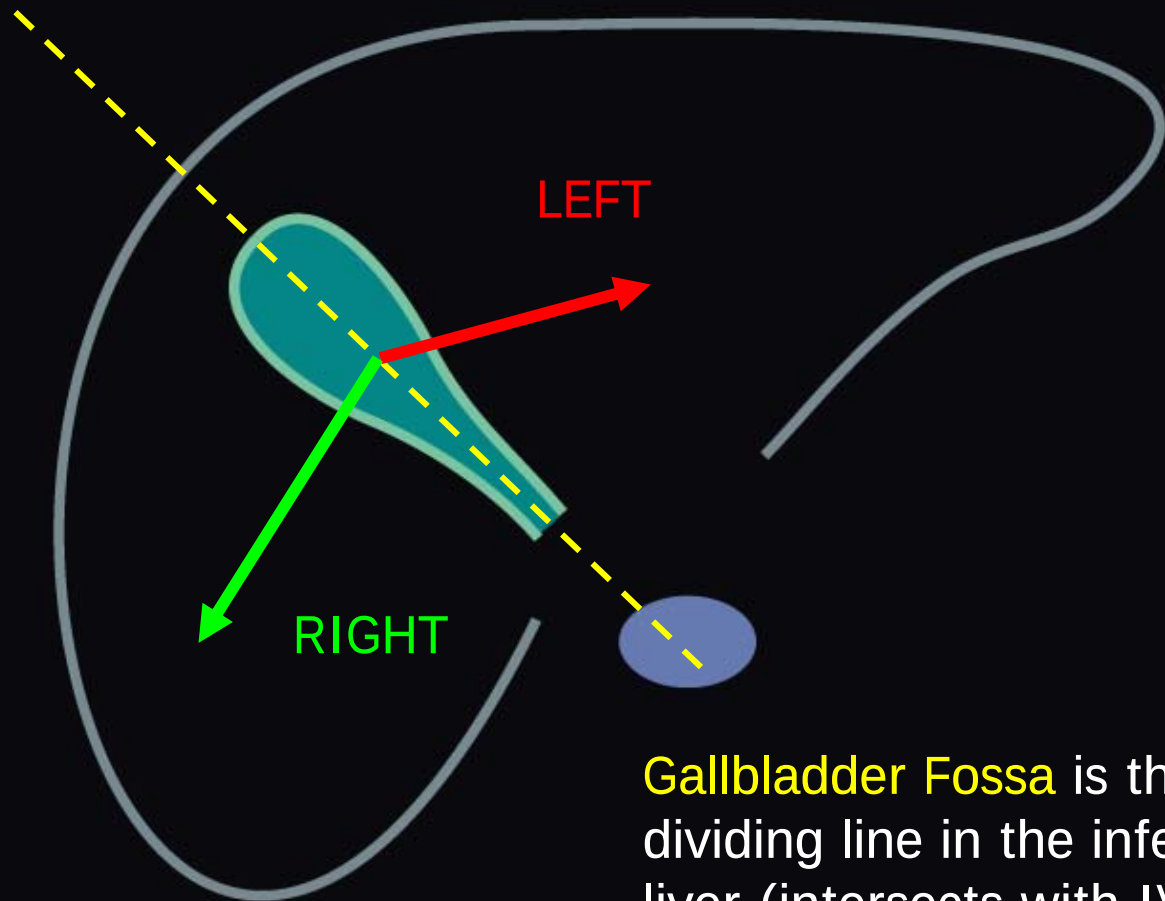
Right vs Left: Axial Landmarks

Superior Liver



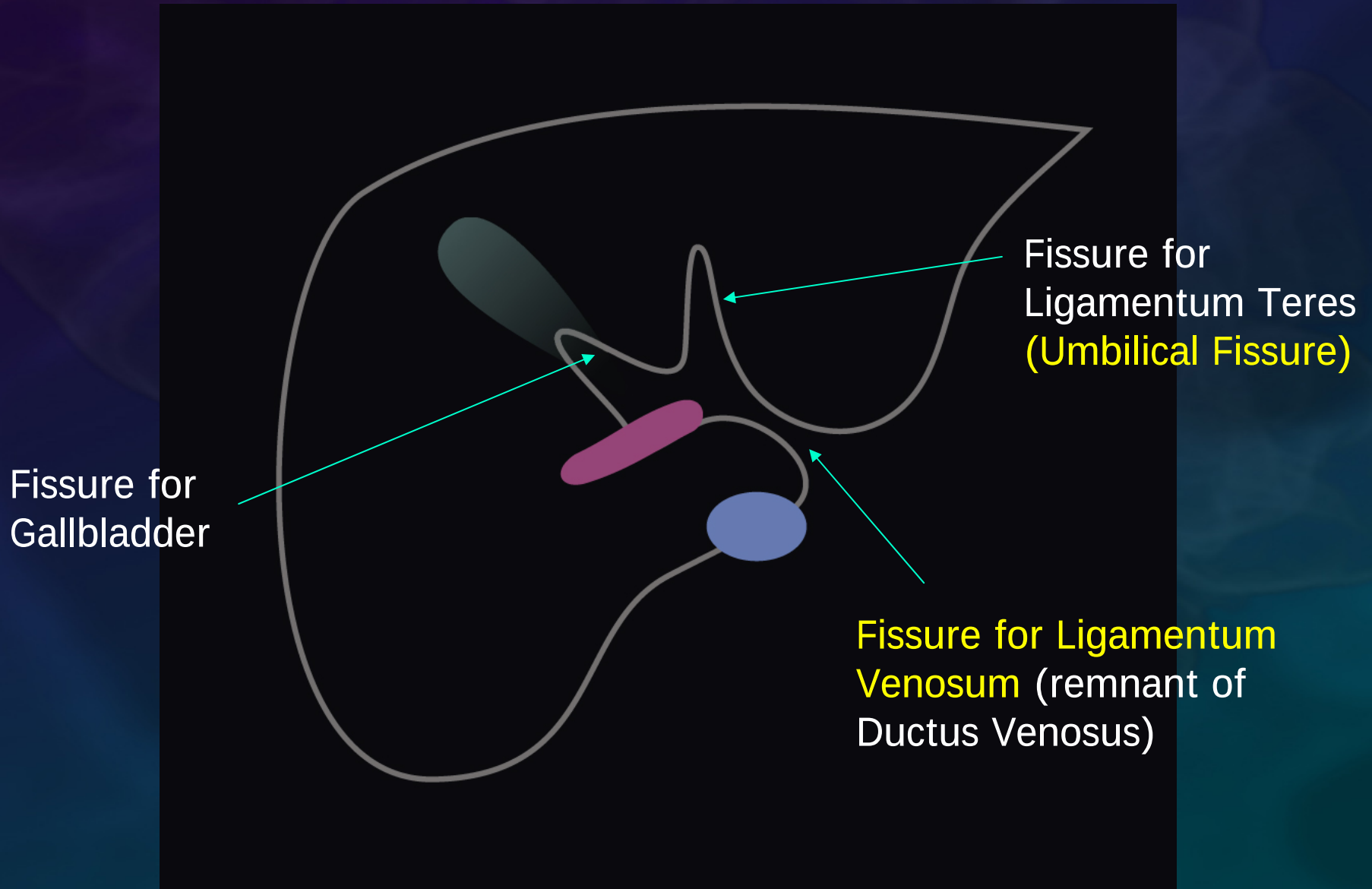
Right vs Left: Axial Landmarks

Inferior Liver

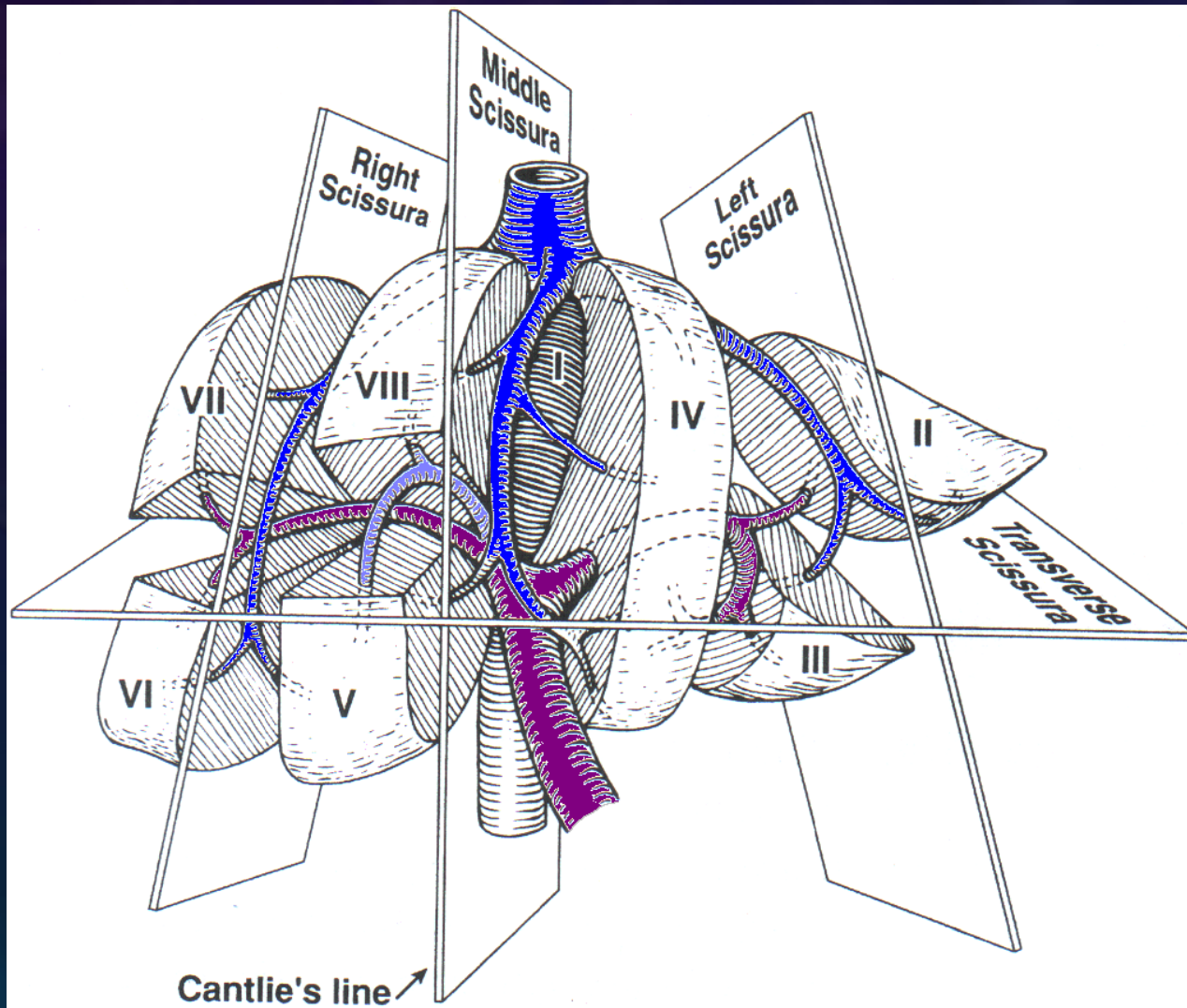


Gallbladder Fossa is the dividing line in the inferior liver (intersects with IVC)

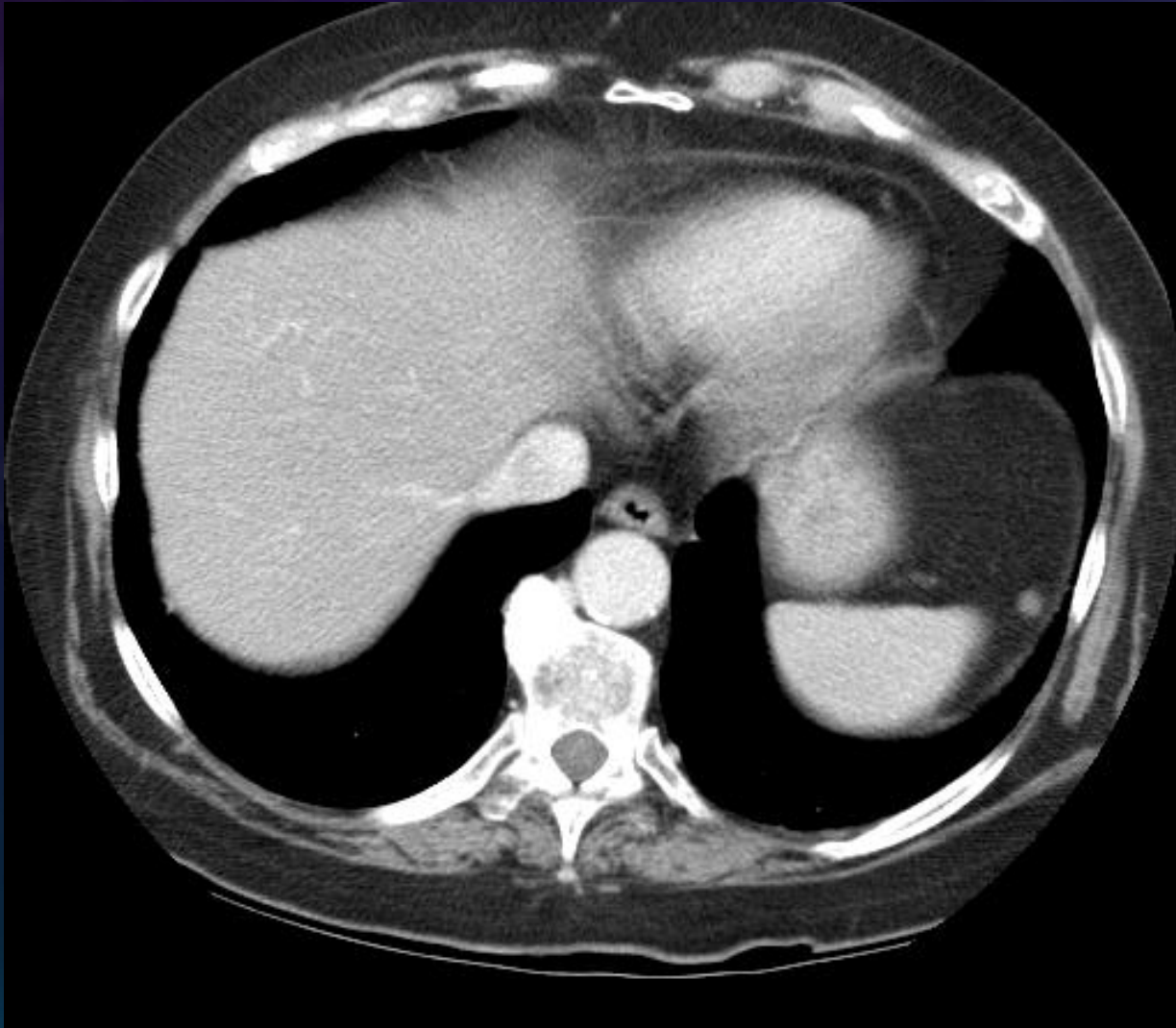
Axial Landmarks: Hepatic Fissures

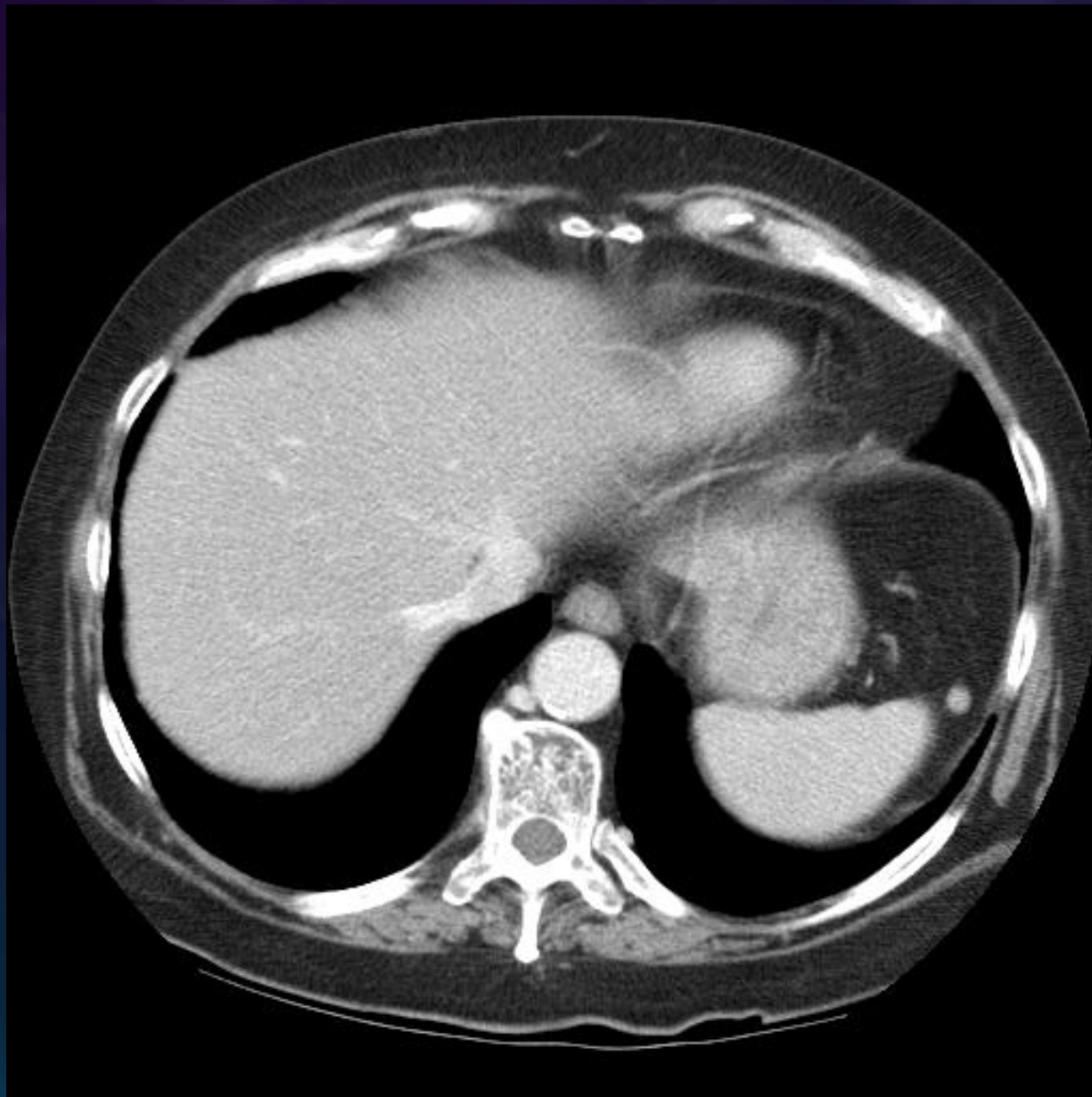


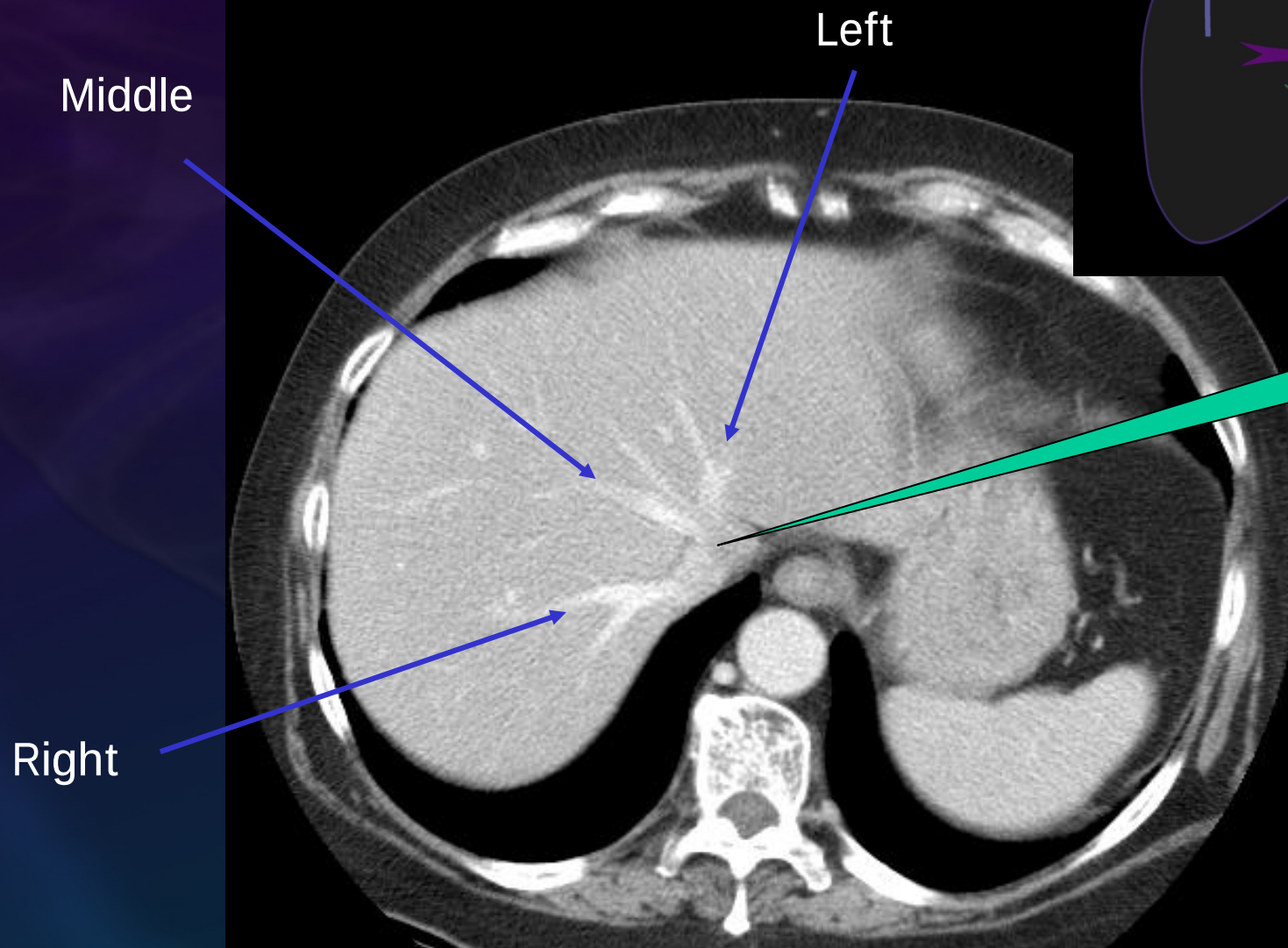
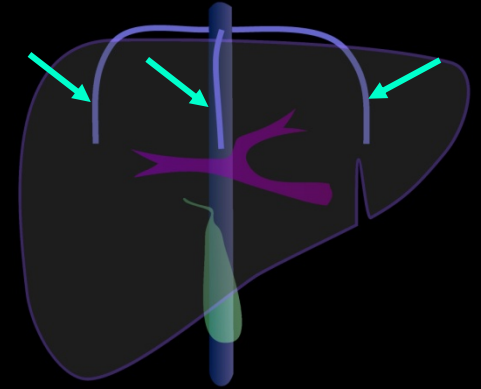
Liver Segments



Liver: Axial landmarks



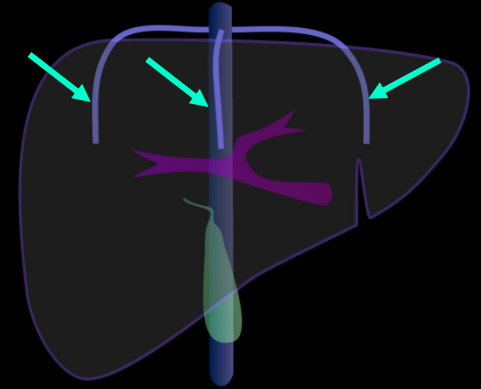




Check the IVC to draw
the right, middle and left
scissurae.
(KIV to use liver window)

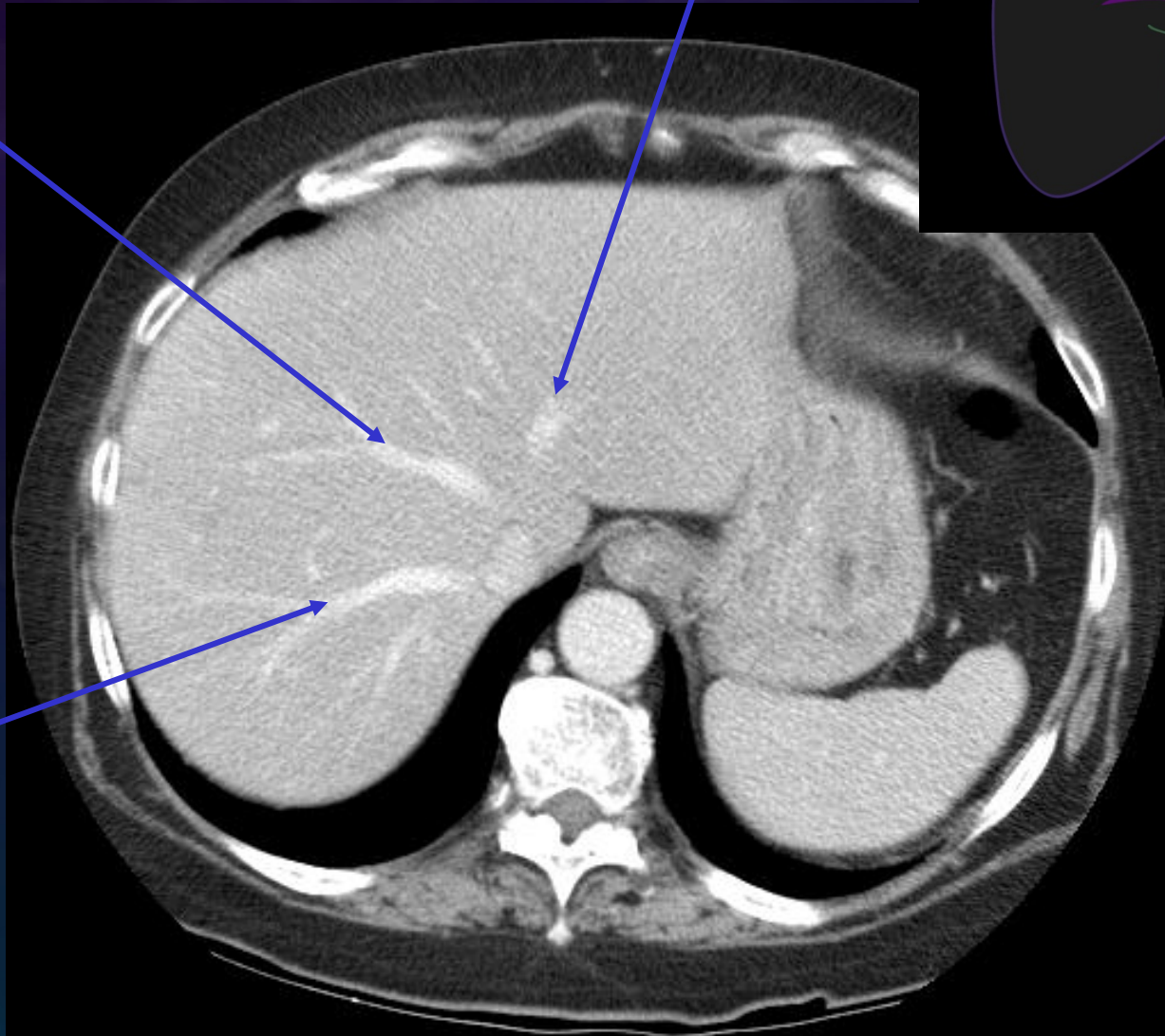
Hepatic Veins x 3

LHV

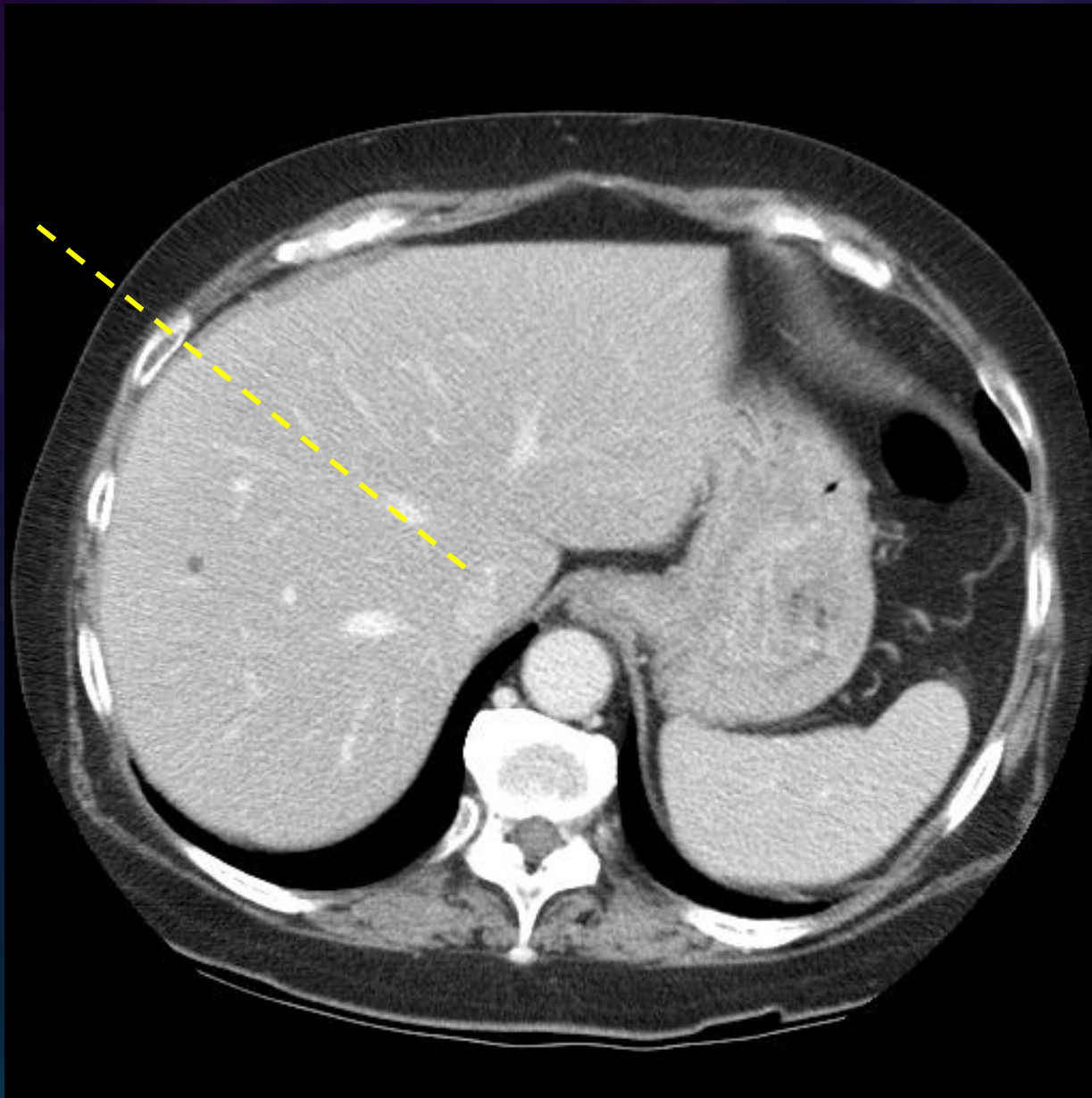


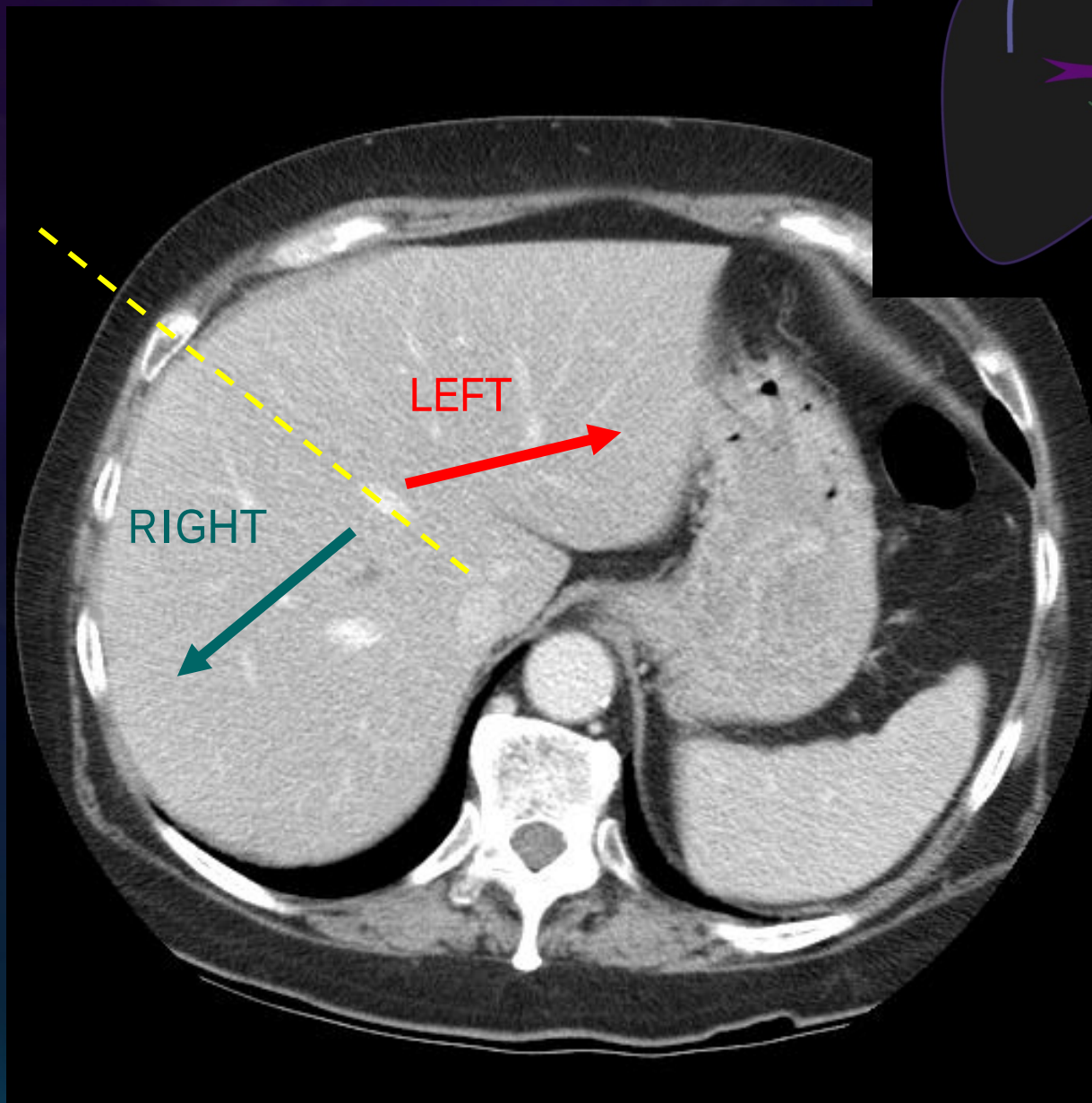
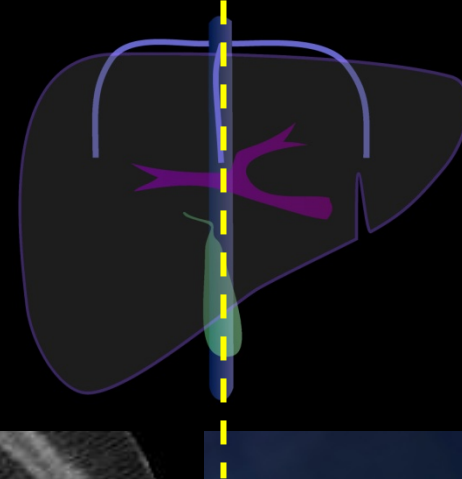
MHV

RHV

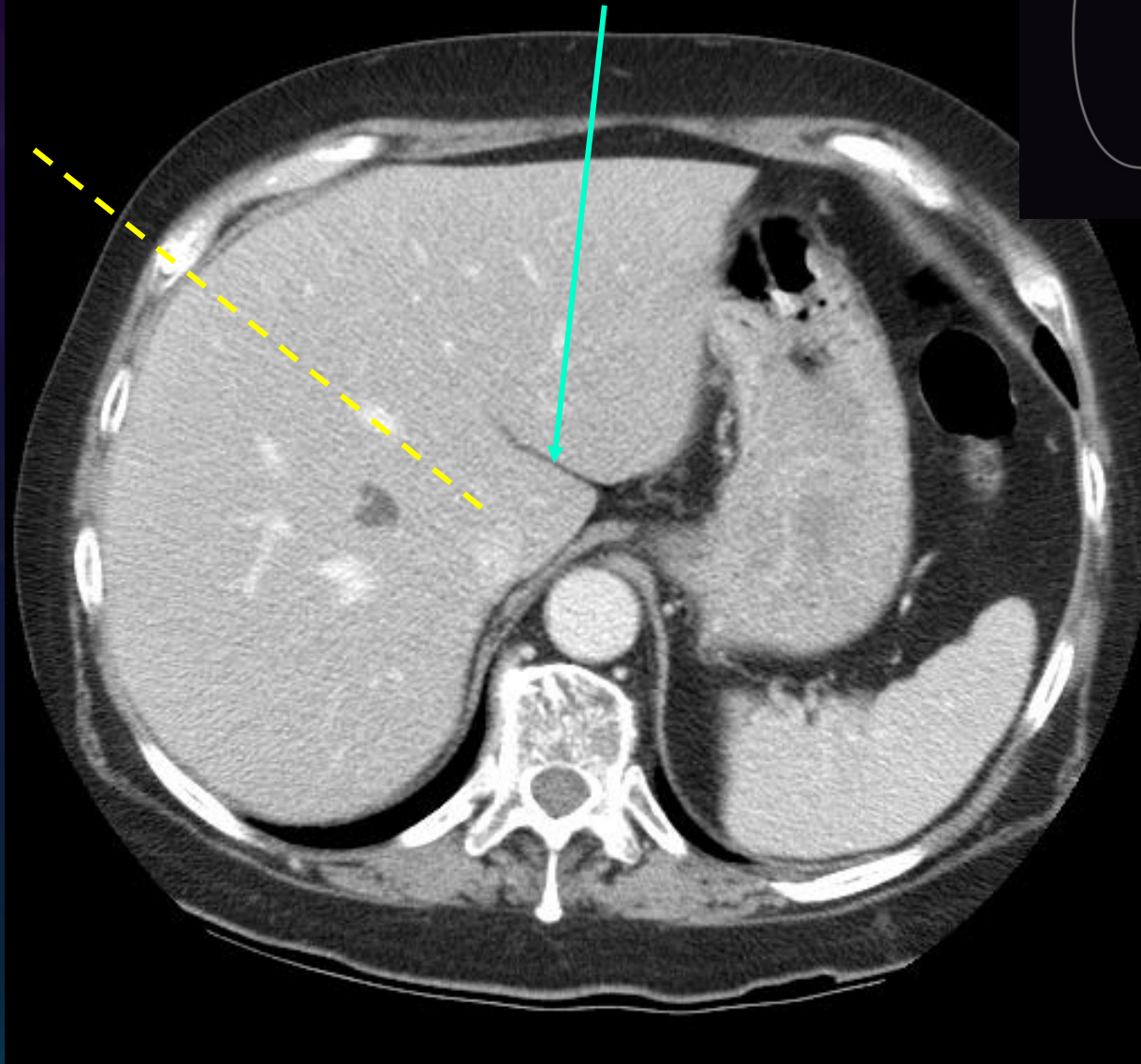
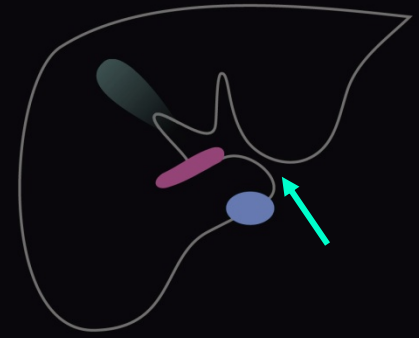


MHV

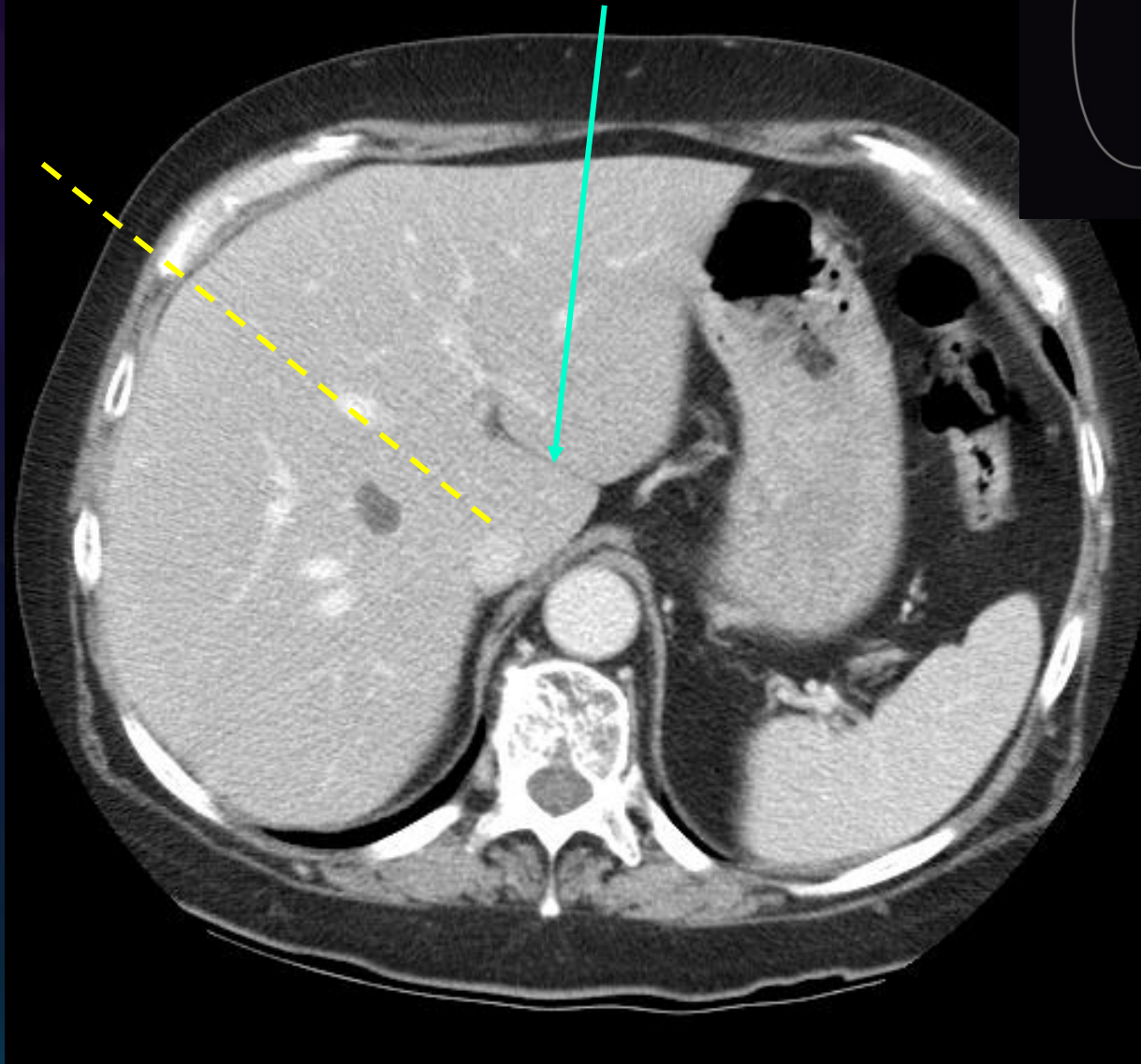




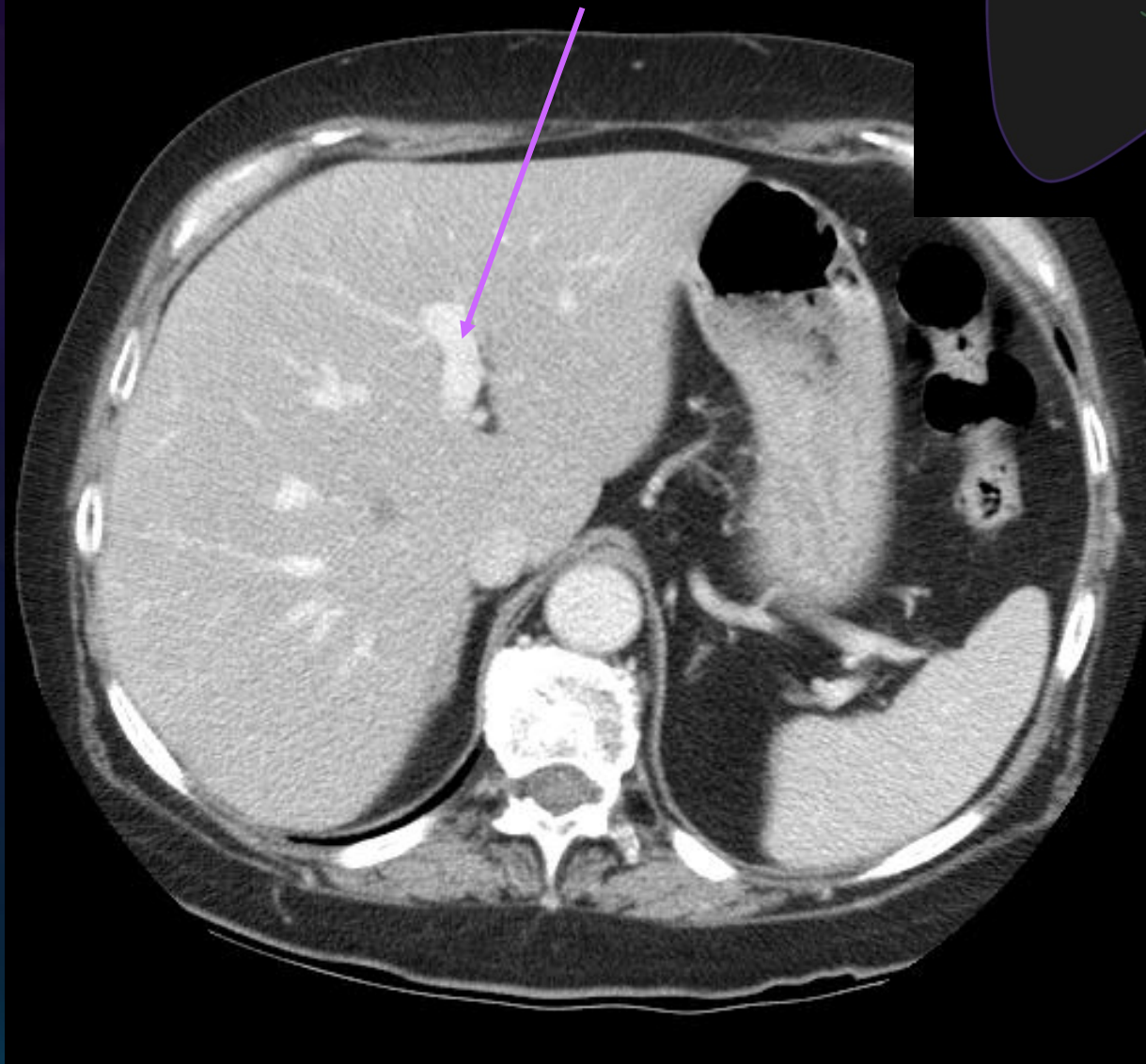
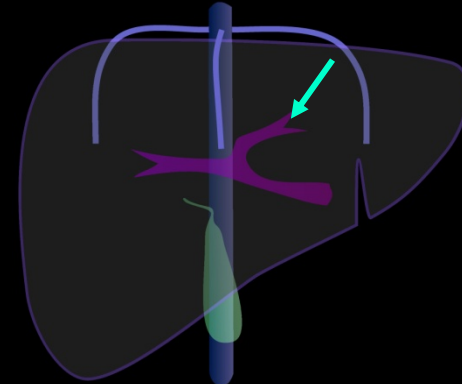
Fissure for Ligamentum Venosum



Fissure for Ligamentum Venosum

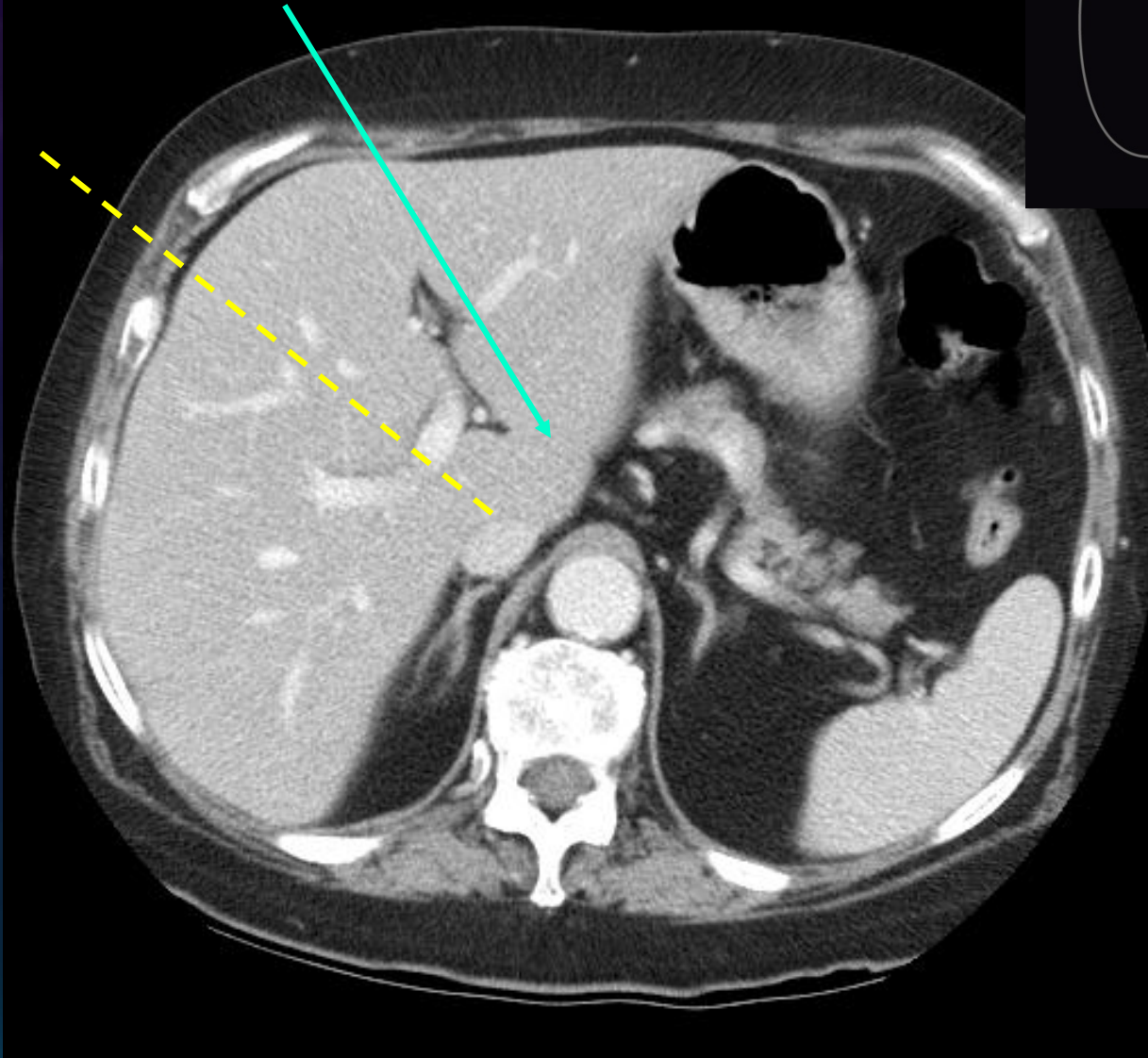
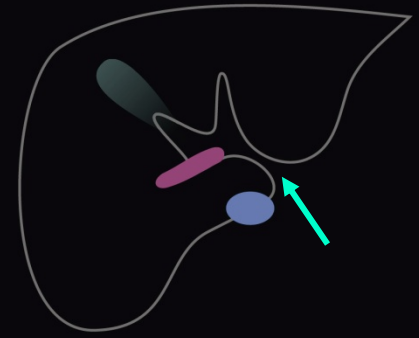


Lt Portal Vein Branch

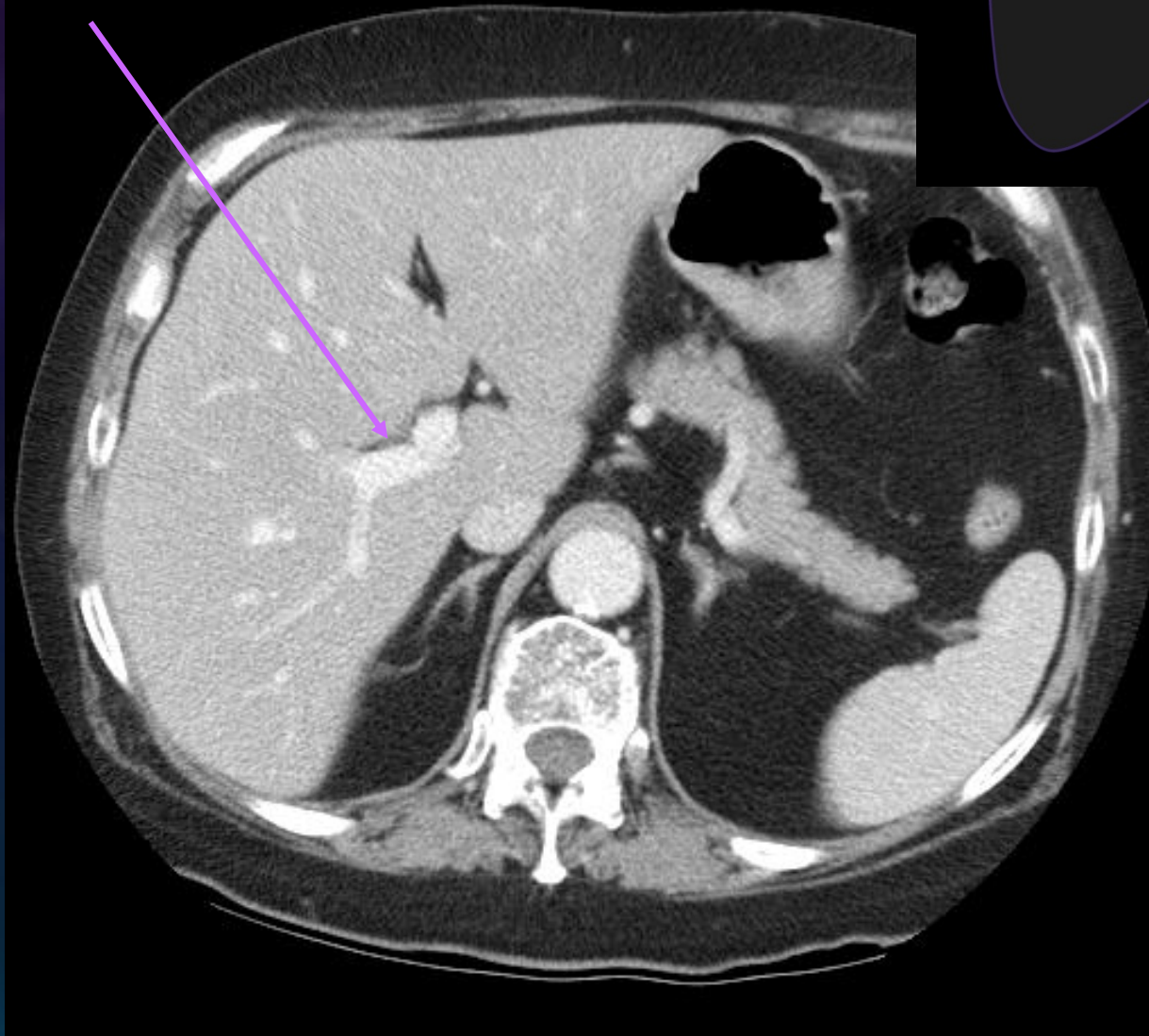
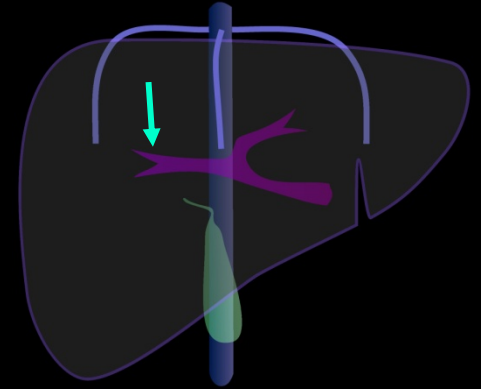




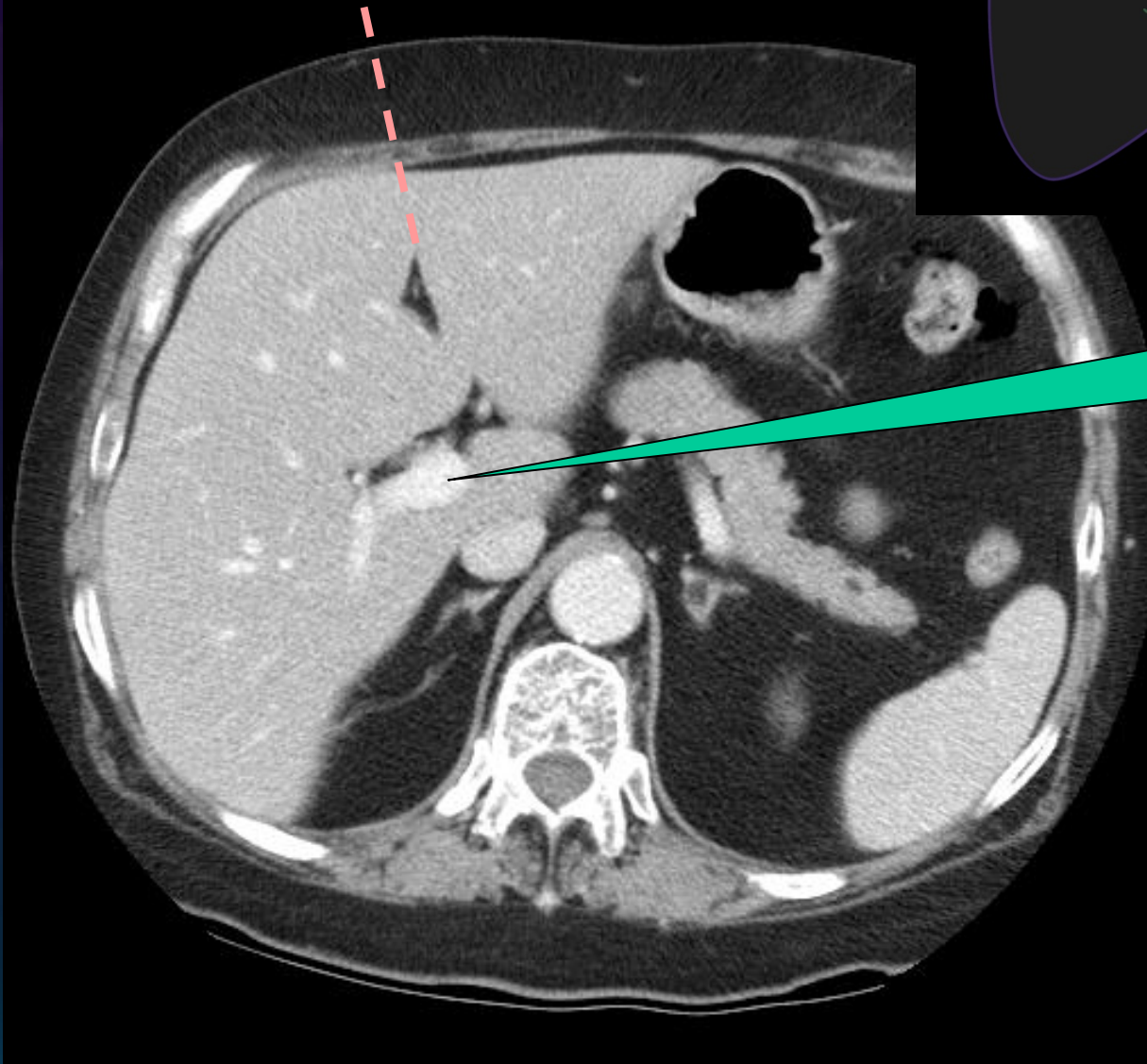
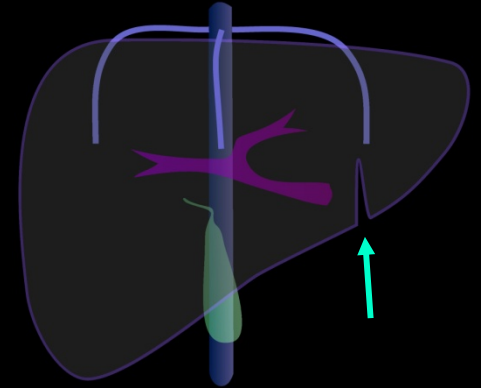
Fissure for Ligamentum Venosum



Rt Portal Vein Branch



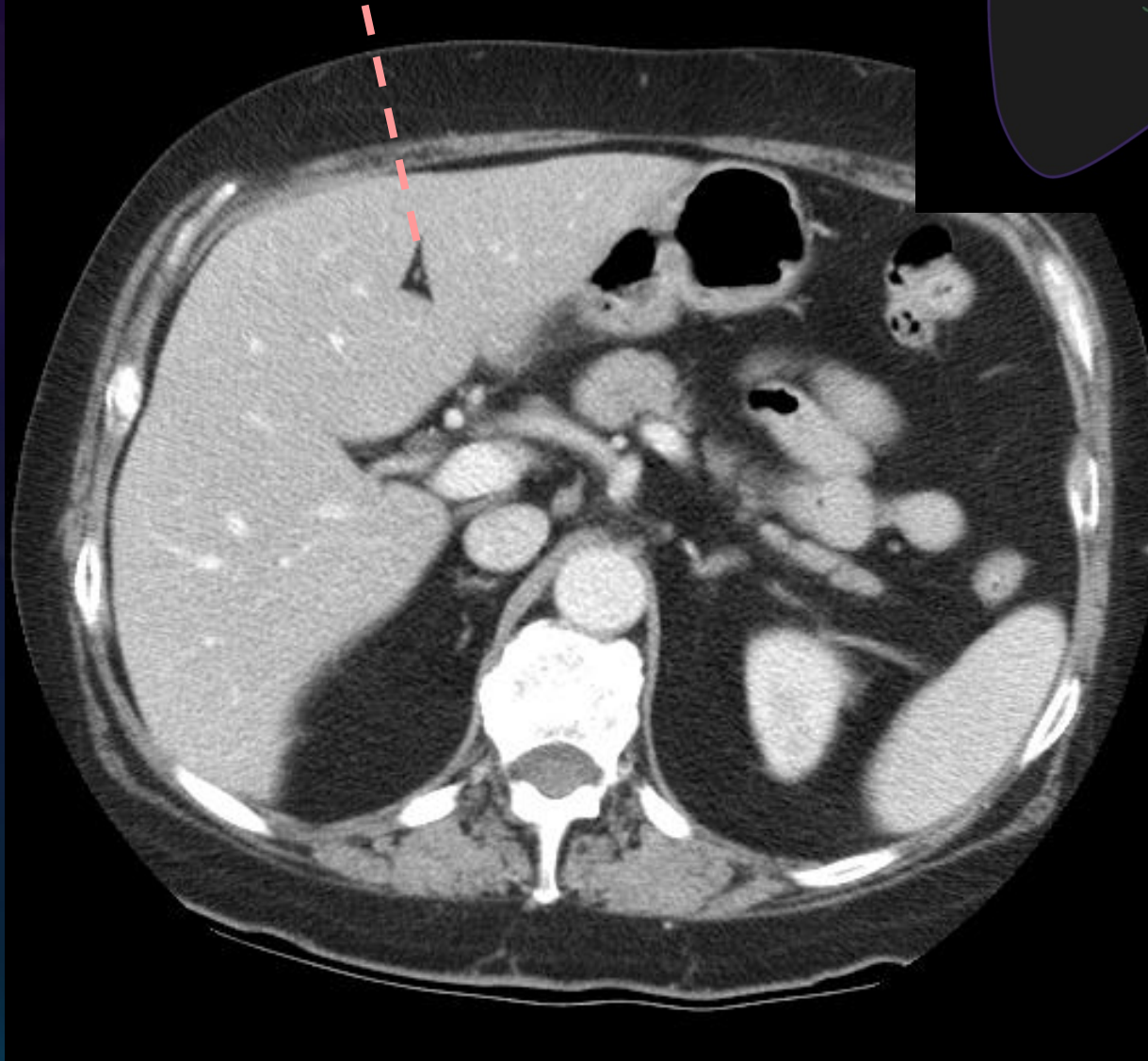
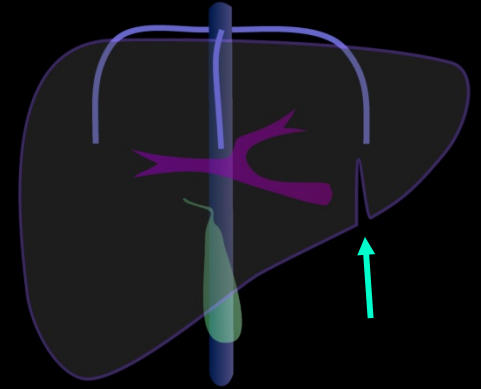
Umbilical Fissure



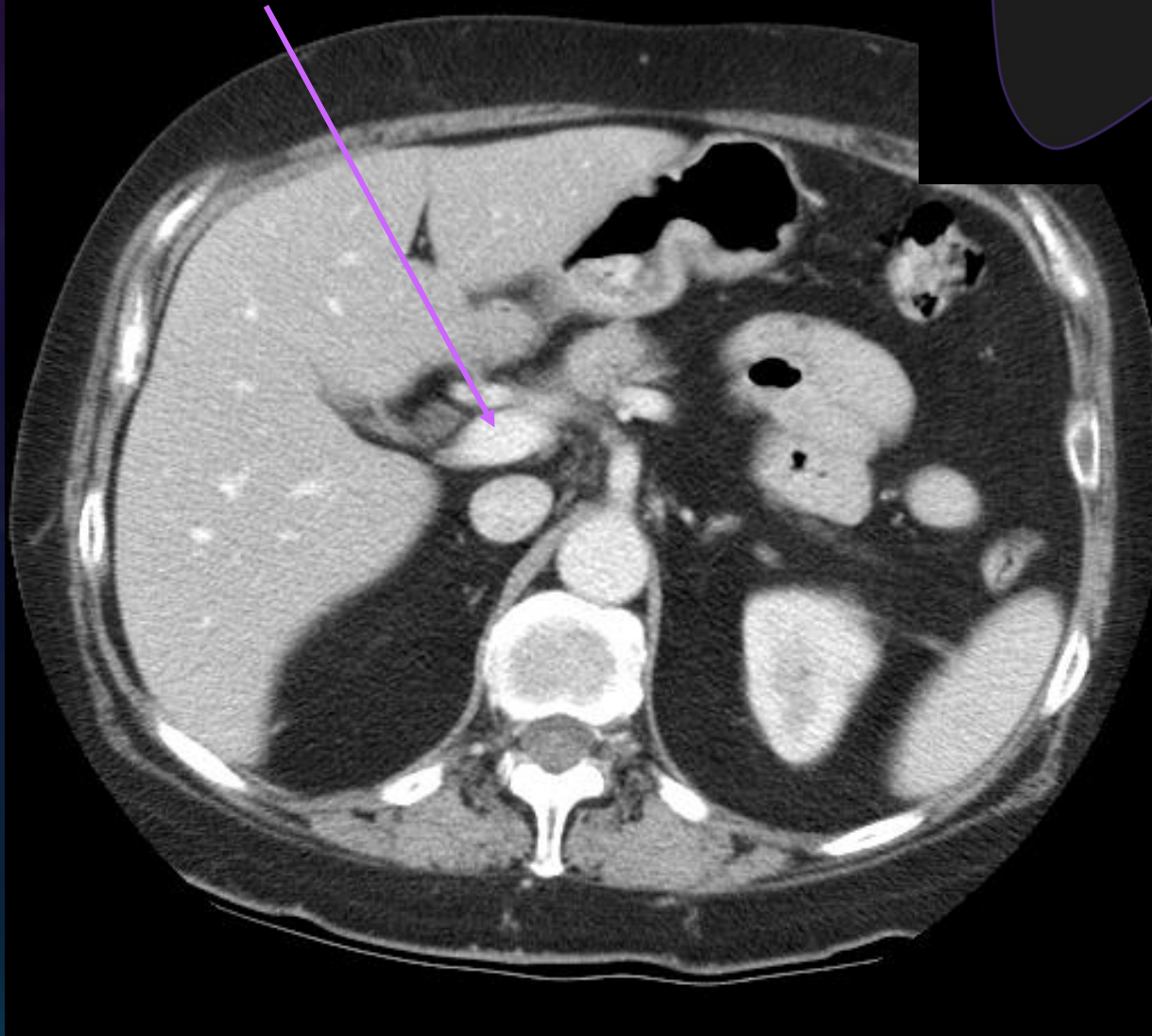
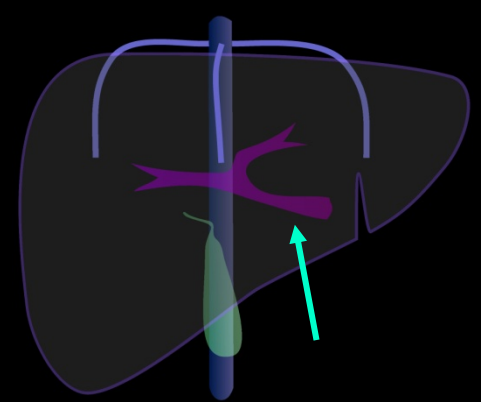
Check the site of entry of portal and then screen up and down (higher for left portal v., lower for right portal v.) for defining transverse scissura.



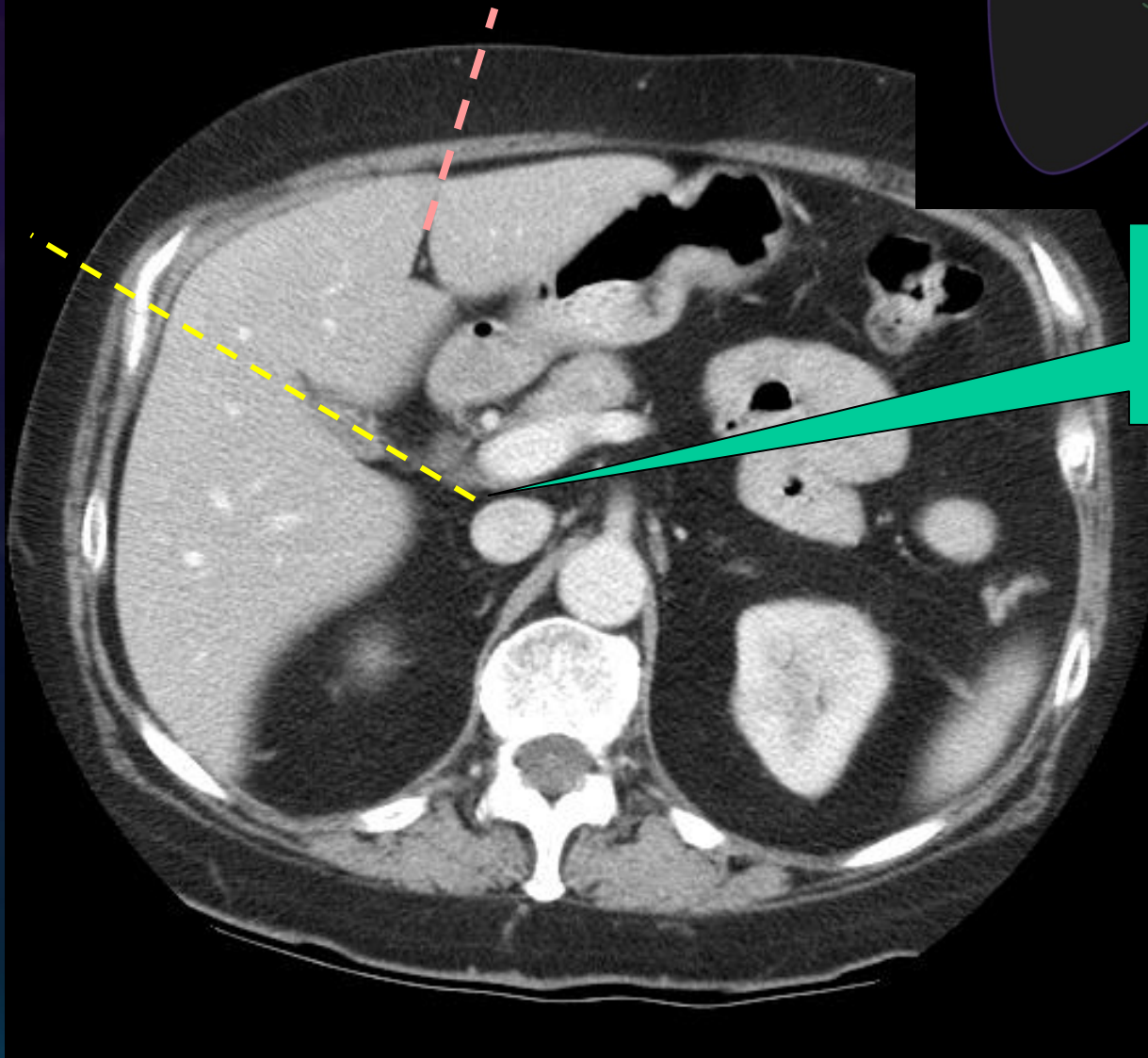
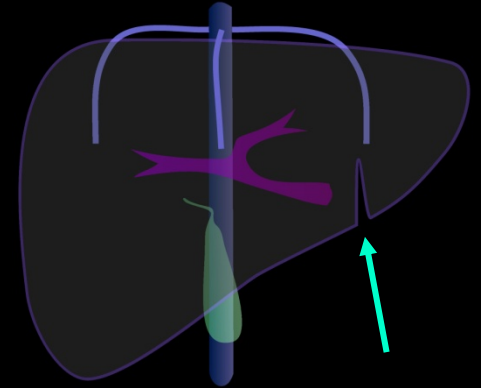
Umbilical Fissure



Main Portal Vein

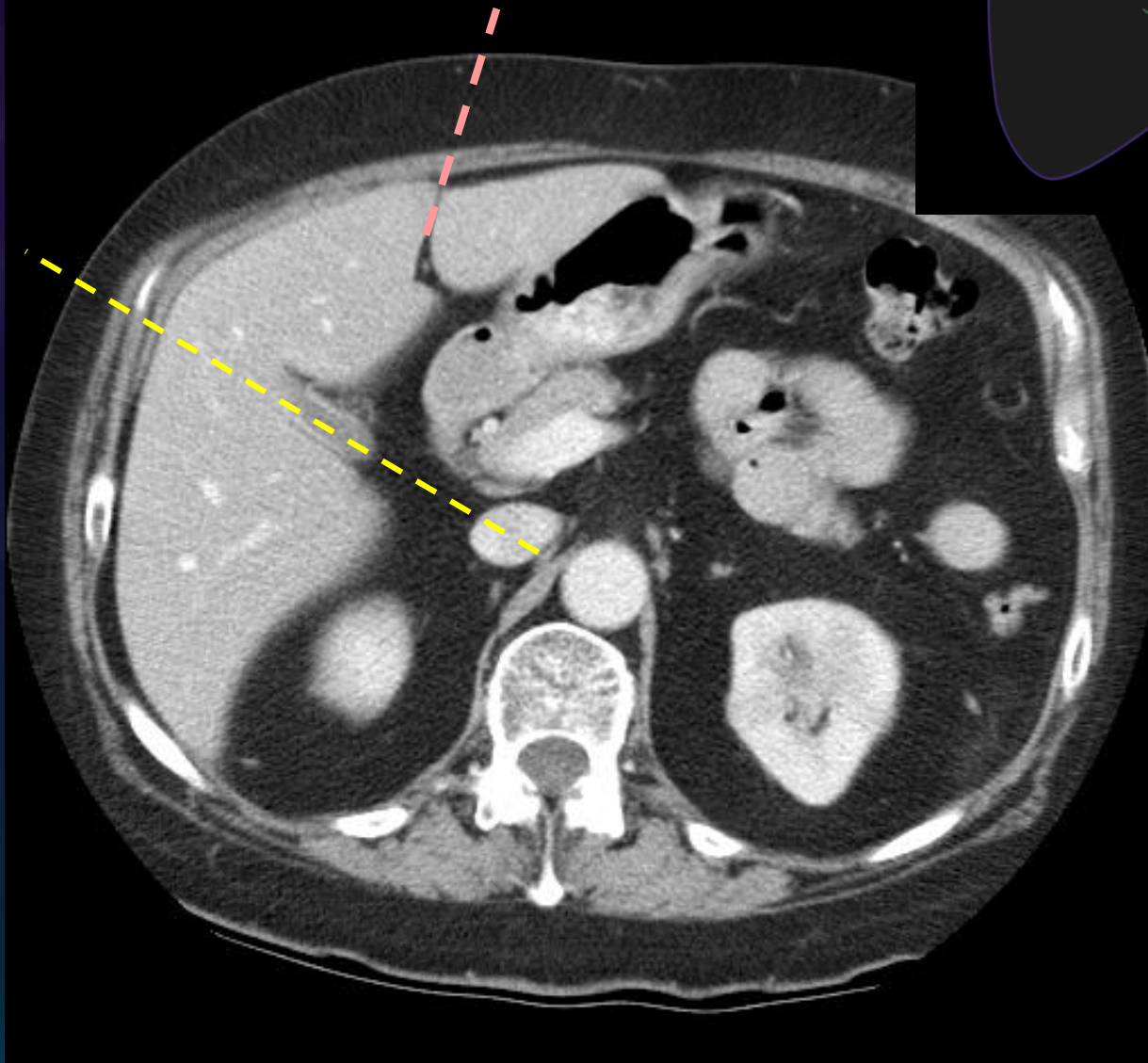
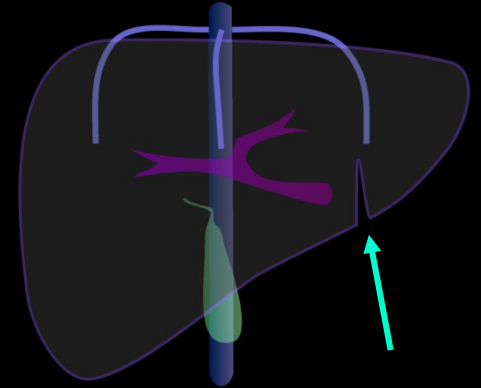


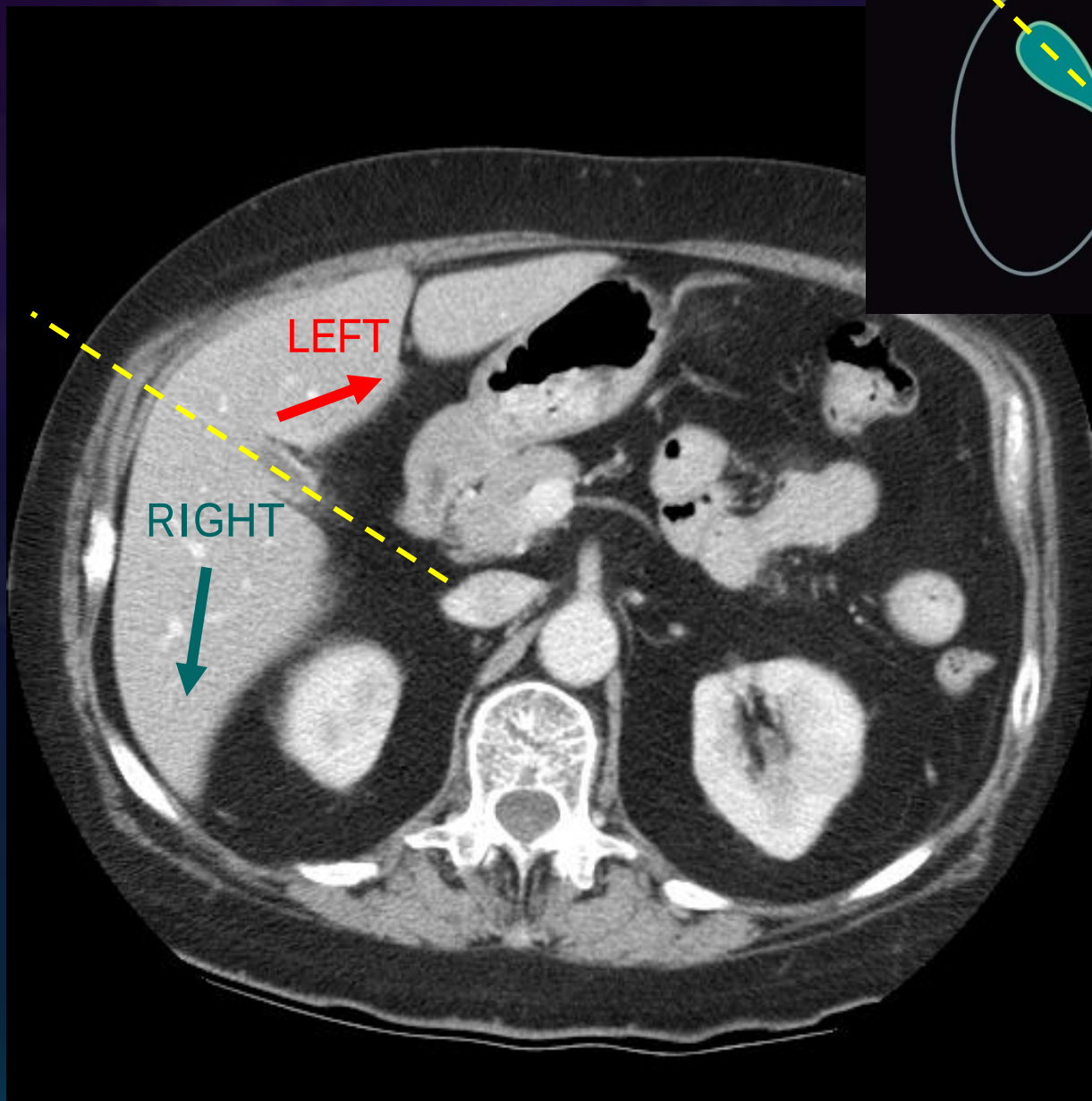
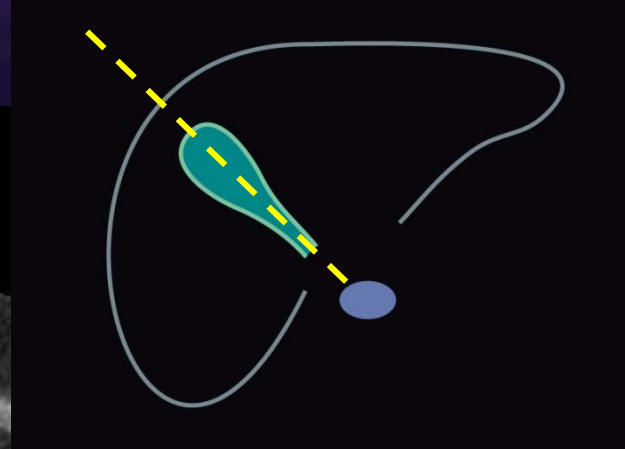
Umbilical Fissure

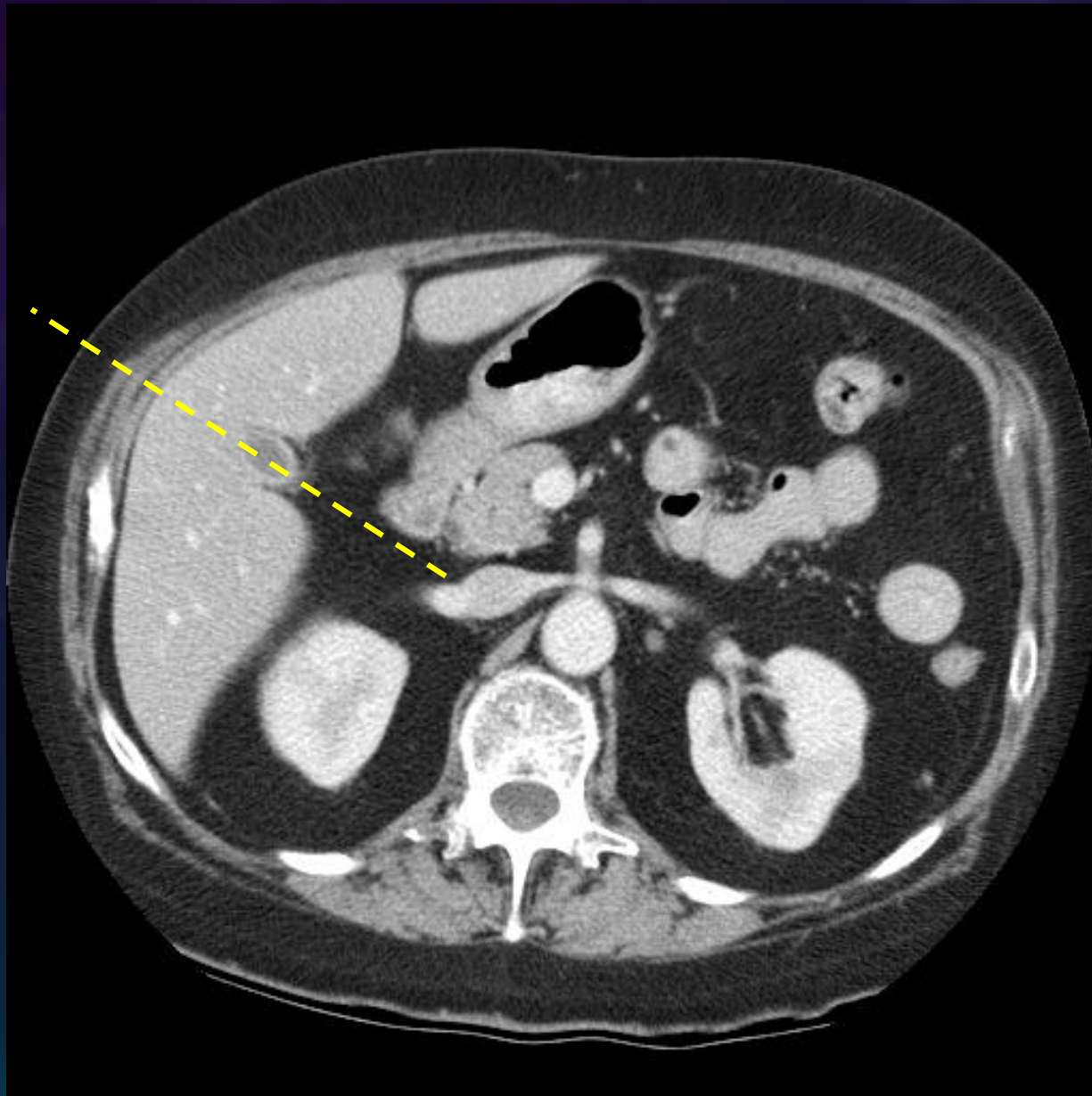


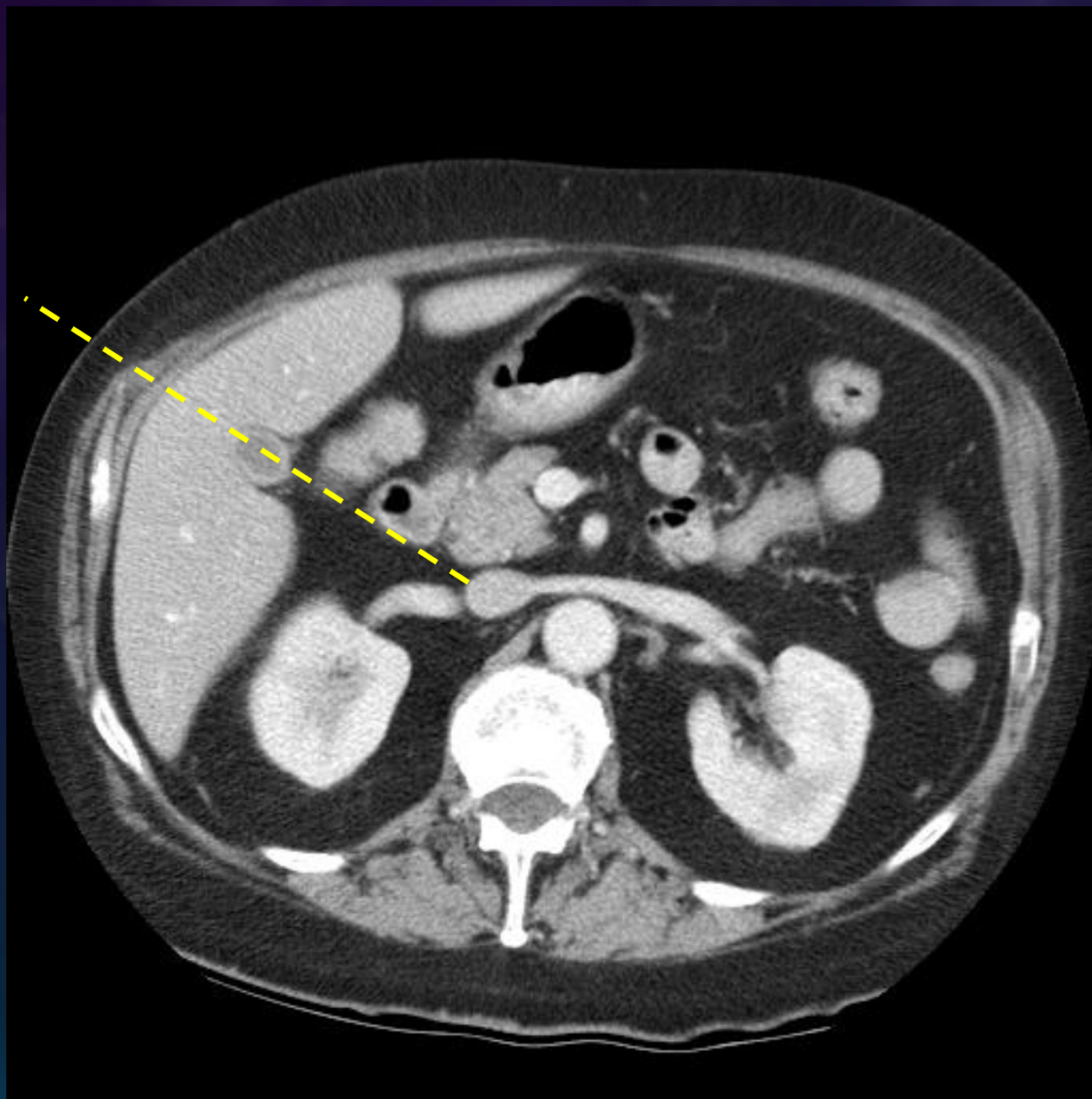
Occasionally the GB is displaced and its neck should be traced so as to draw an imaginary Cantlie's line, dividing left and right hepatic lobe.

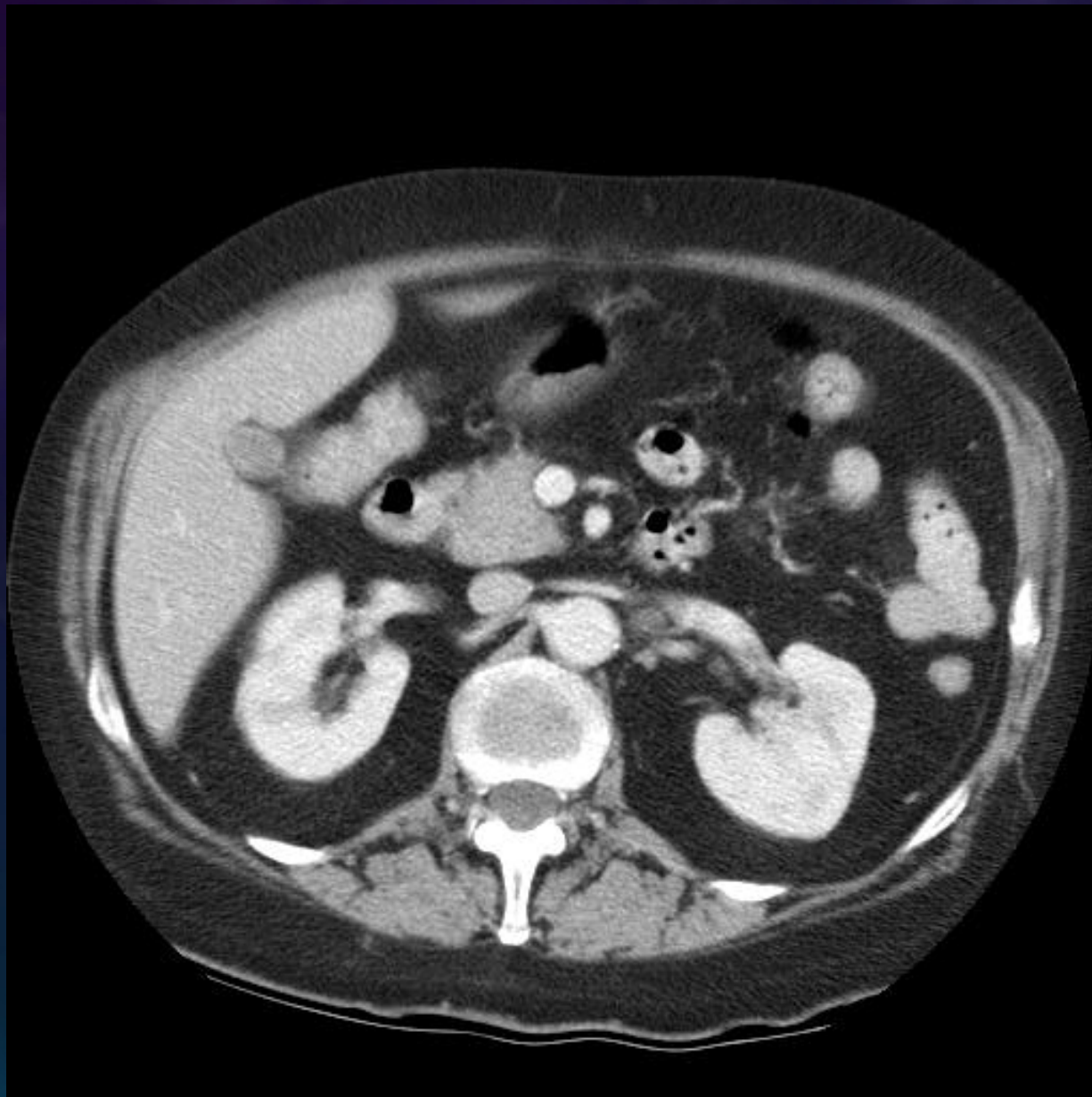
Umbilical Fissure







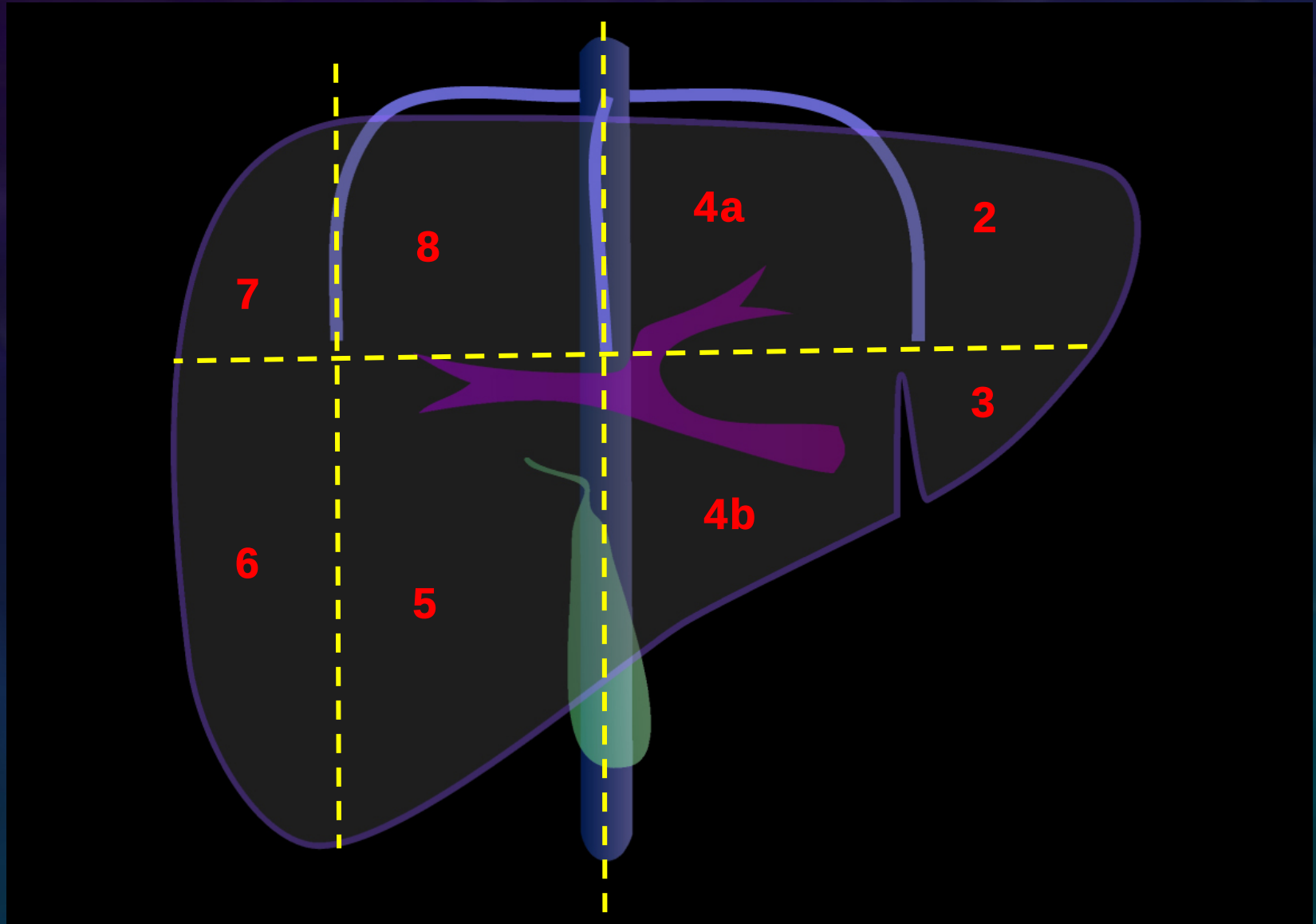




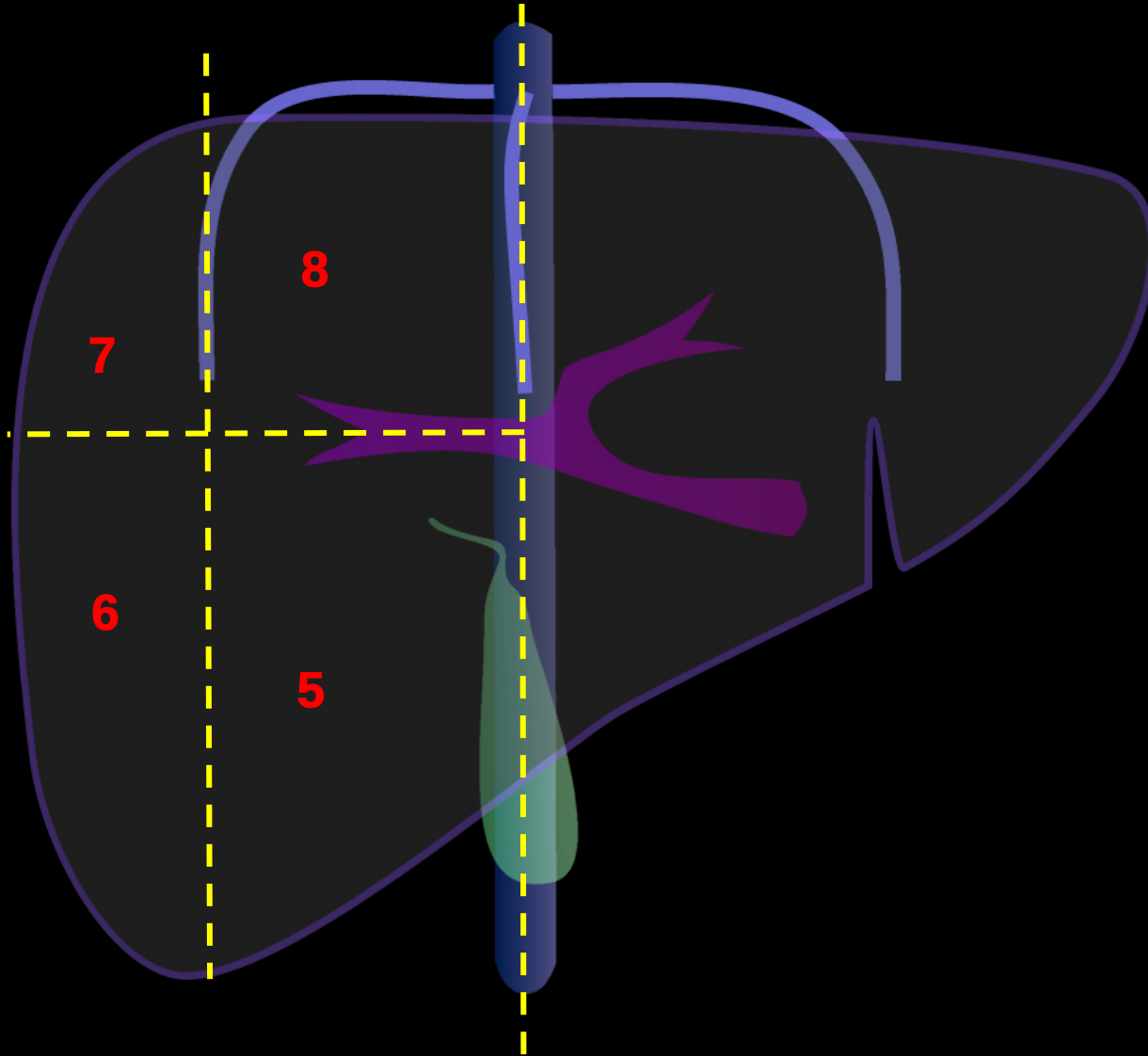




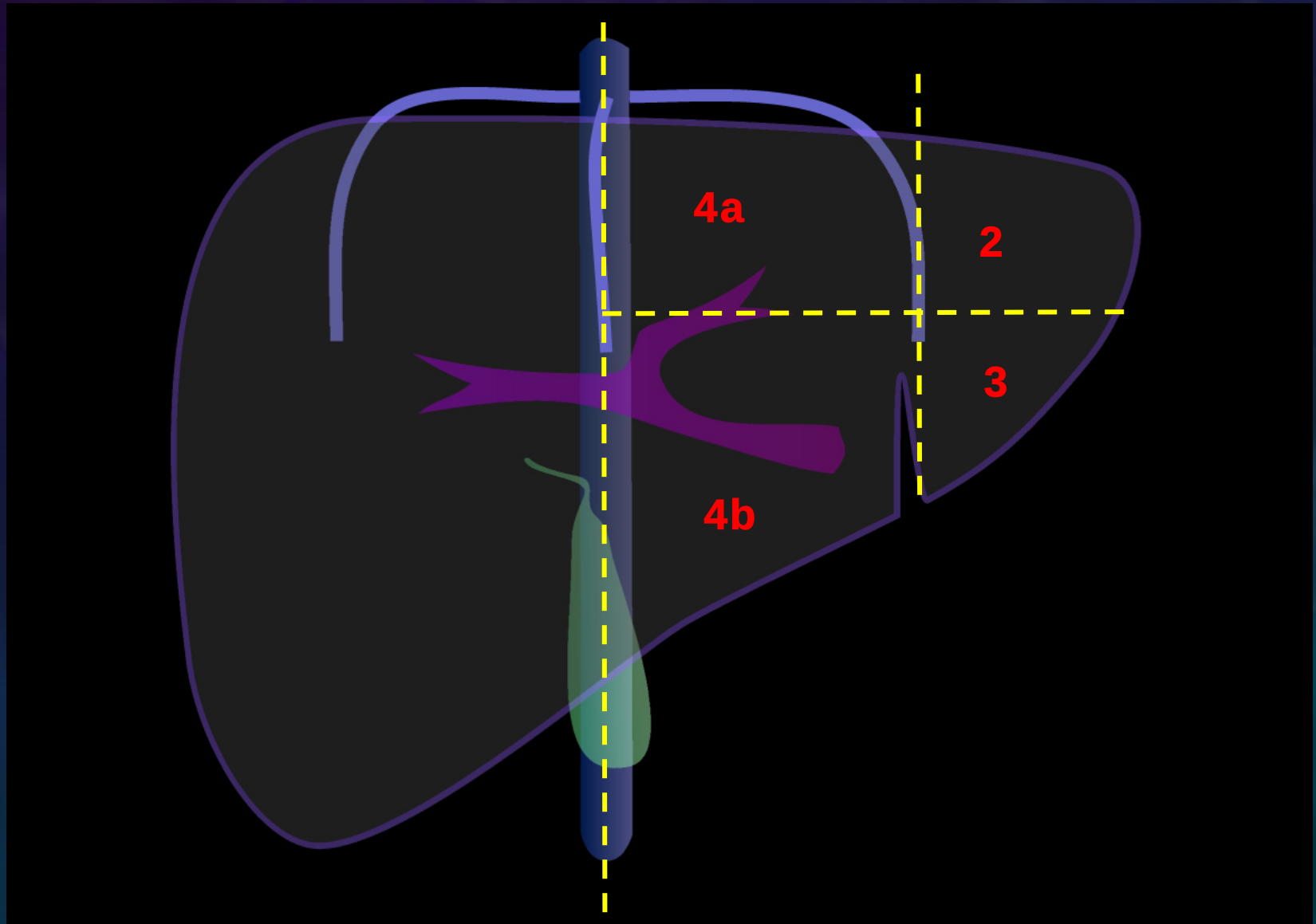
Liver Segments: Coronal Schematic



Right Lobe: Segments 5,6,7,8



Left Lobe: Segments 2,3,4



Left Lobe: Segment 1

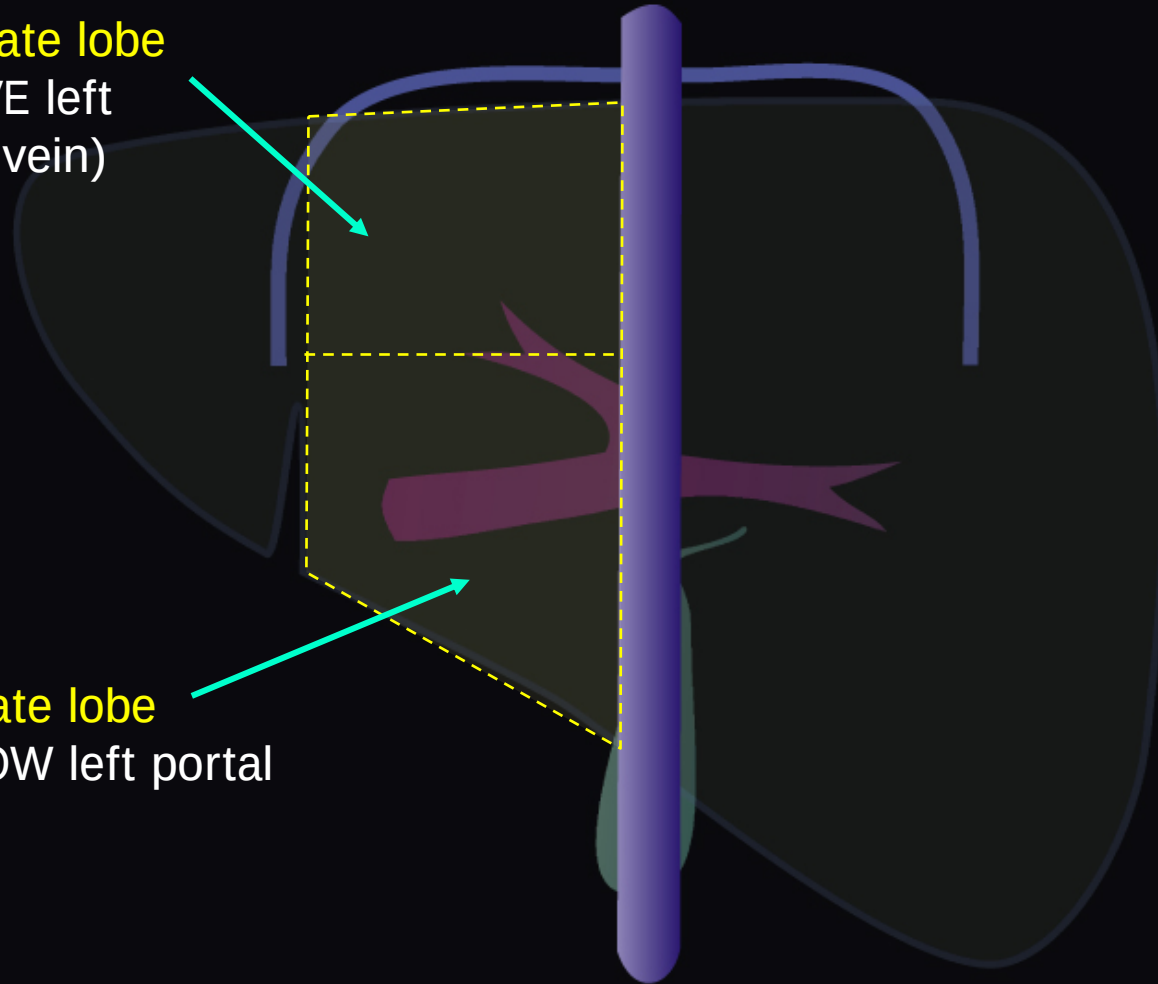
View from behind

Quadrate lobe

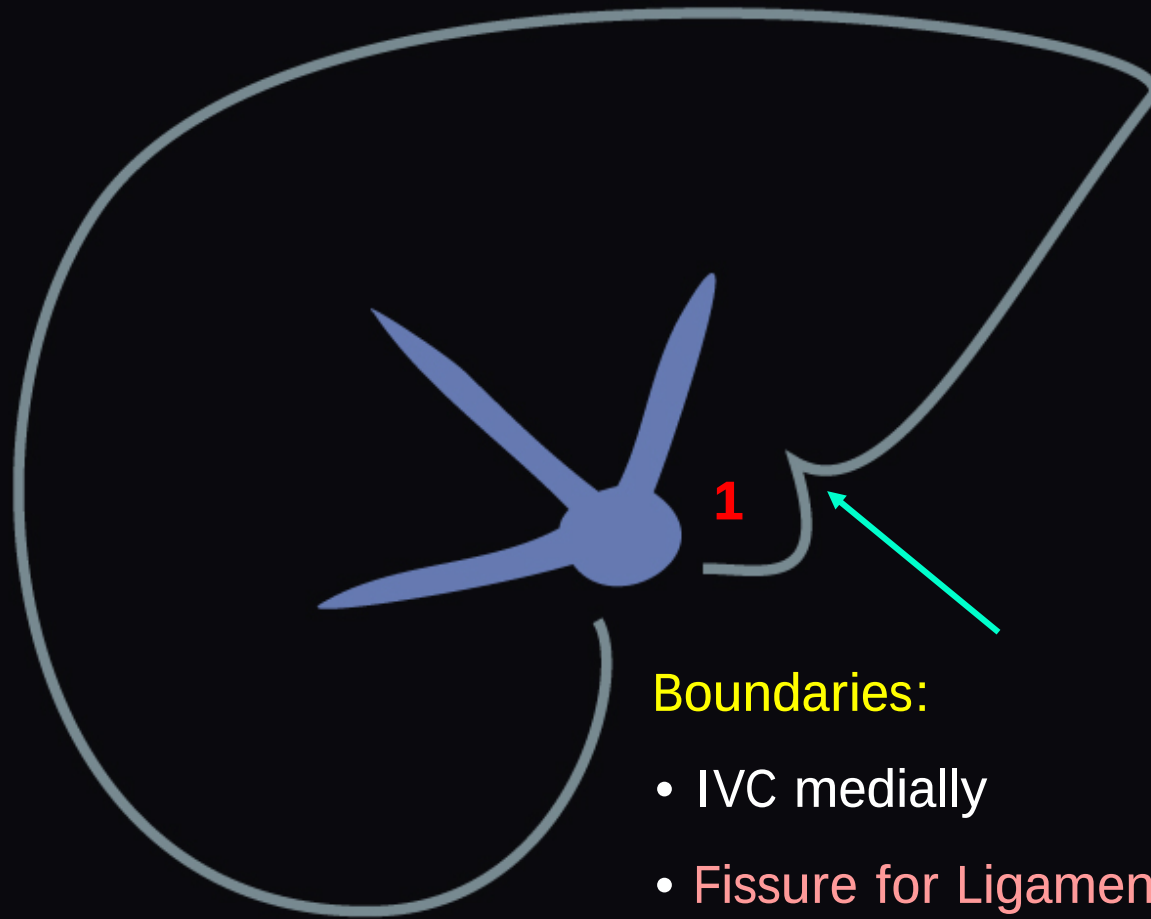
(ABOVE left
portal vein)

Caudate lobe

(BELOW left portal
vein)



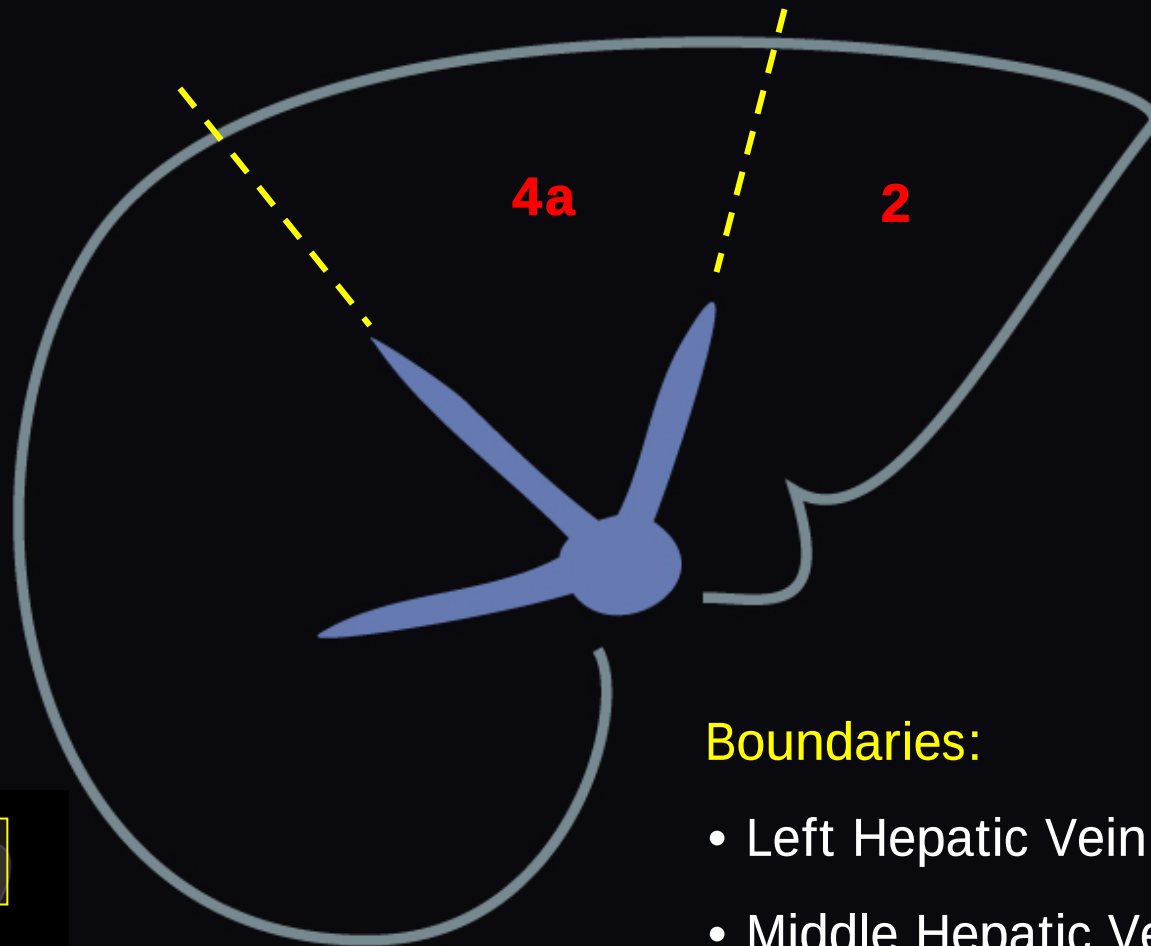
Left Lobe: Segment 1



Boundaries:

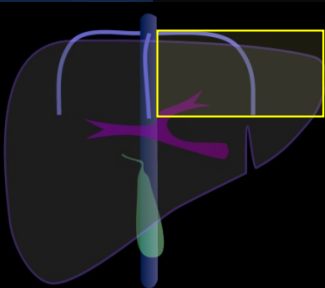
- IVC medially
- Fissure for Ligamentum Venosum laterally

Left Lobe: Segments 2,3,4

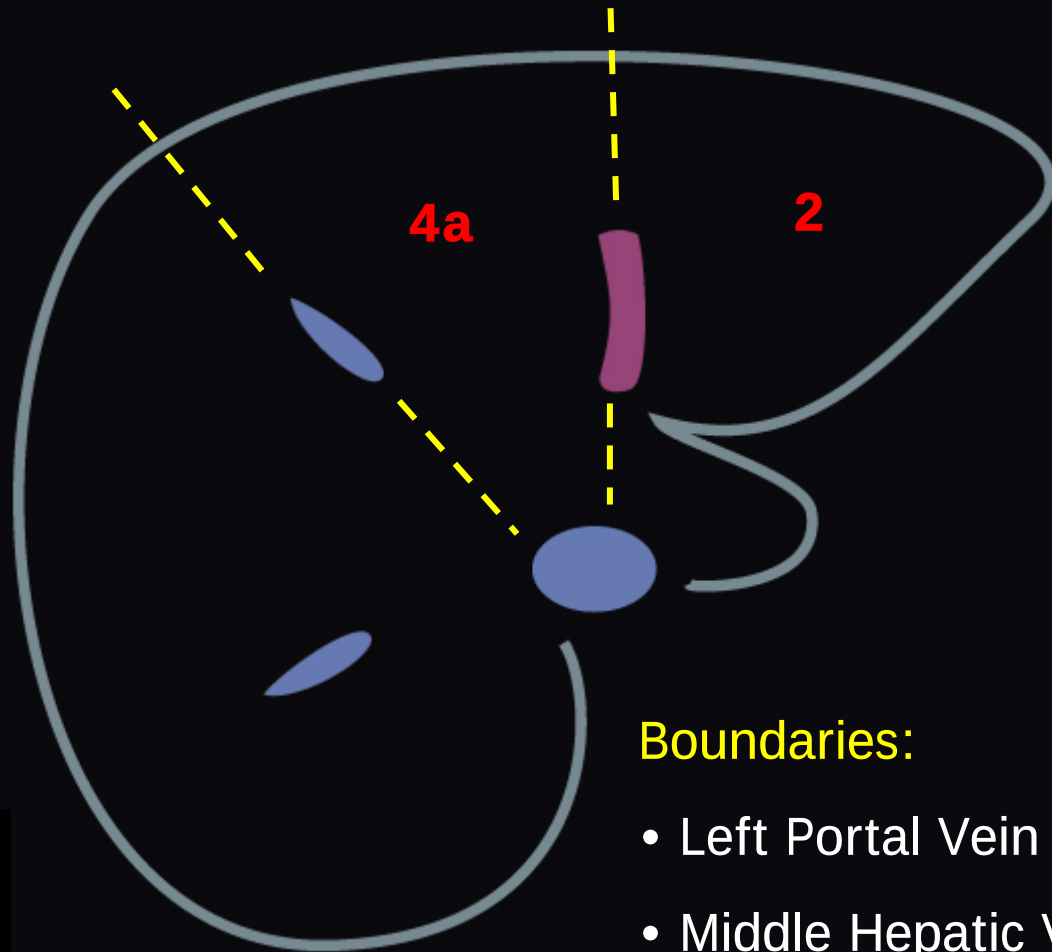
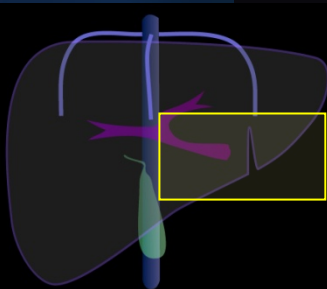


Boundaries:

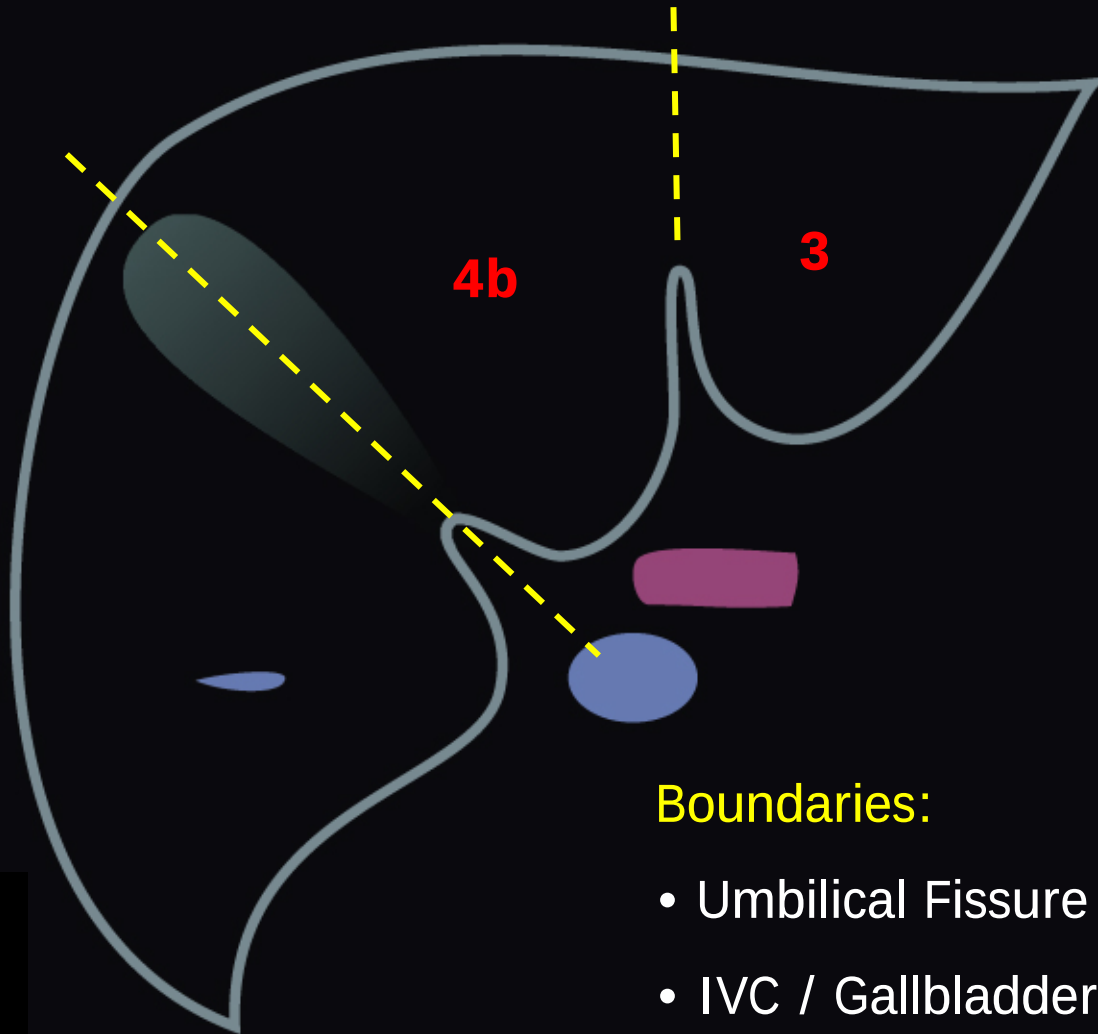
- Left Hepatic Vein
- Middle Hepatic Vein



Left Lobe: Segments 2,3,4

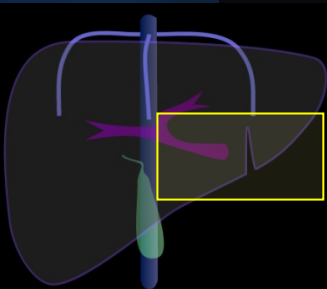


Left Lobe: Segments 2,3,4



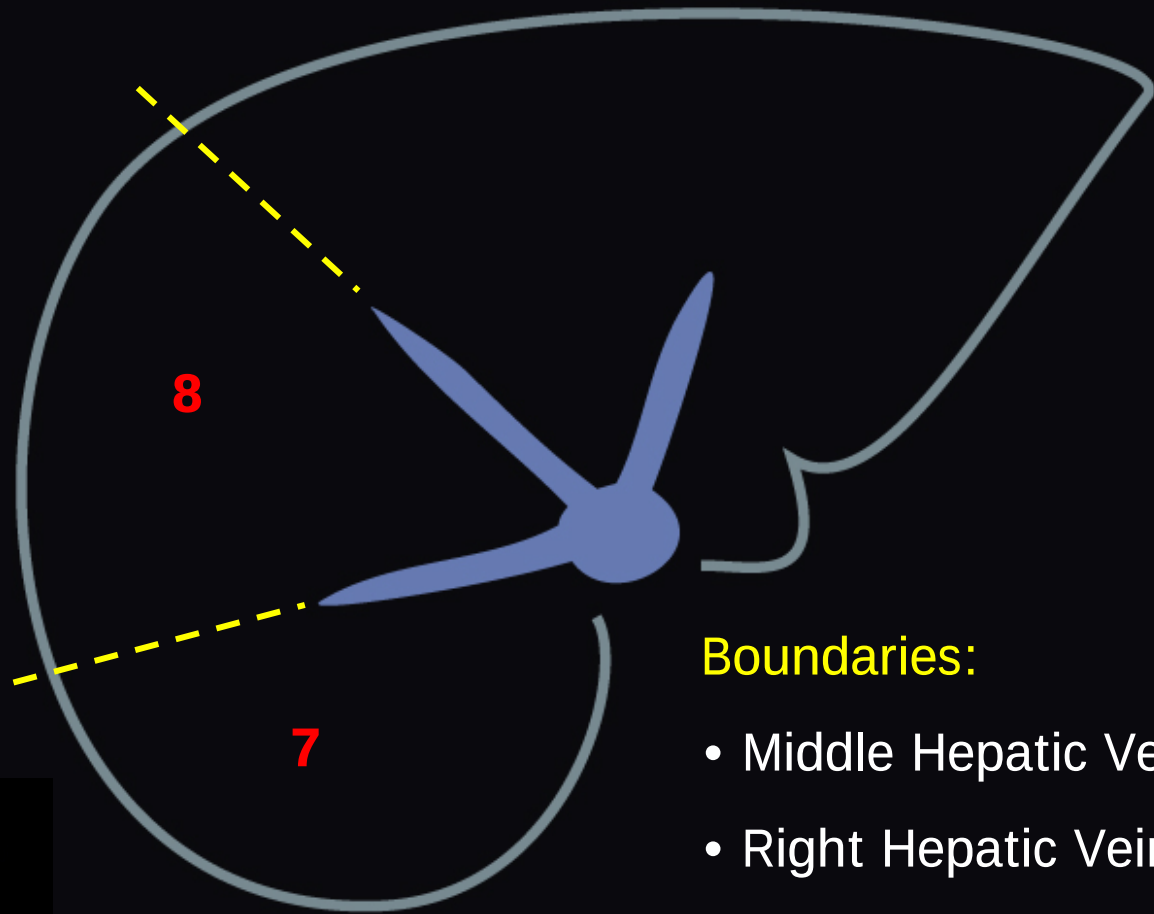
Boundaries:

- Umbilical Fissure
- IVC / Gallbladder Axis



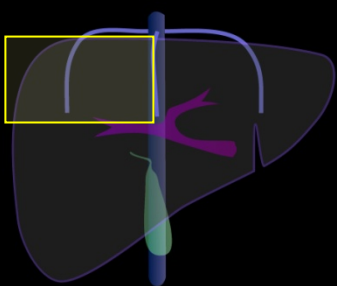
Right Lobe: Segments 7,8

ABOVE the right portal vein

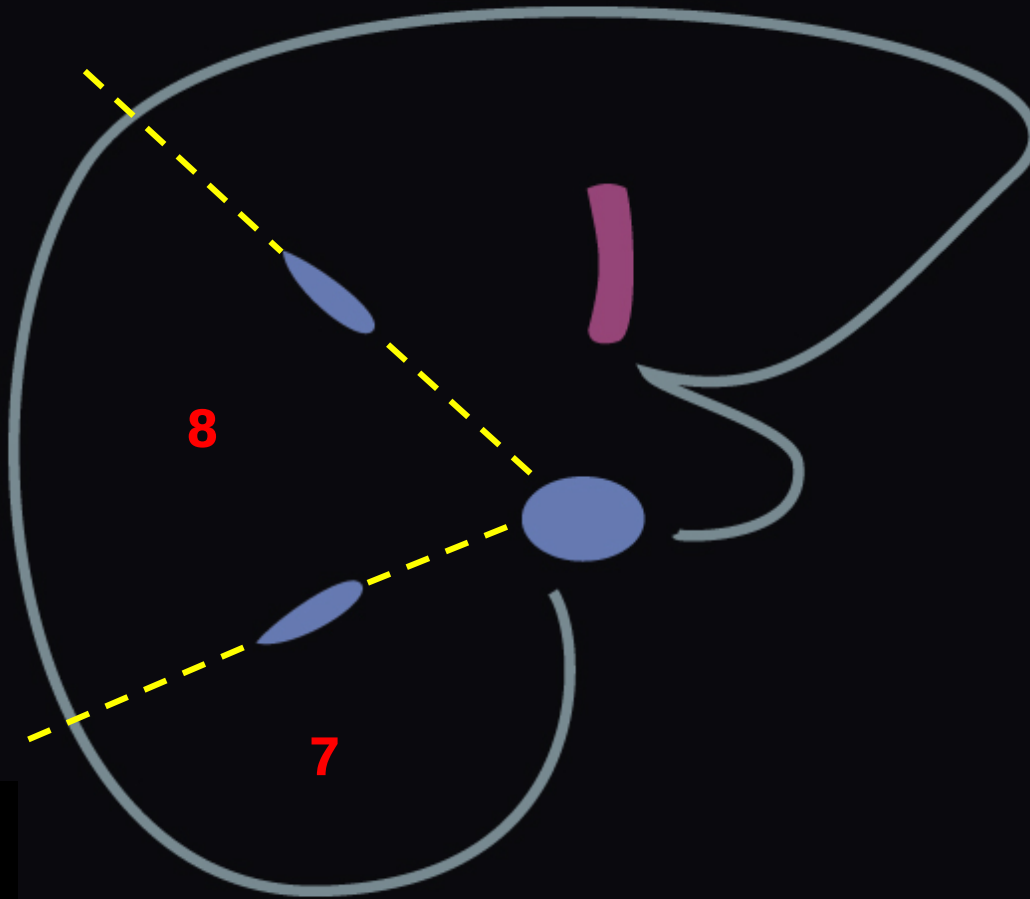
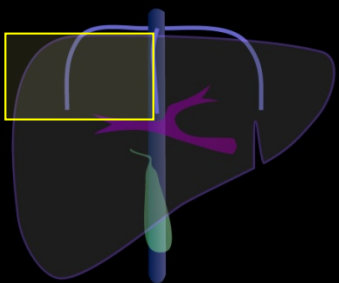


Boundaries:

- Middle Hepatic Vein
- Right Hepatic Vein

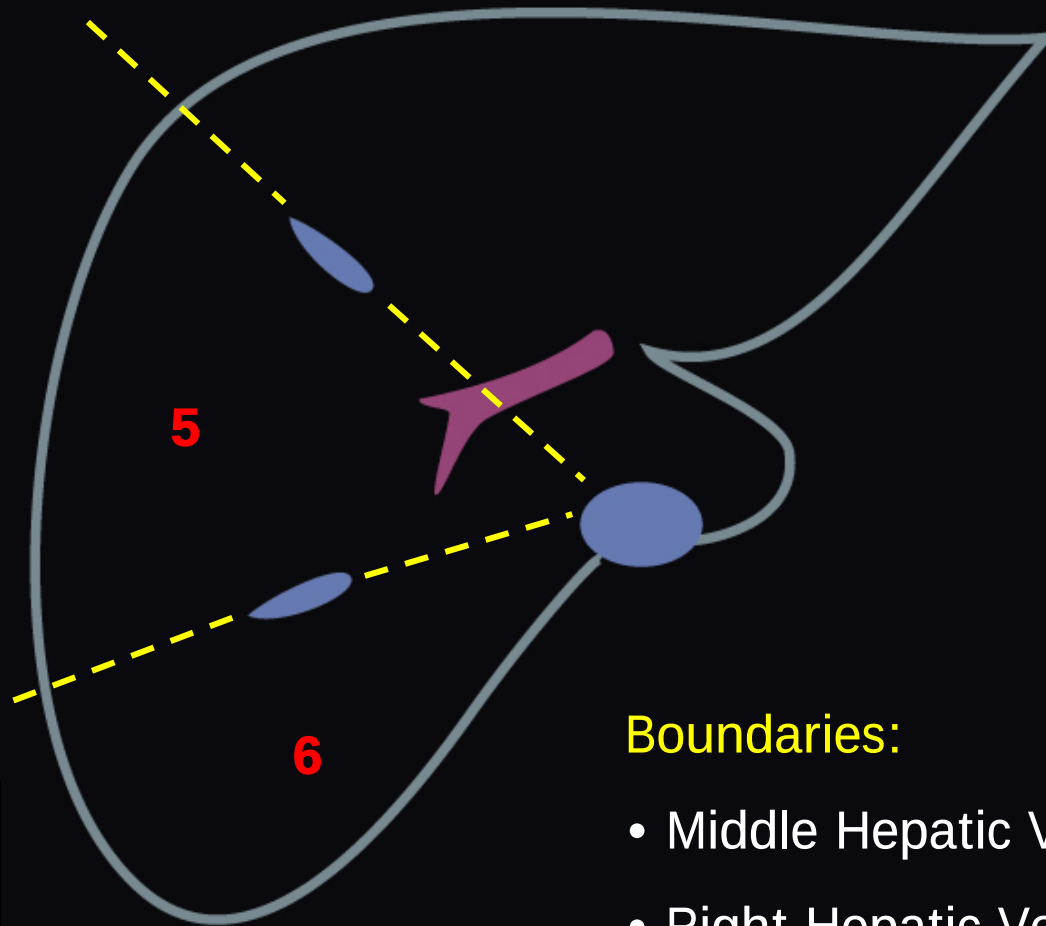


Right Lobe: Segments 7,8



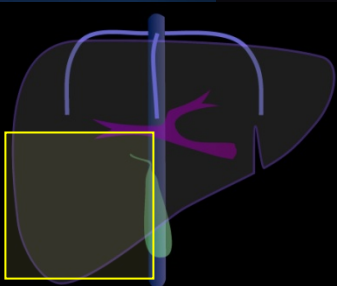
Right Lobe: Segments 5,6

BELOW the right portal vein

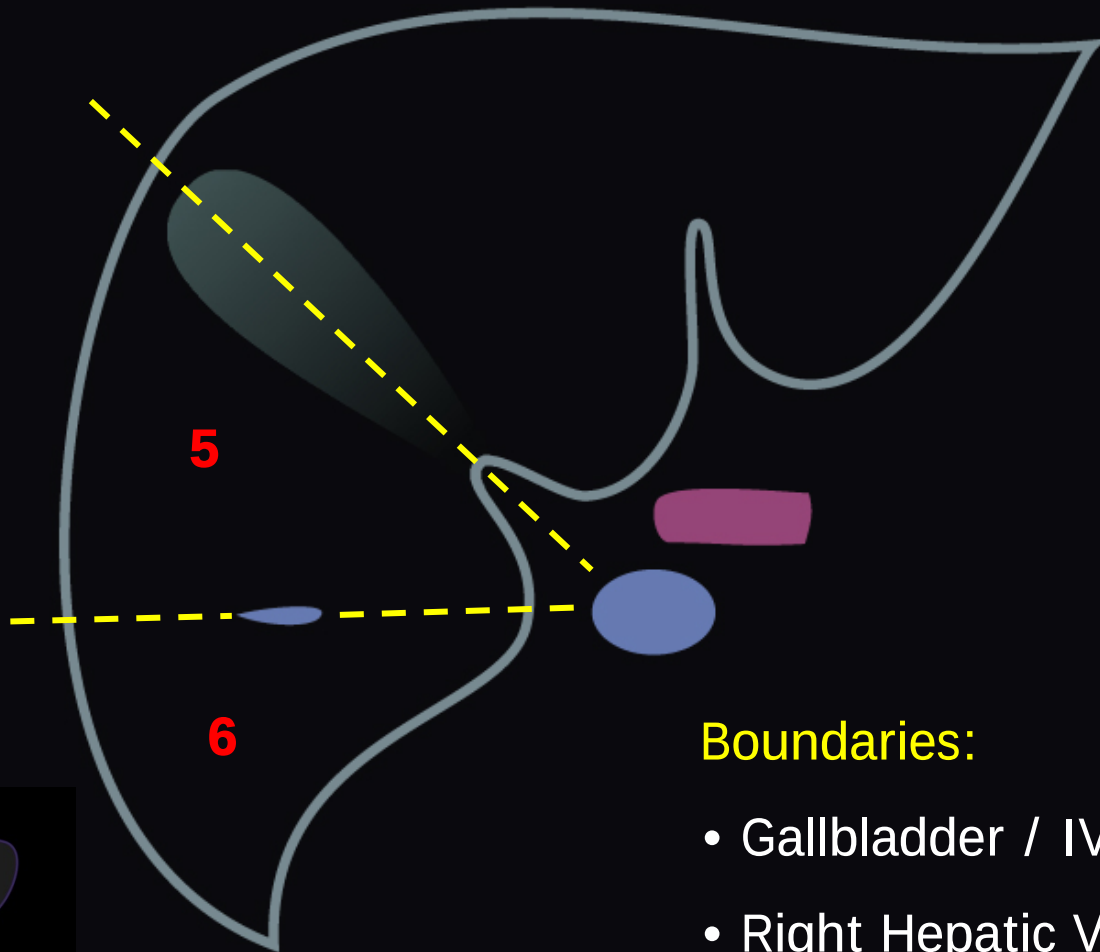


Boundaries:

- Middle Hepatic Vein
- Right Hepatic Vein

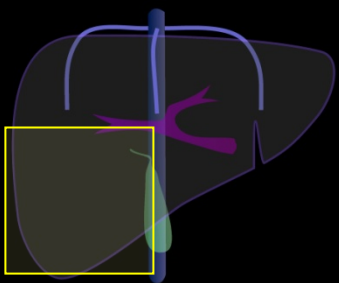


Right Lobe: Segments 5,6

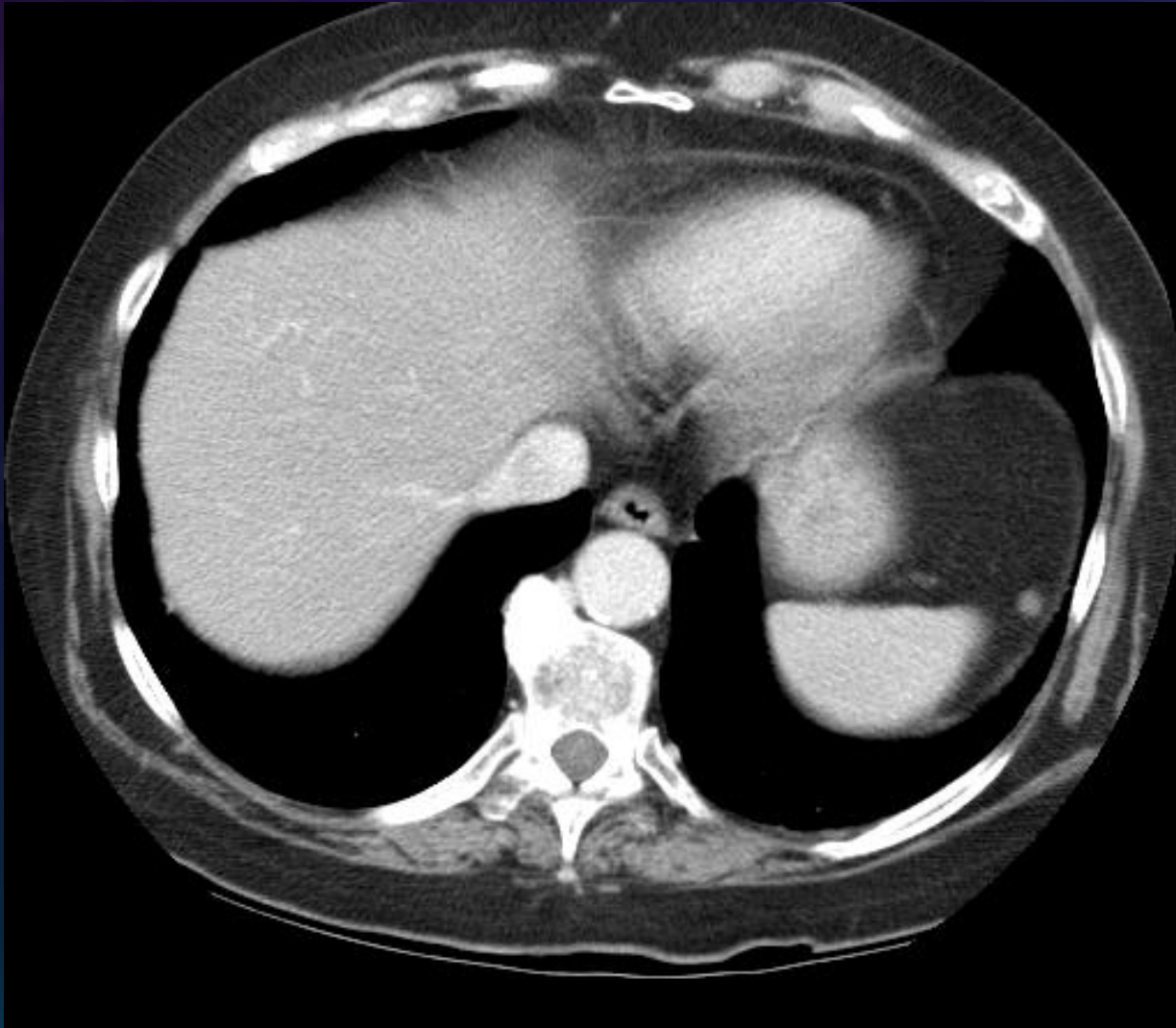


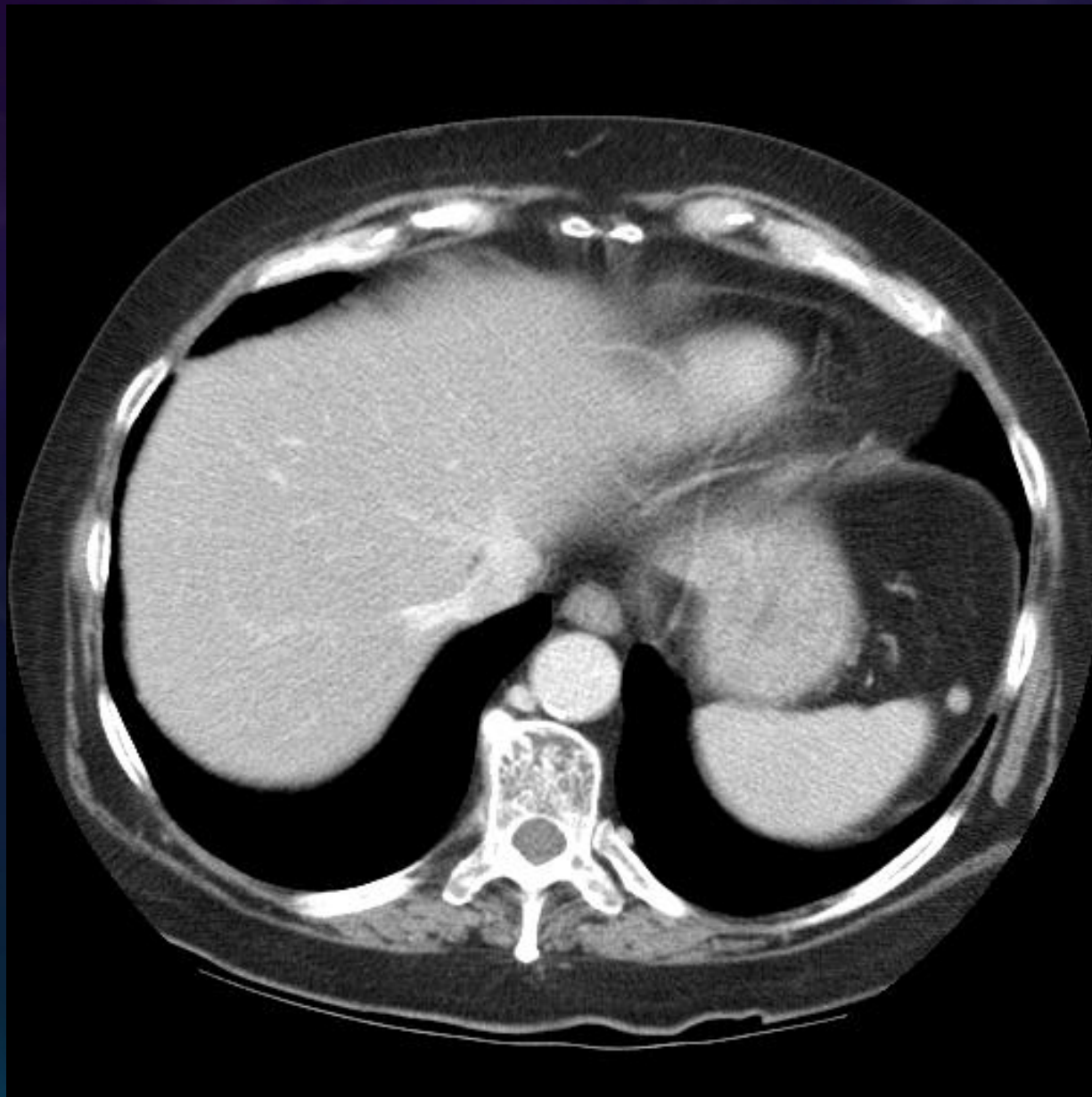
Boundaries:

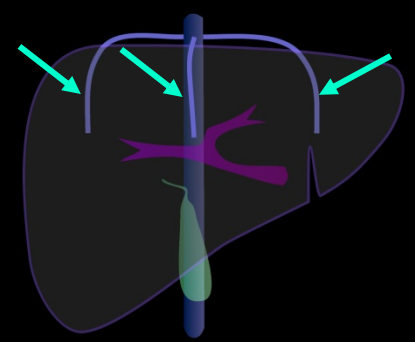
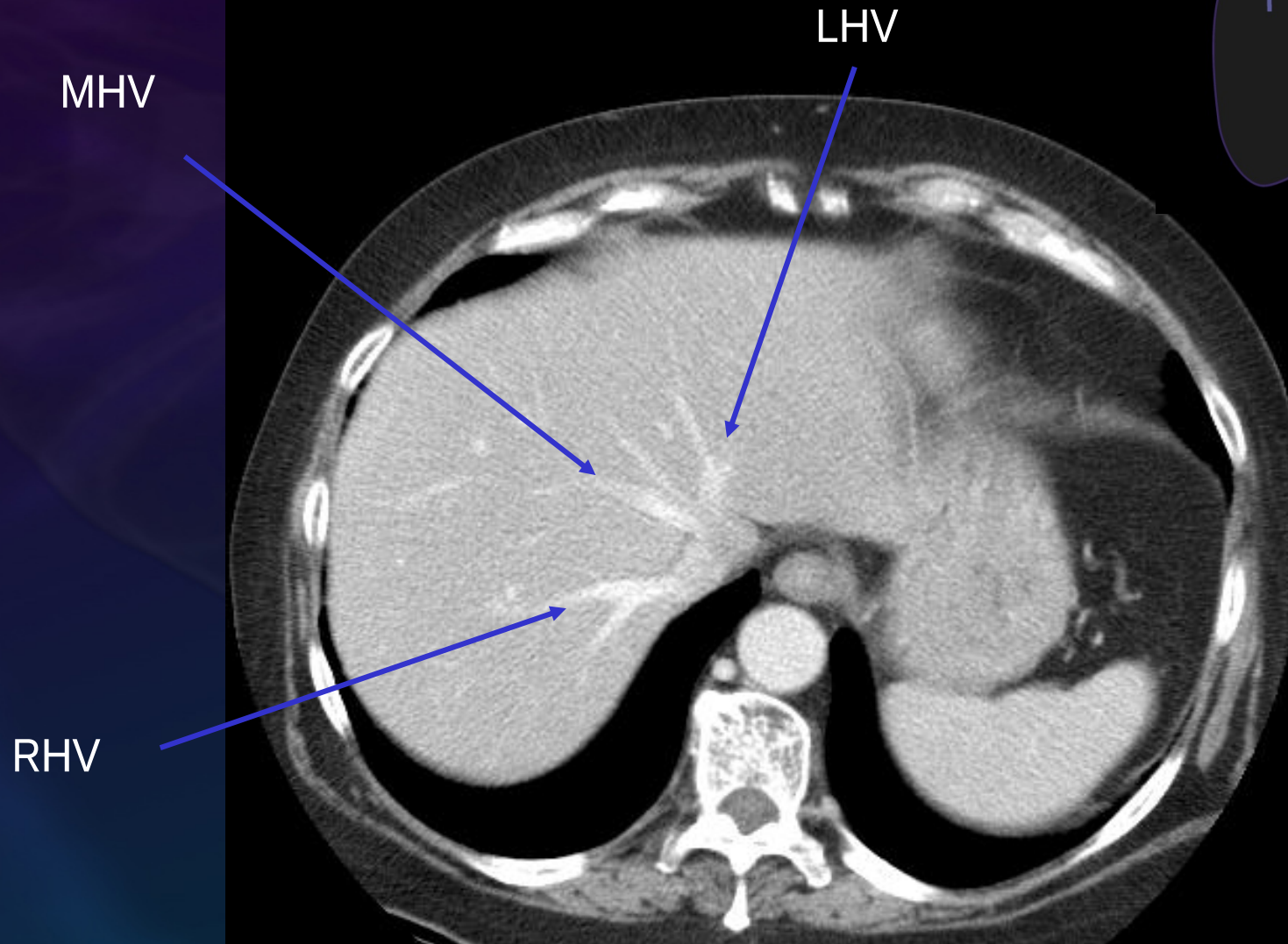
- Gallbladder / IVC axis
- Right Hepatic Vein



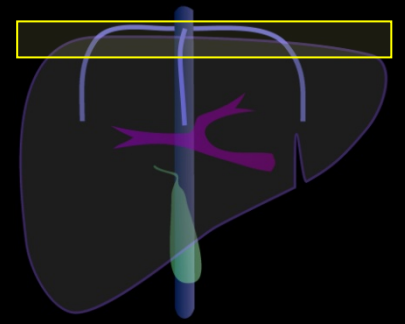
Liver Segments







LHV



MHV

2

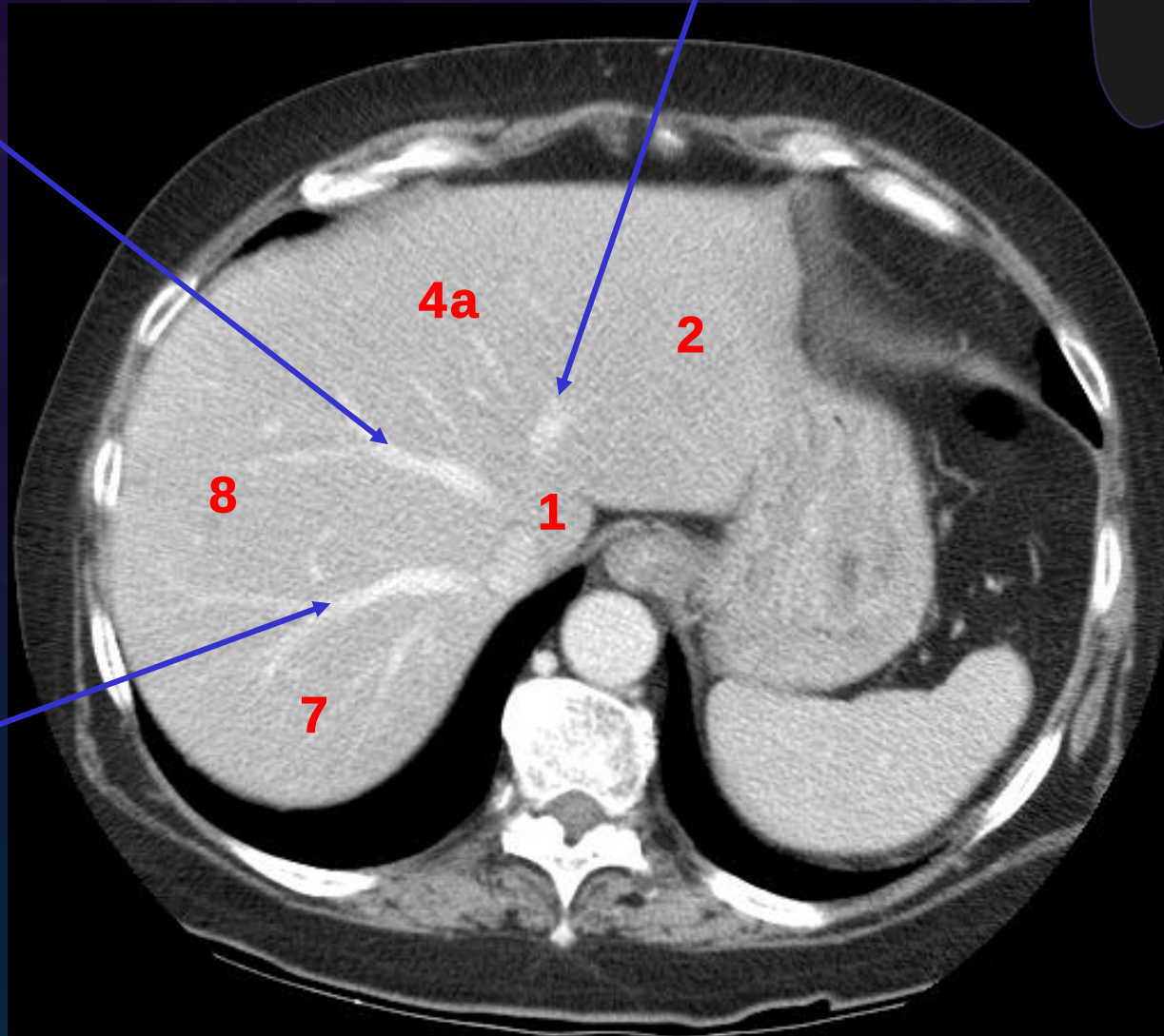
4a

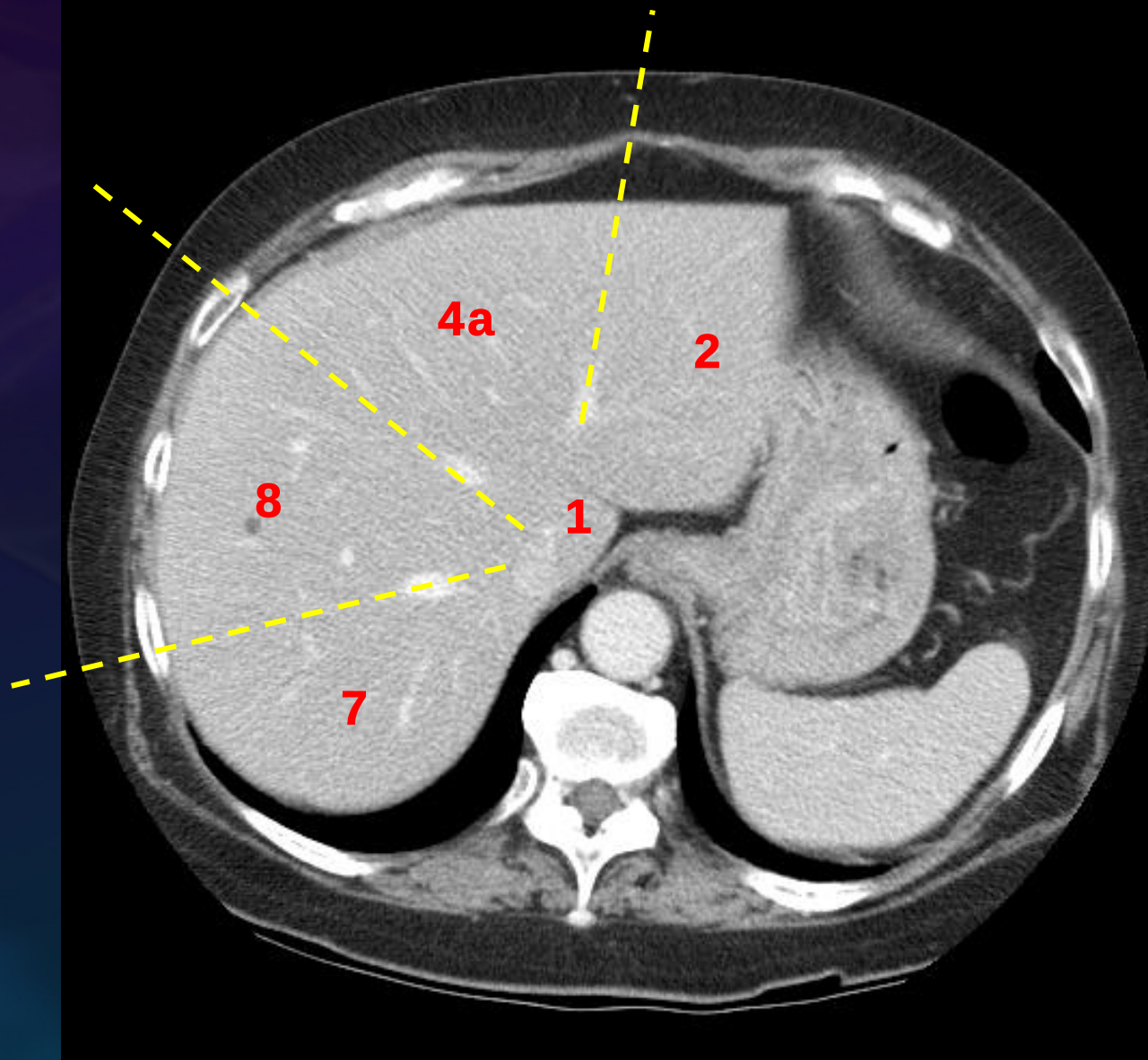
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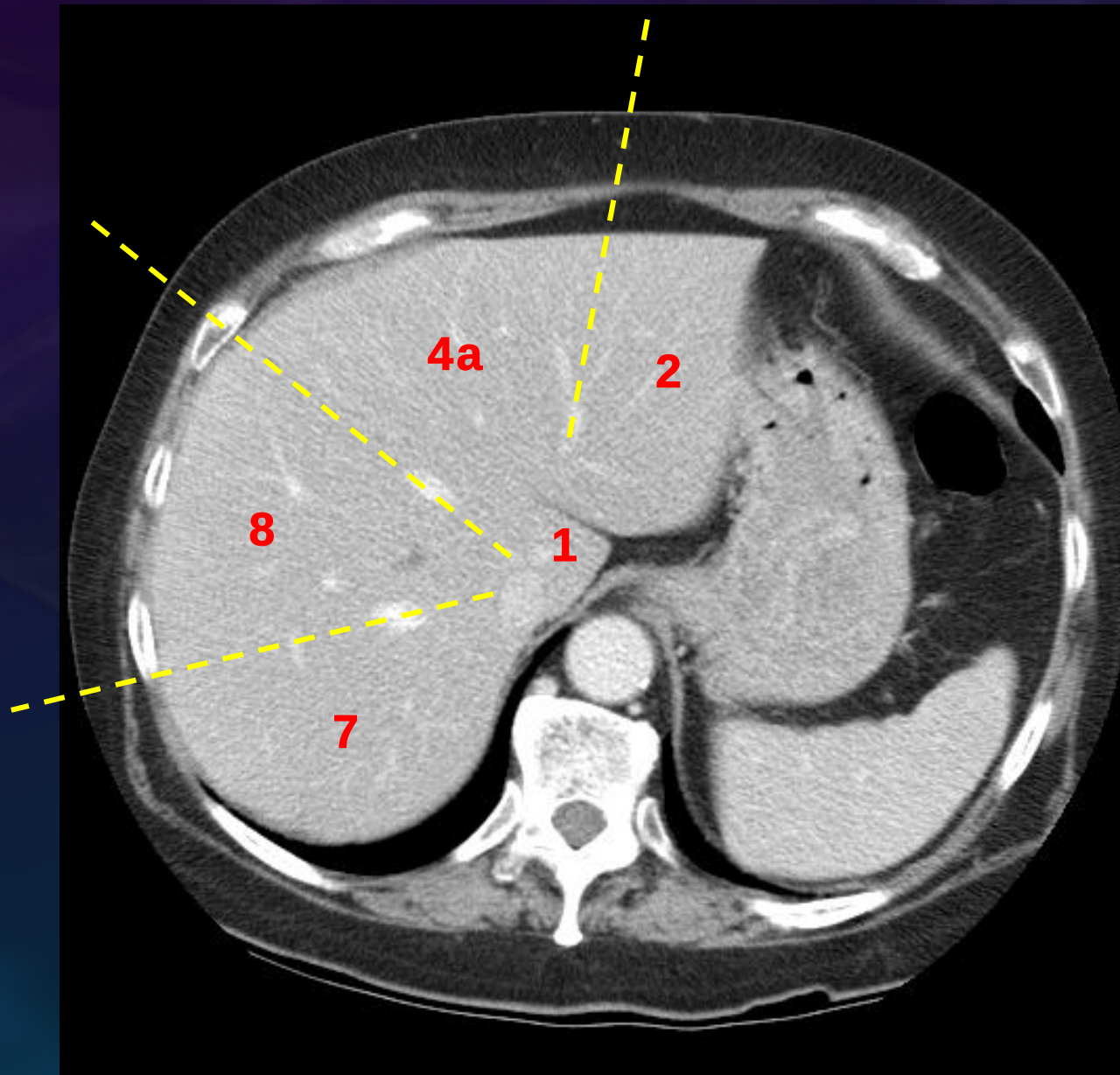
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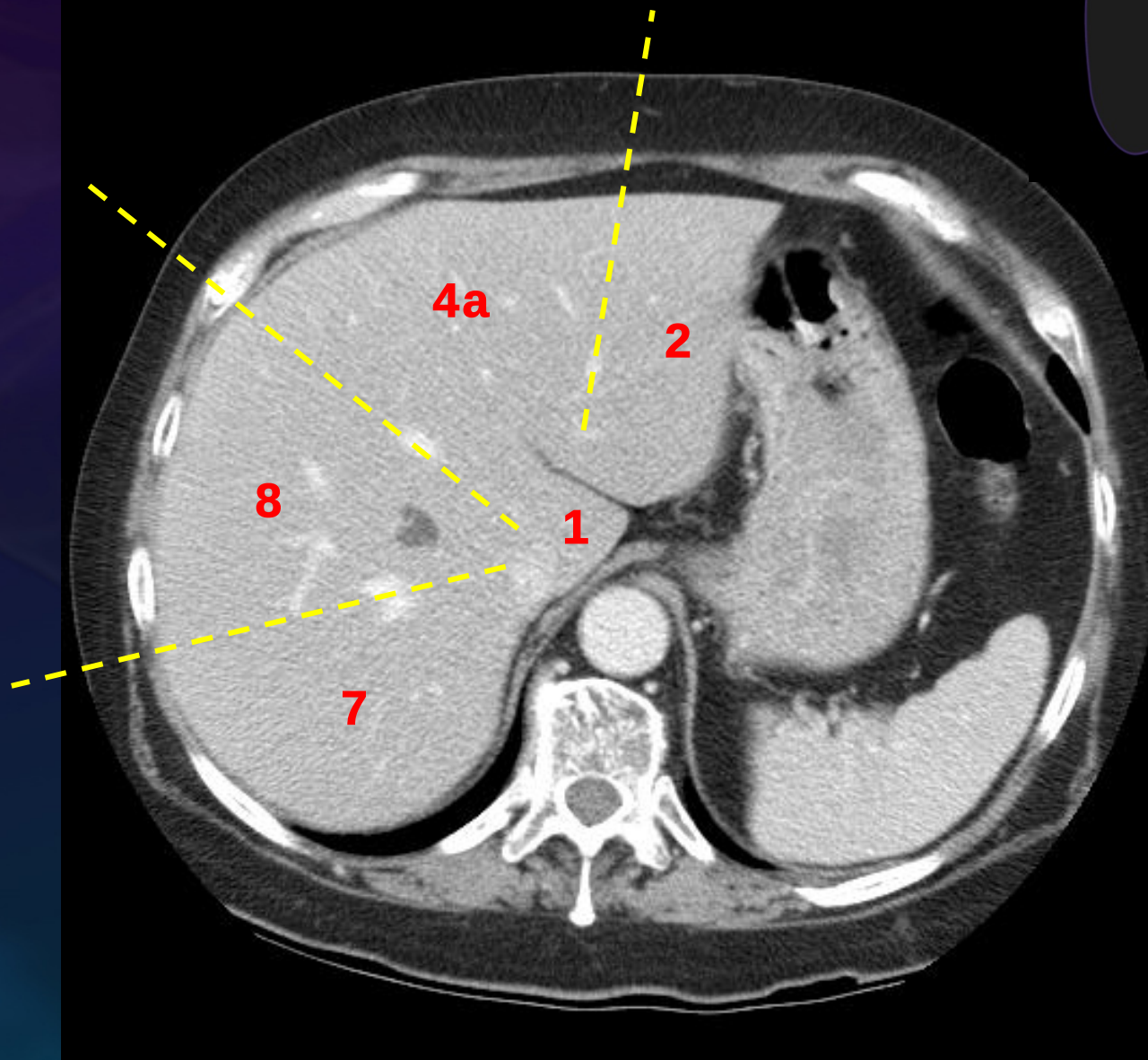
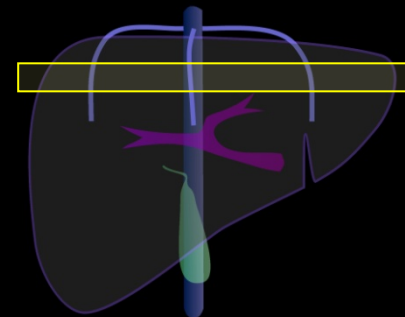
7

RHV



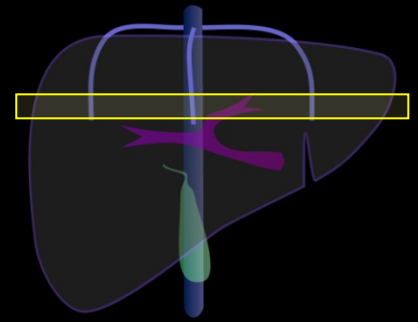
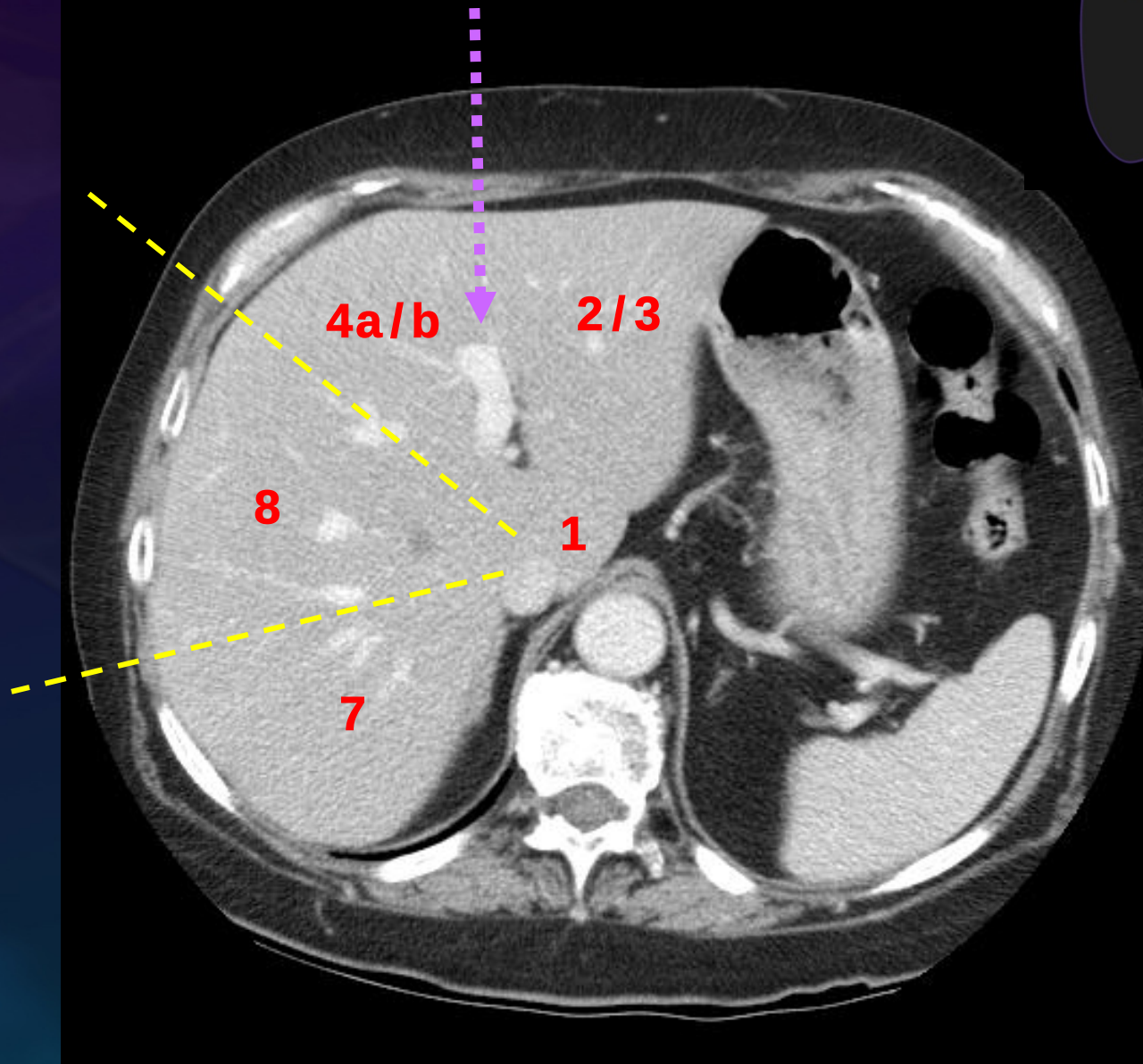




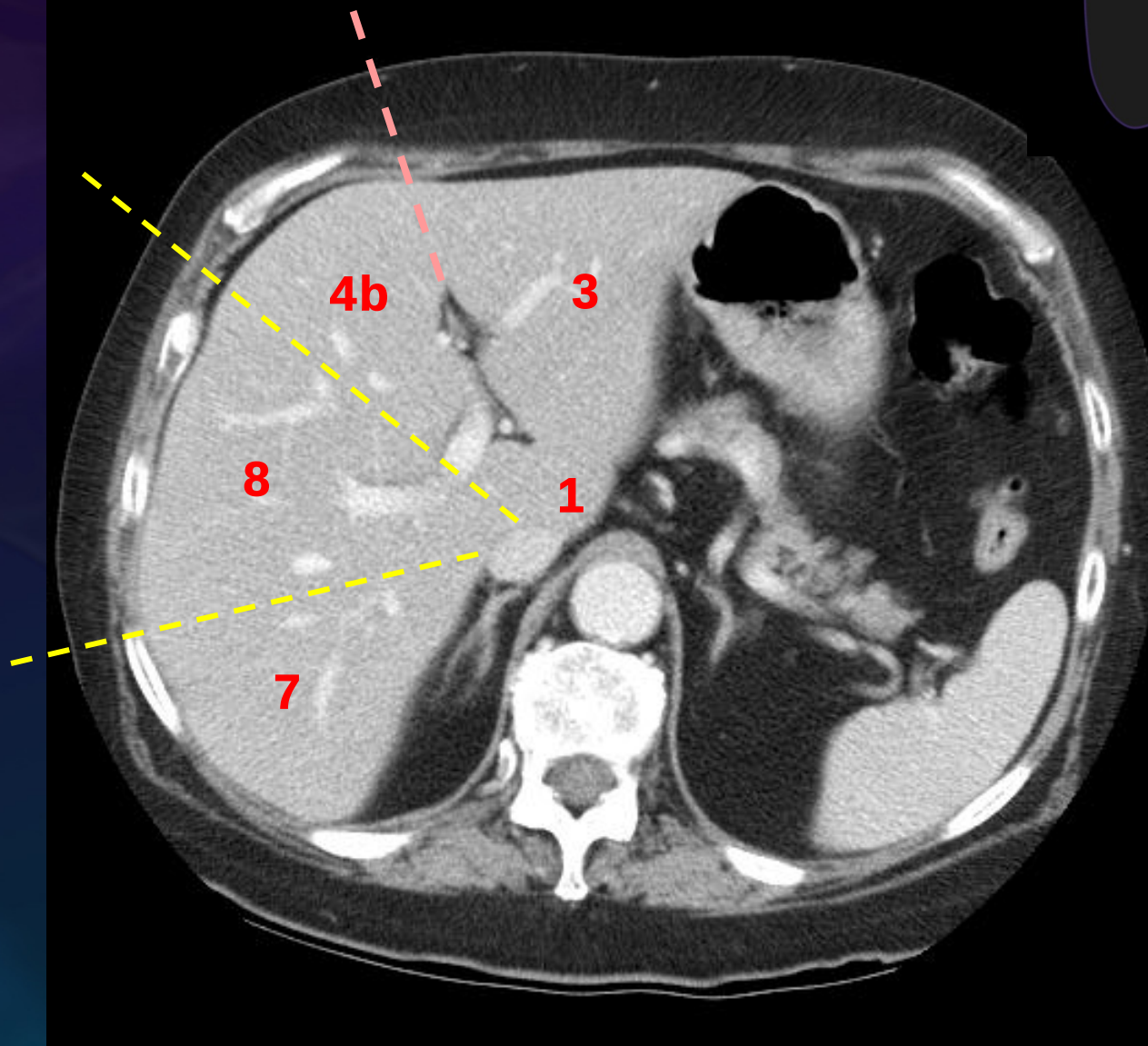
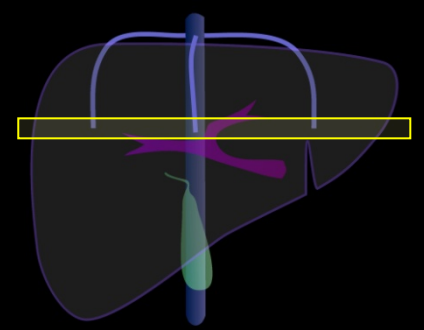


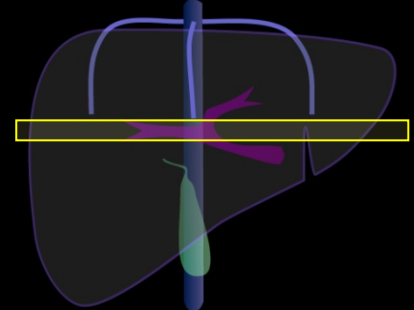
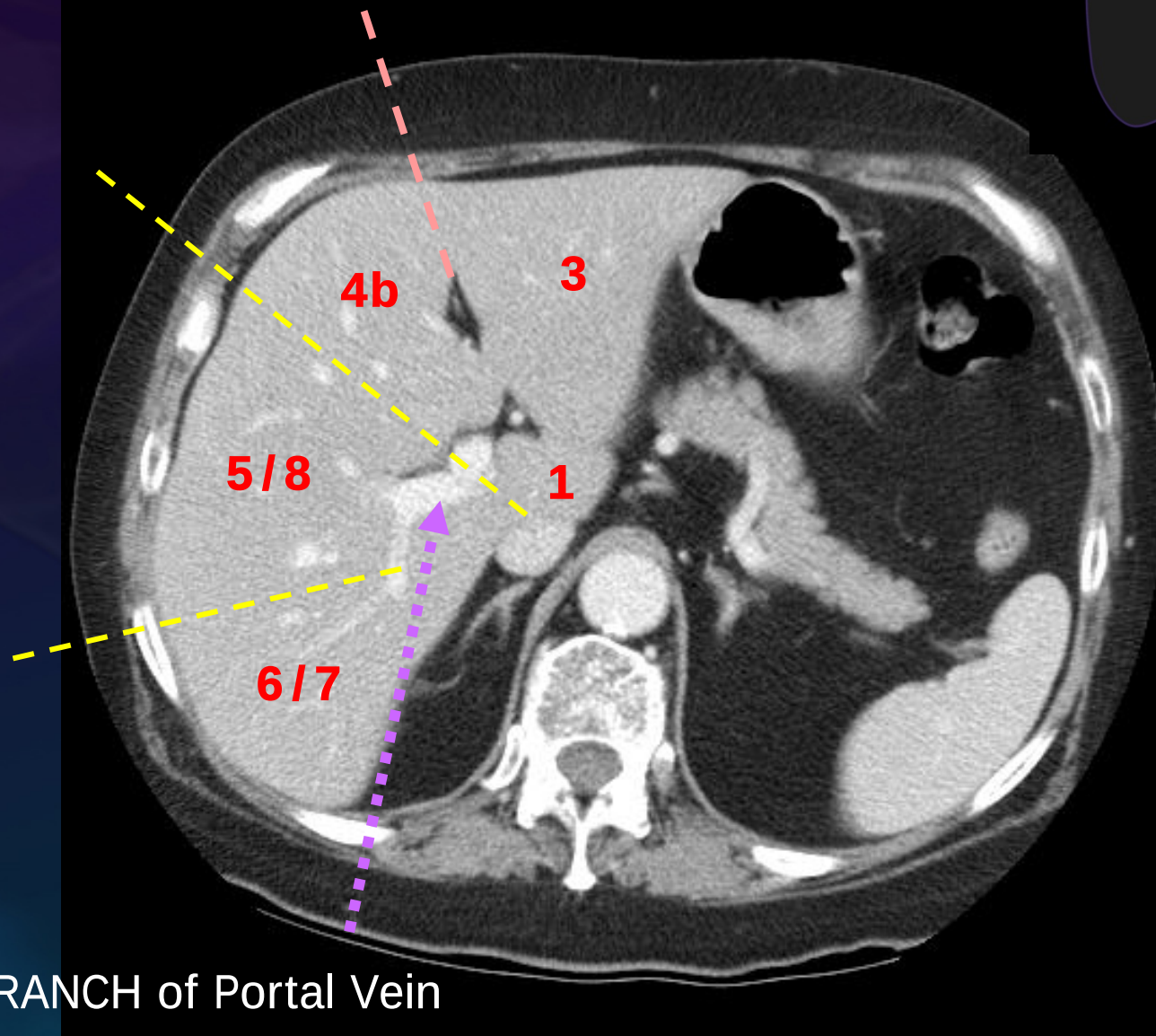


LEFT BRANCH of Portal Vein

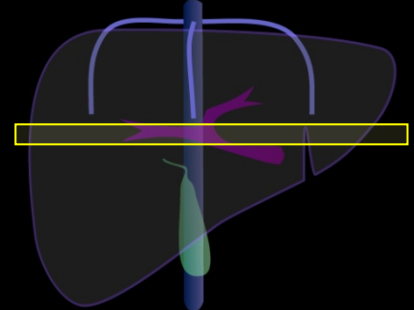
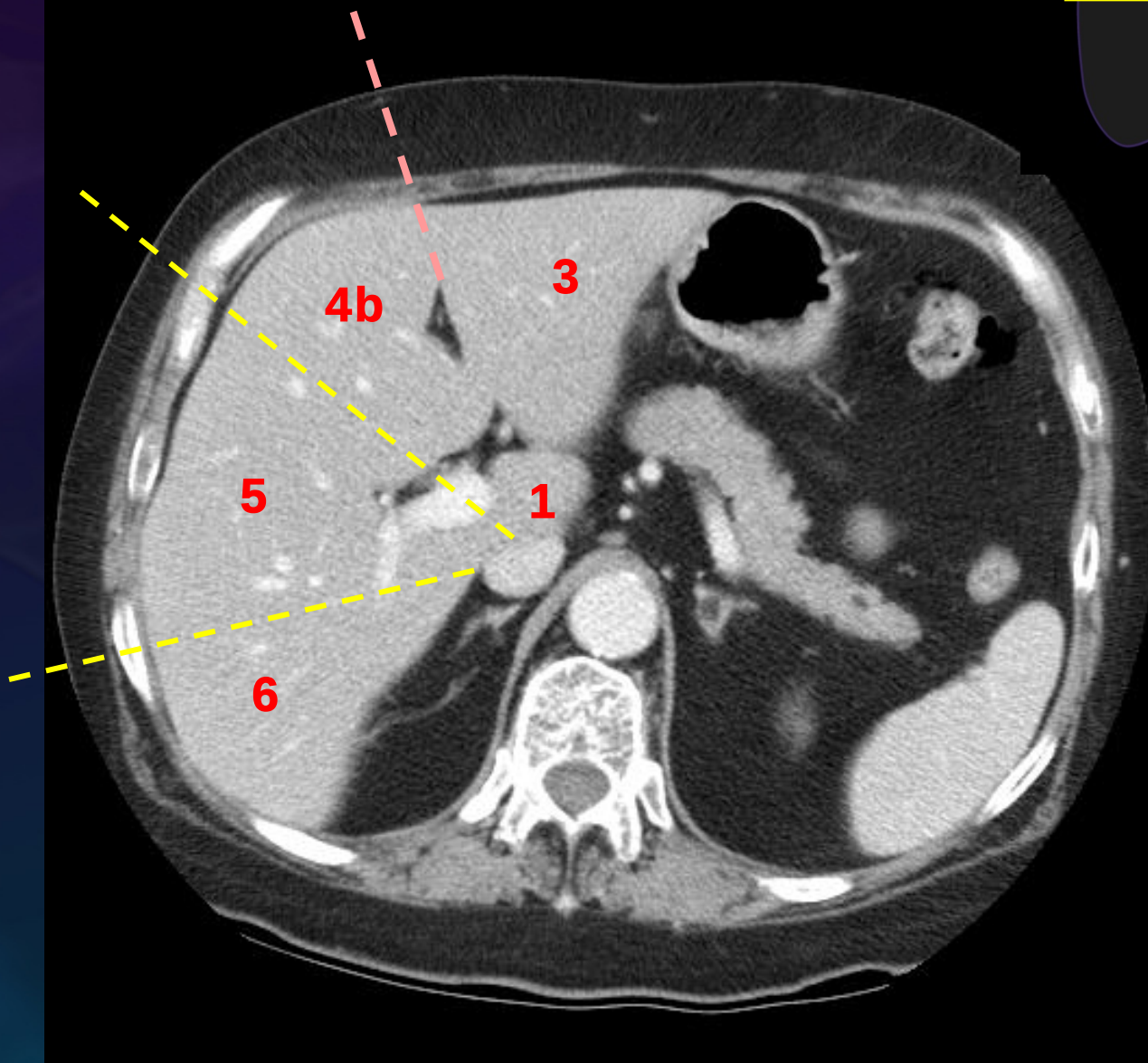




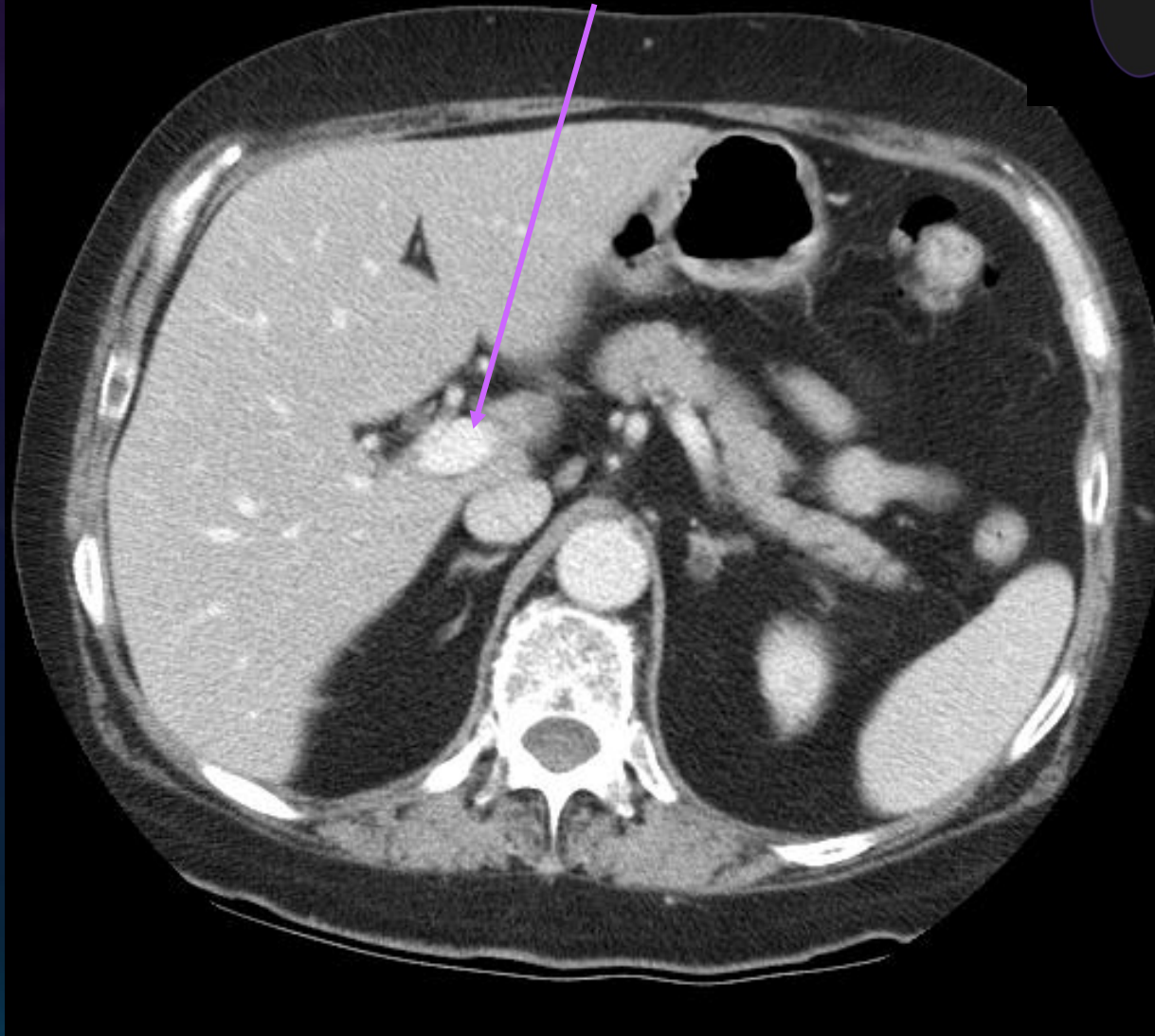
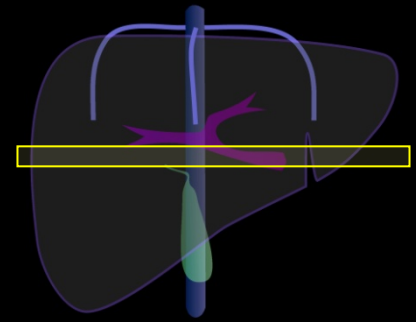


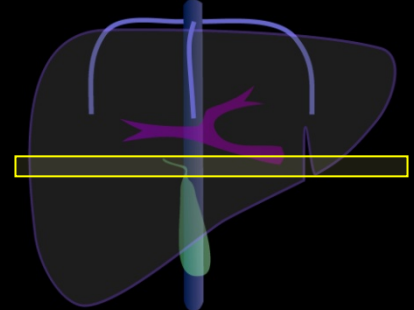
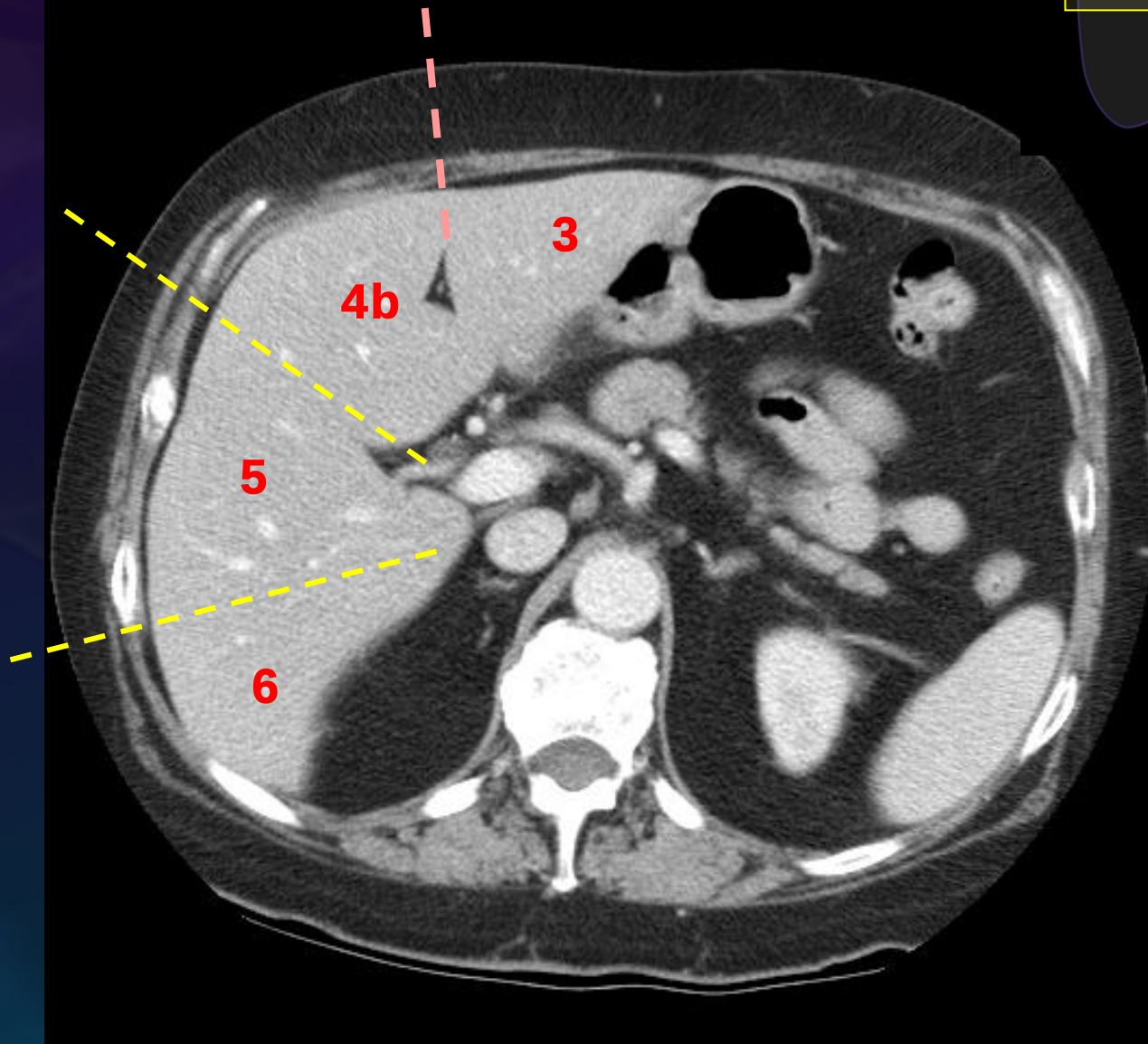


RIGHT BRANCH of Portal Vein

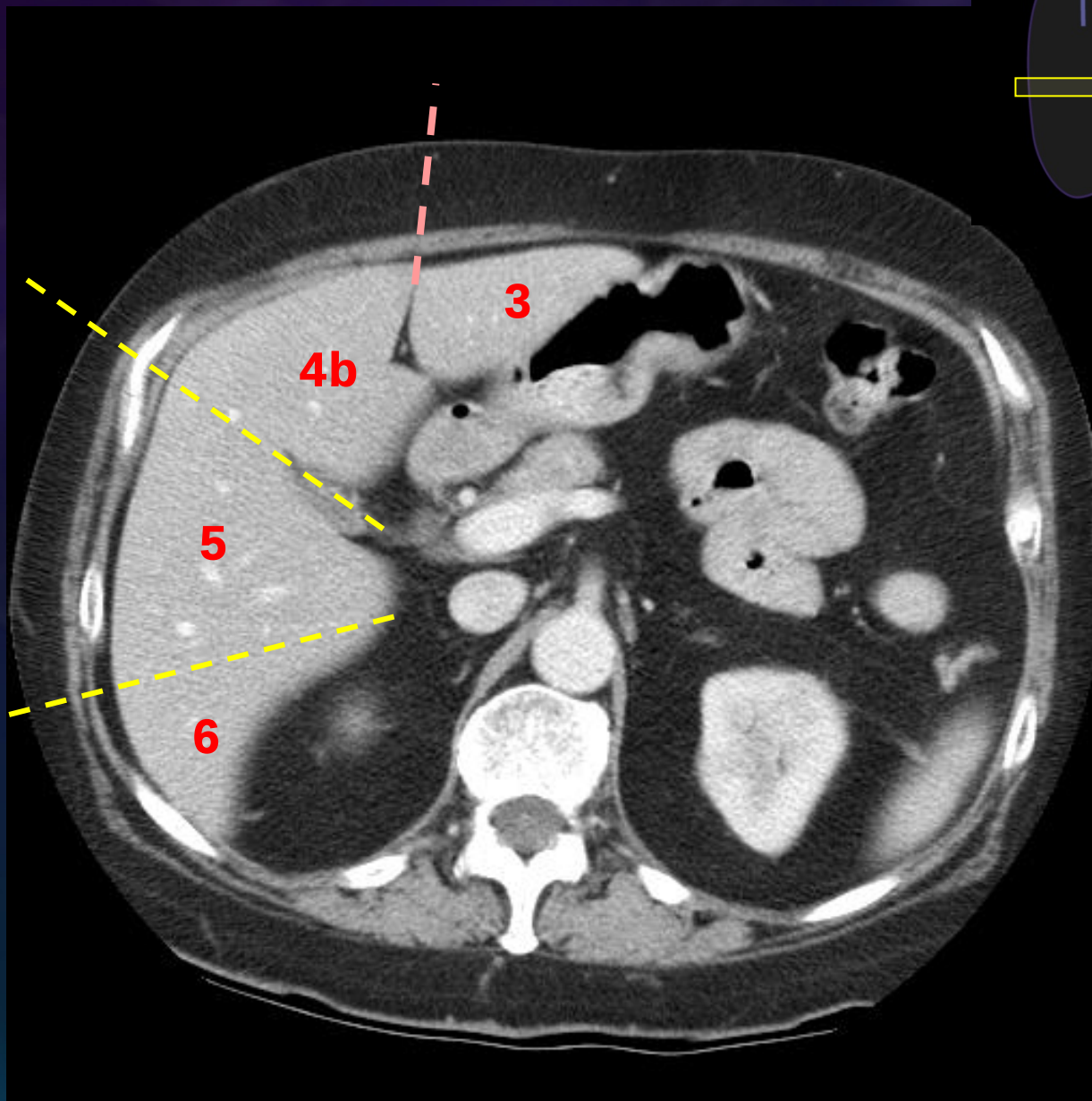
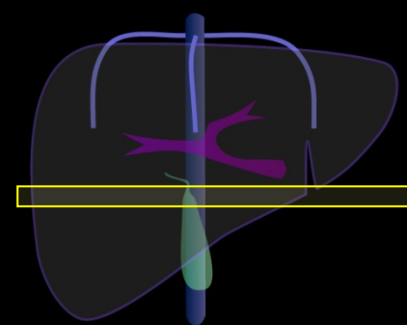


Main Portal Vein

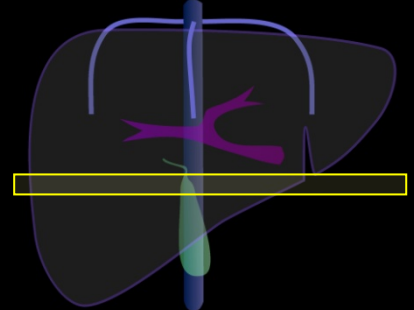
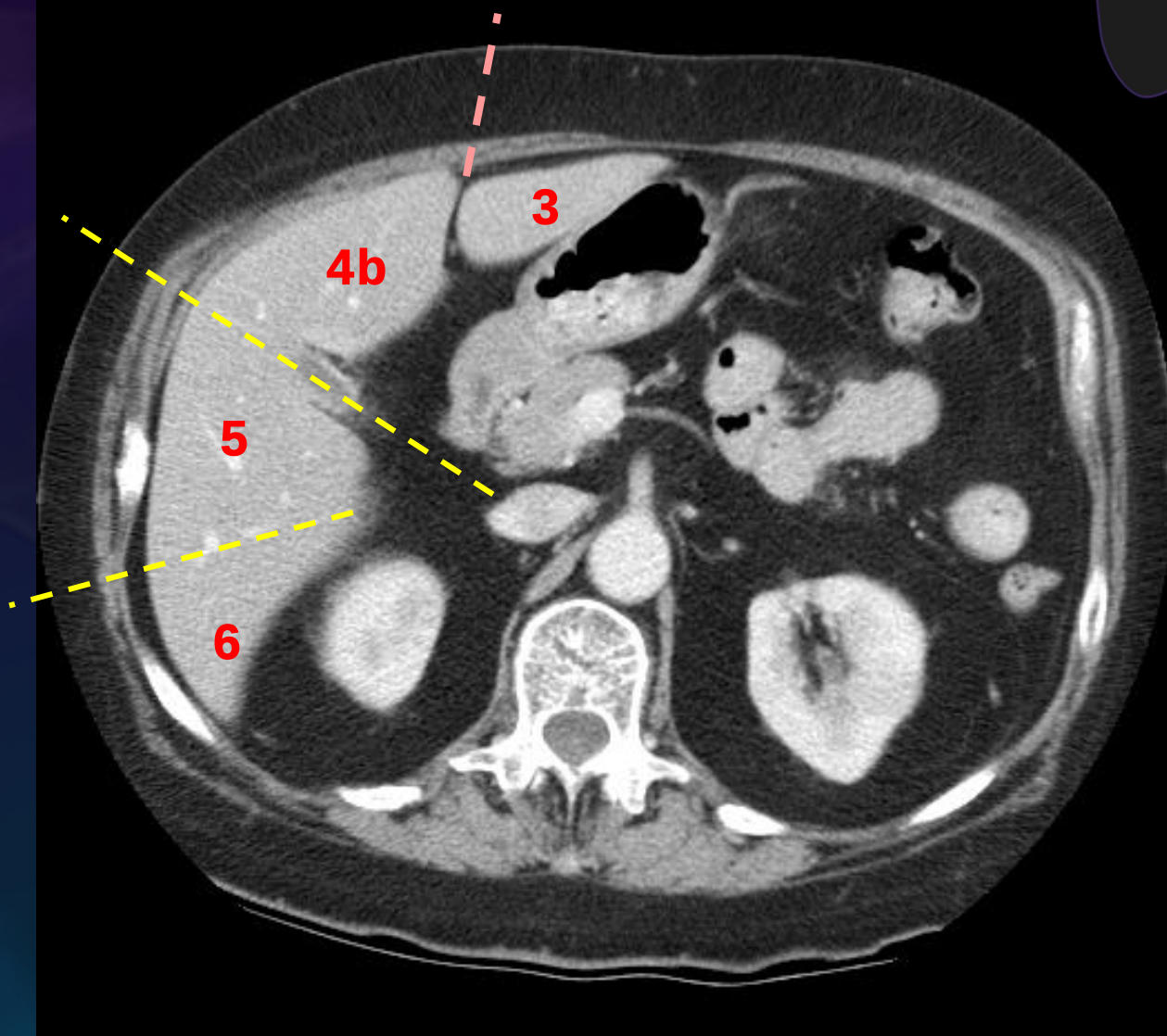


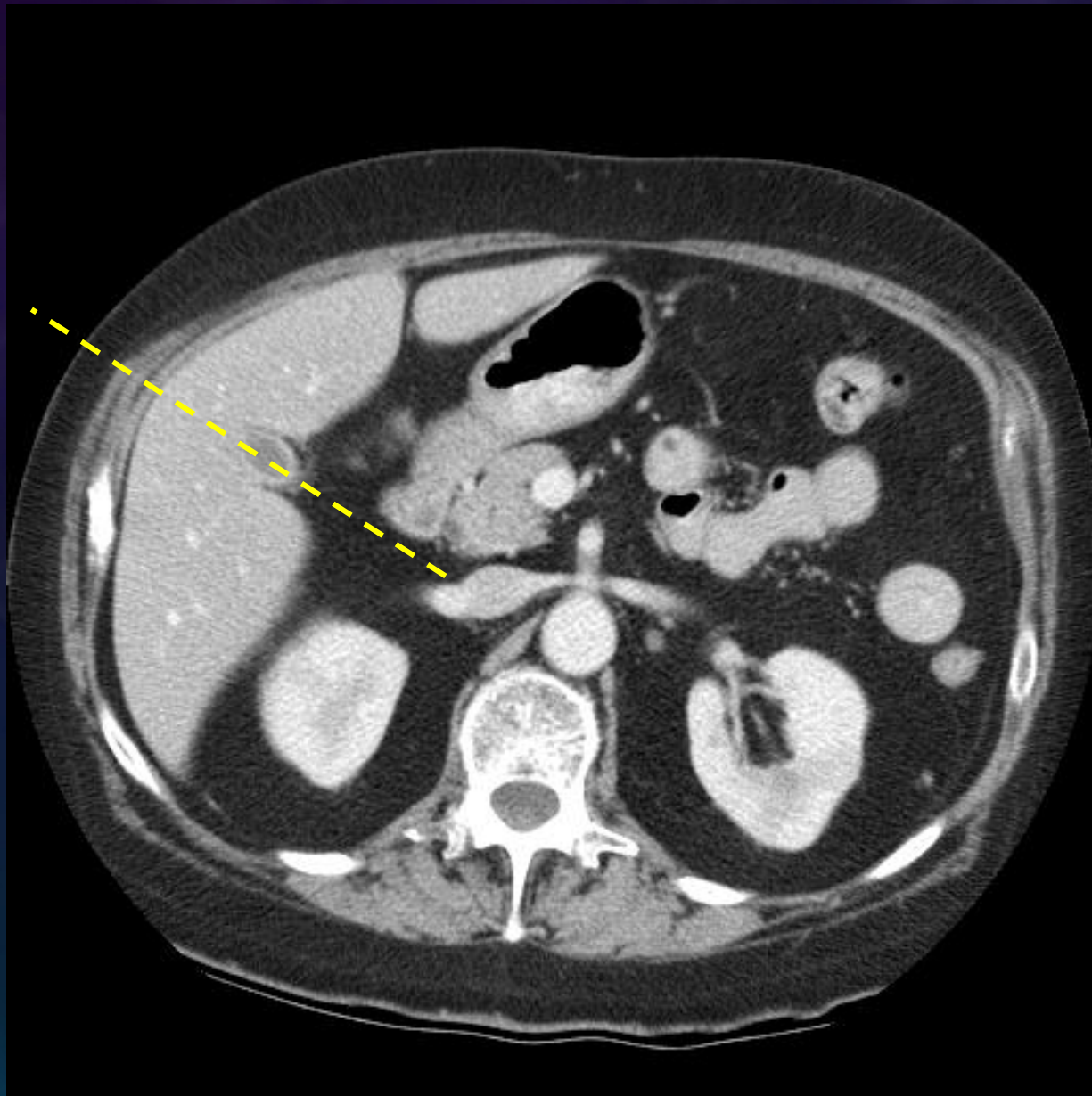


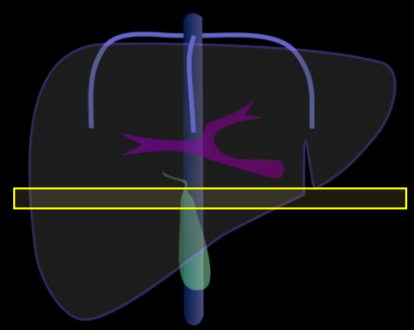
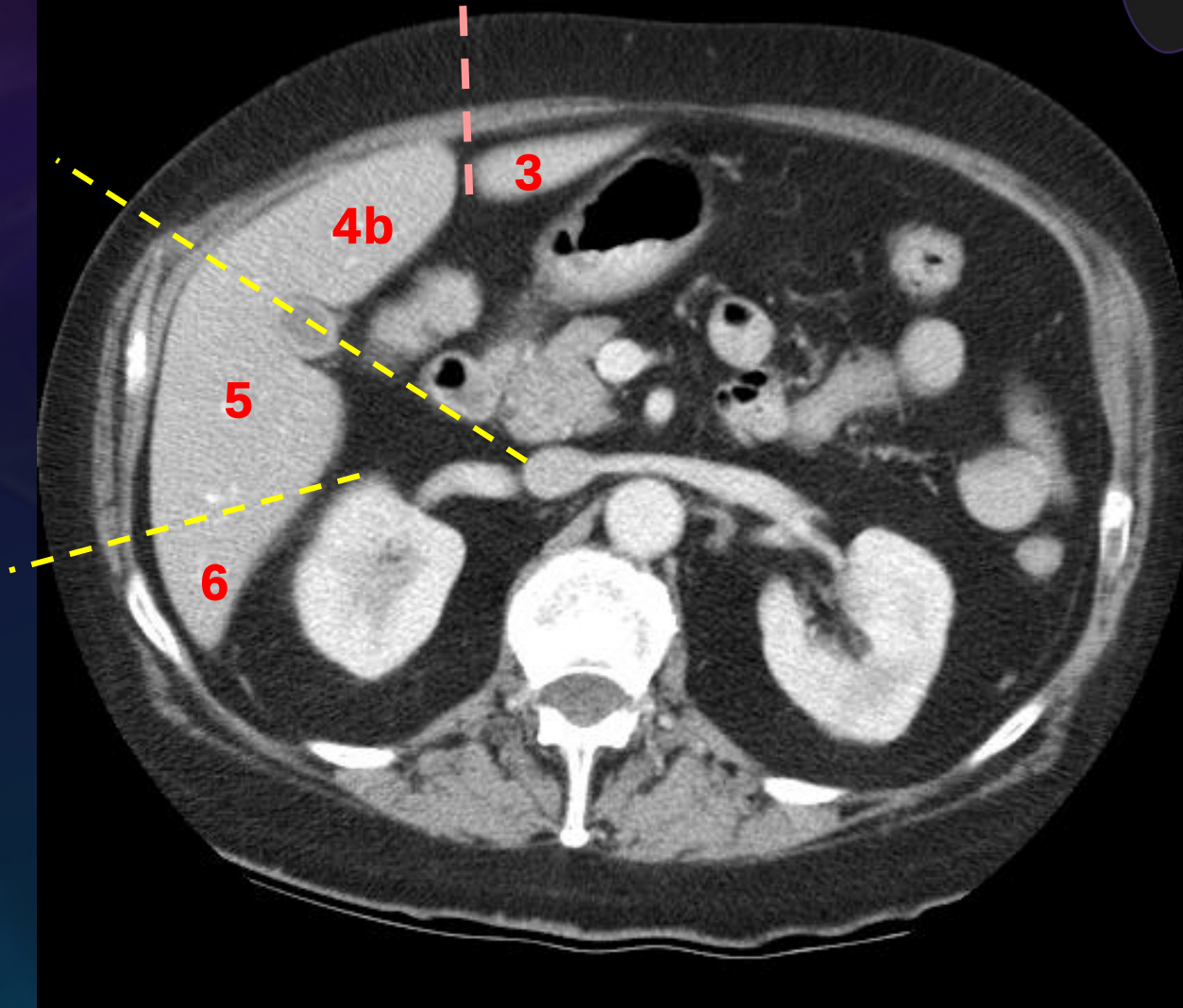


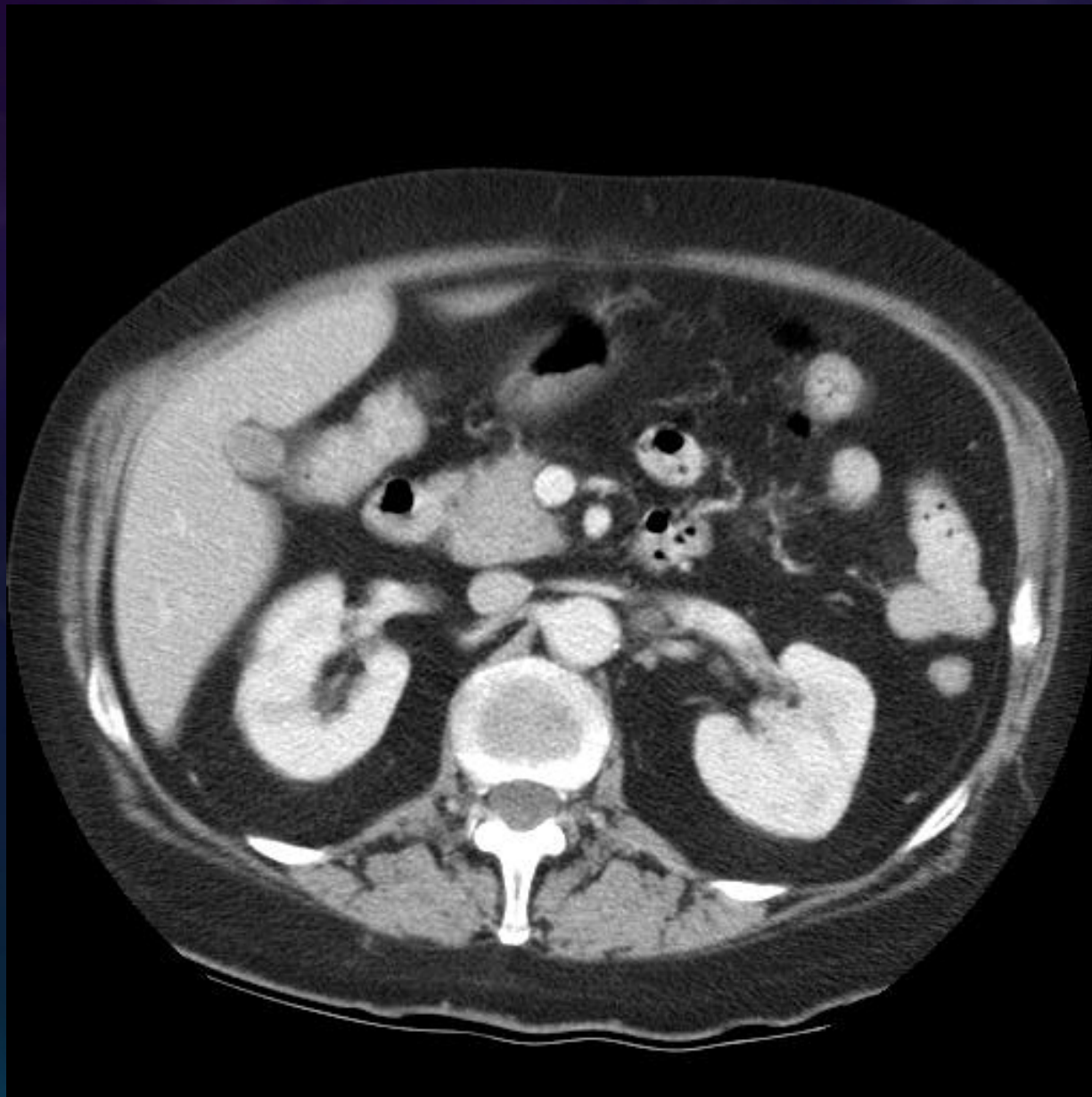


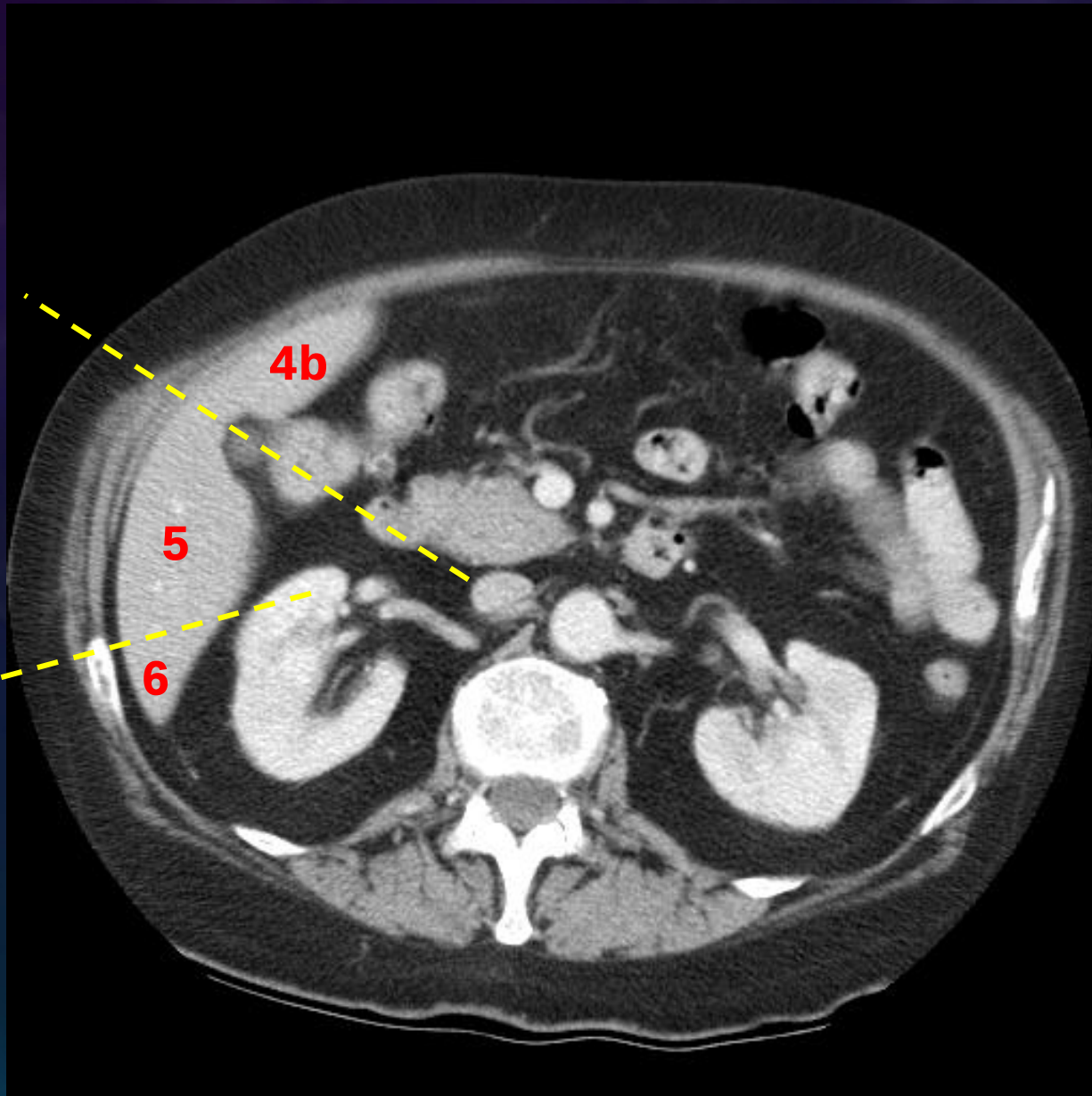


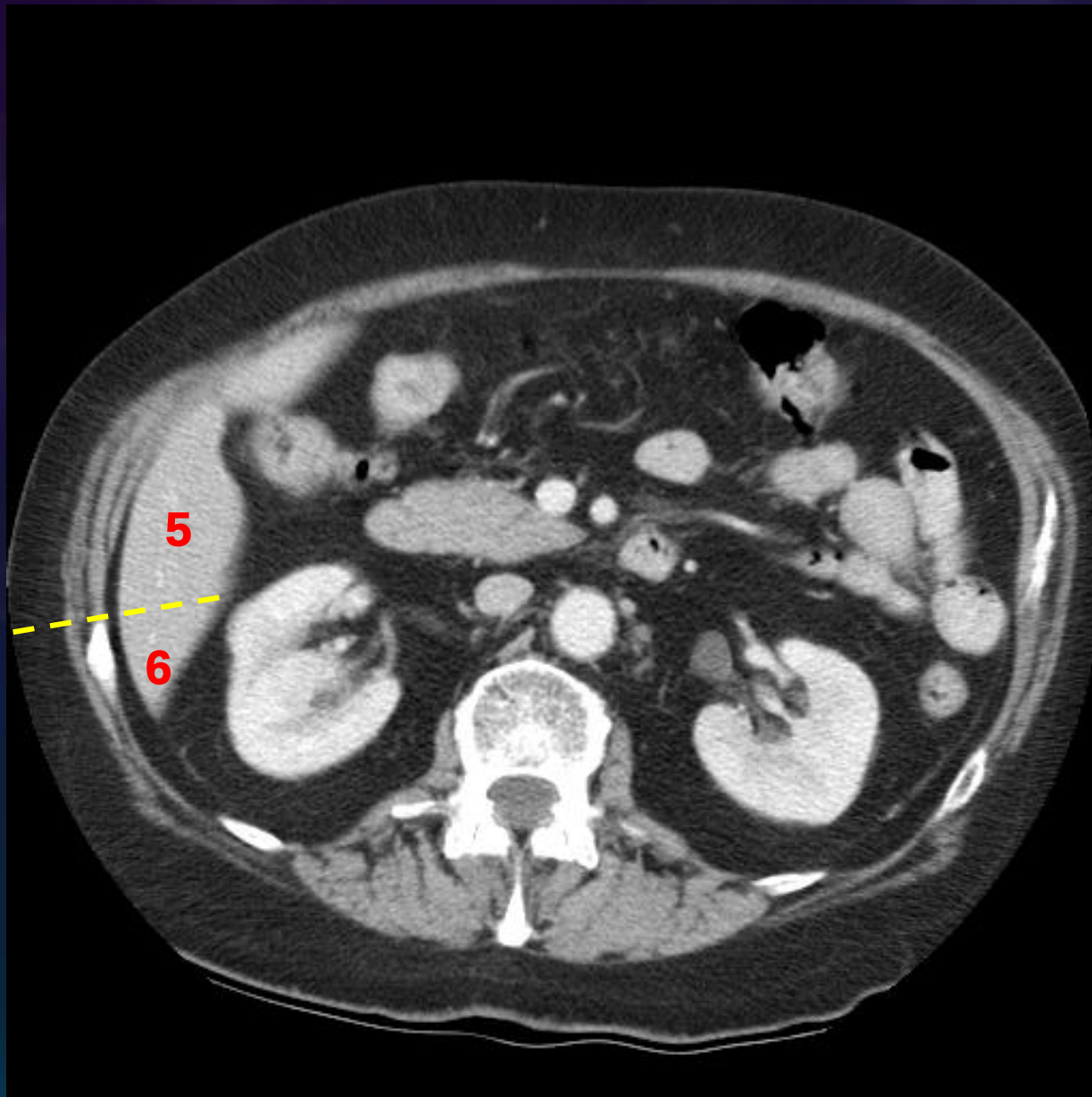




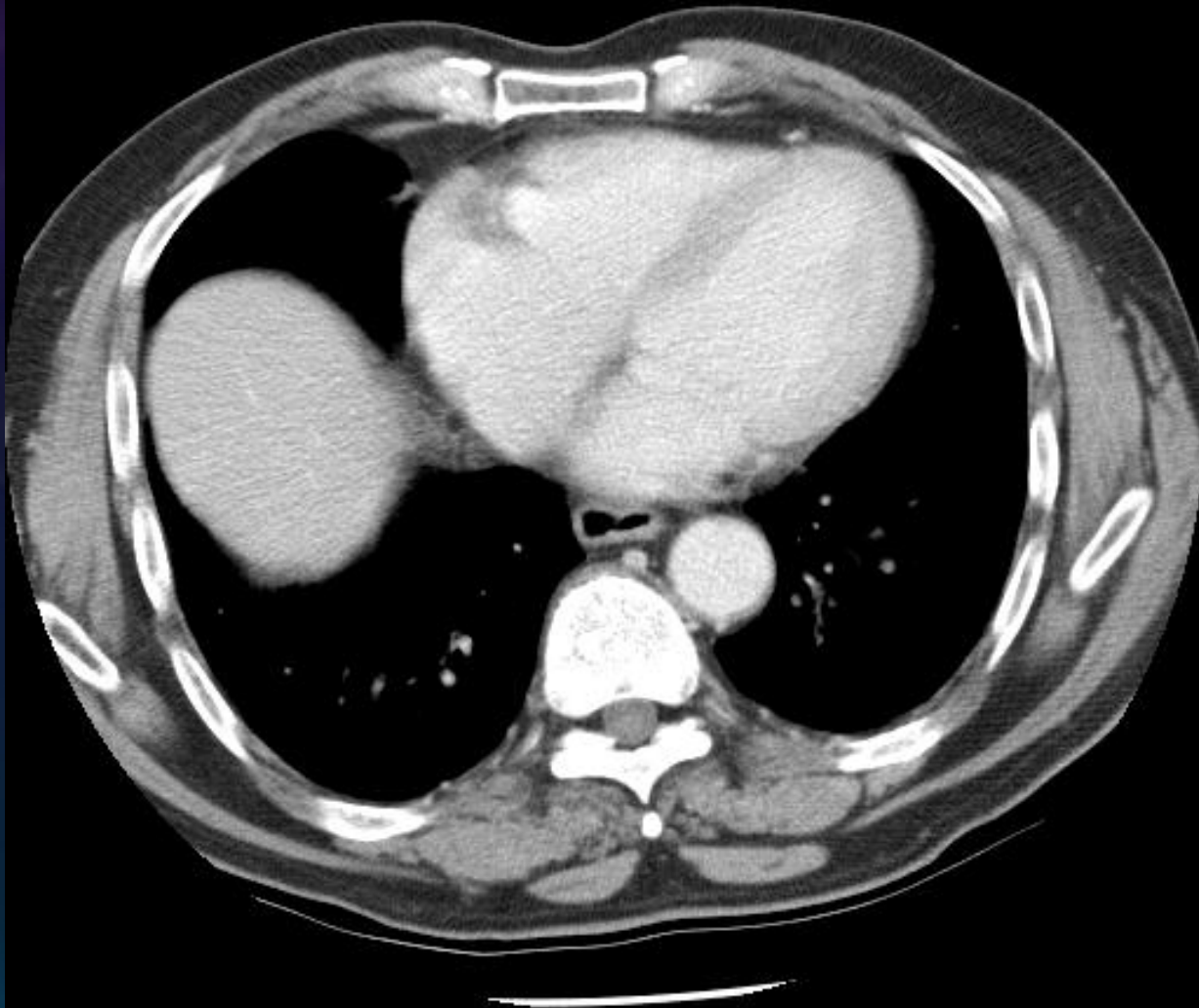




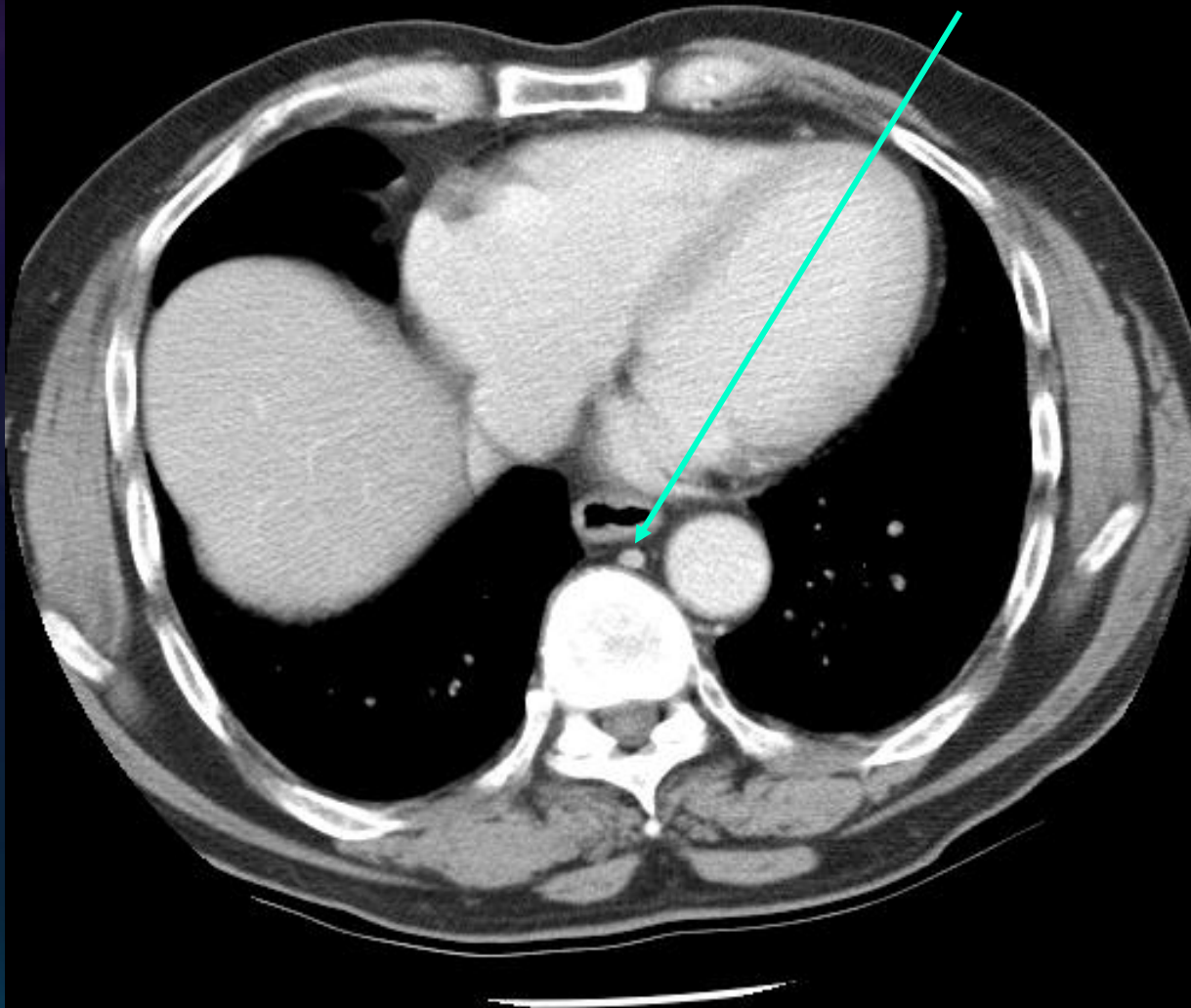


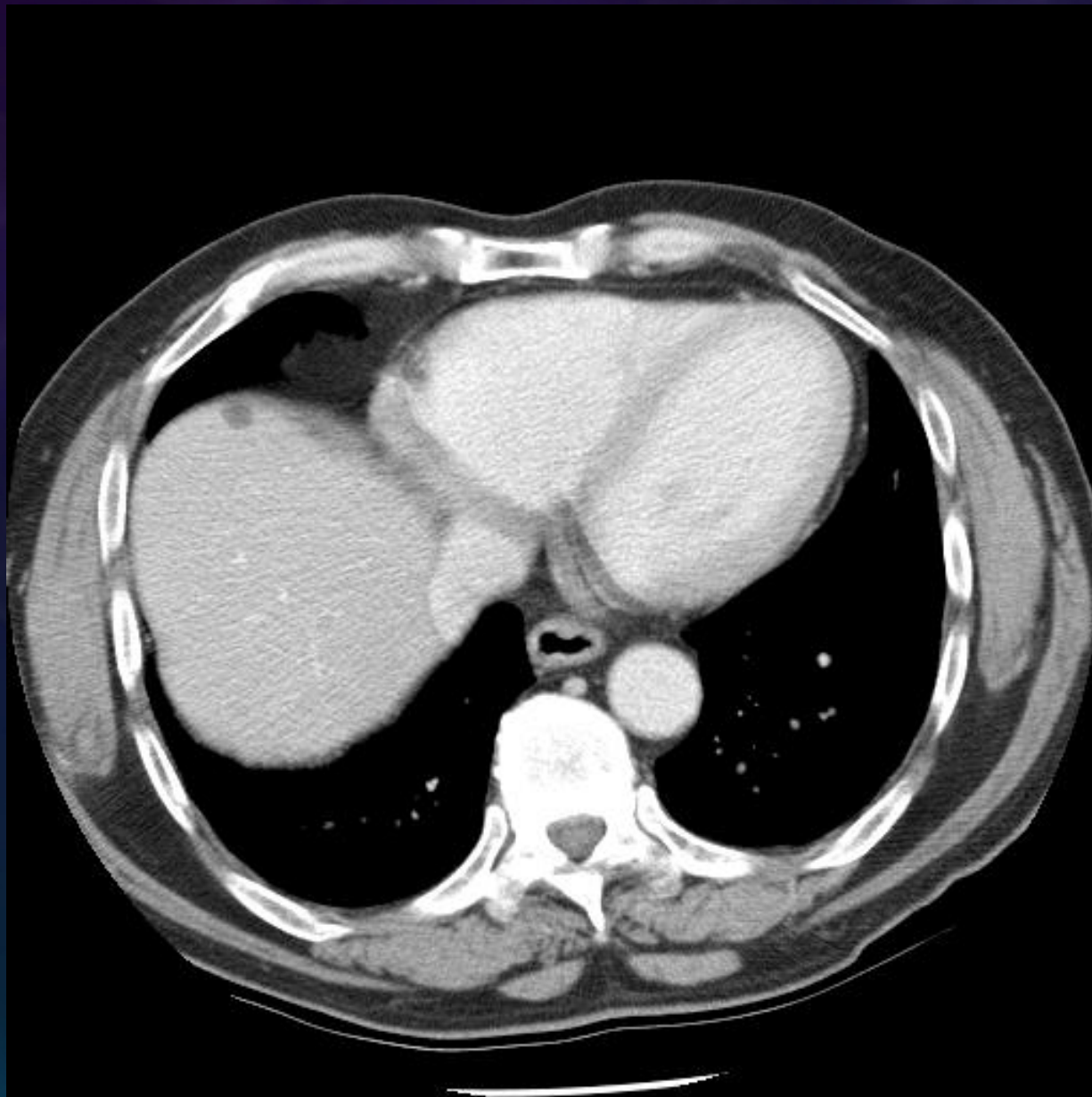


Review

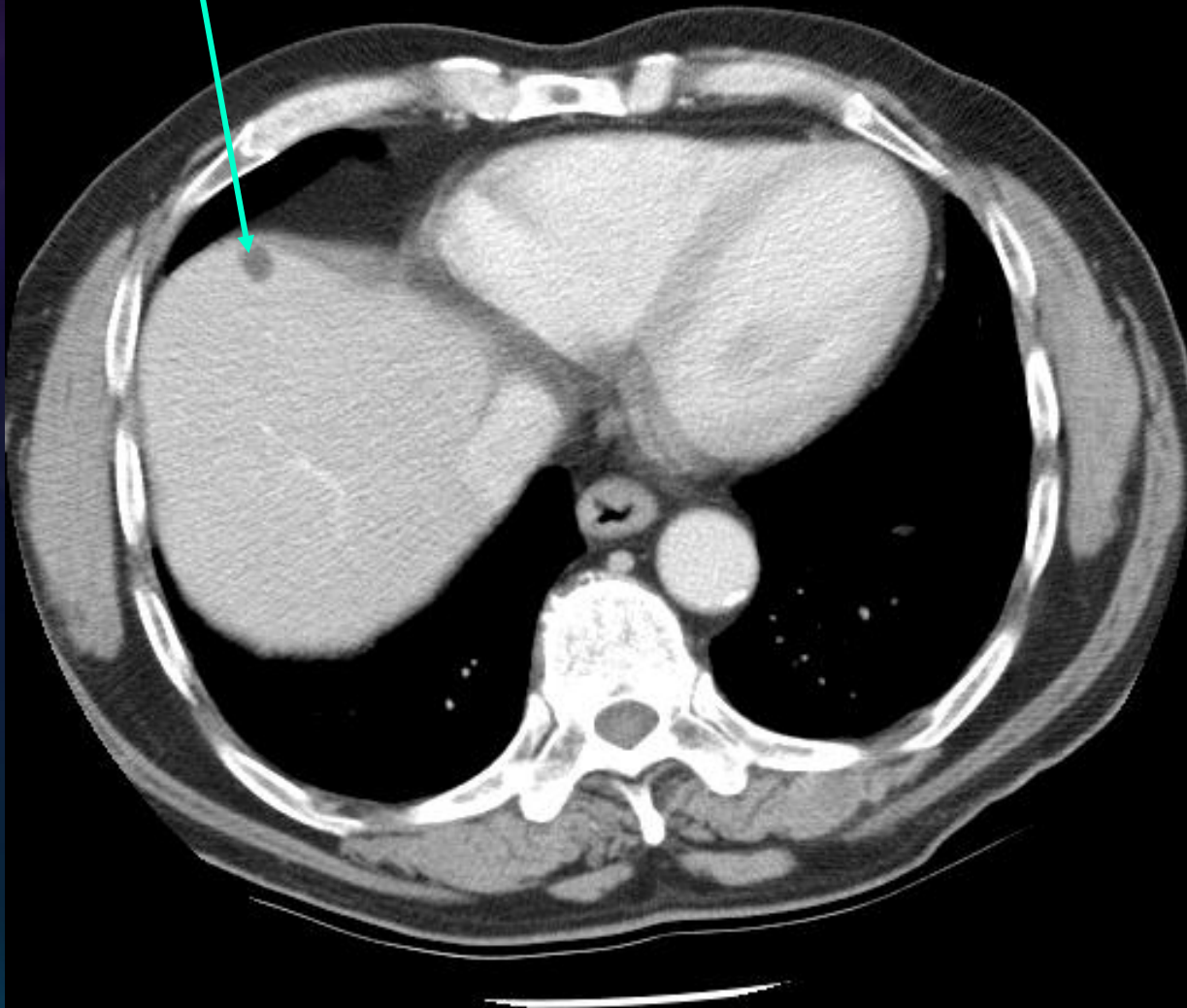


Azygos Vein

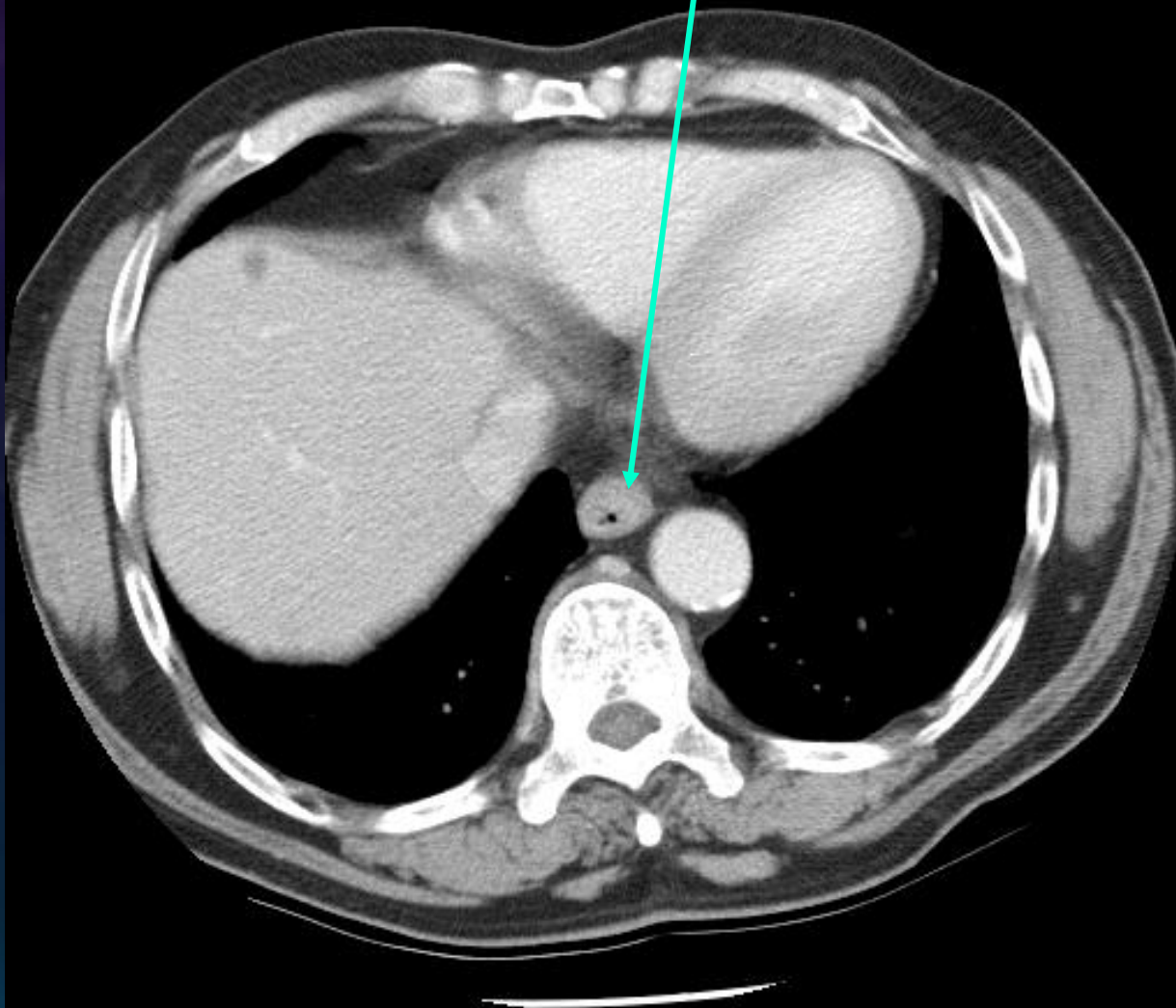




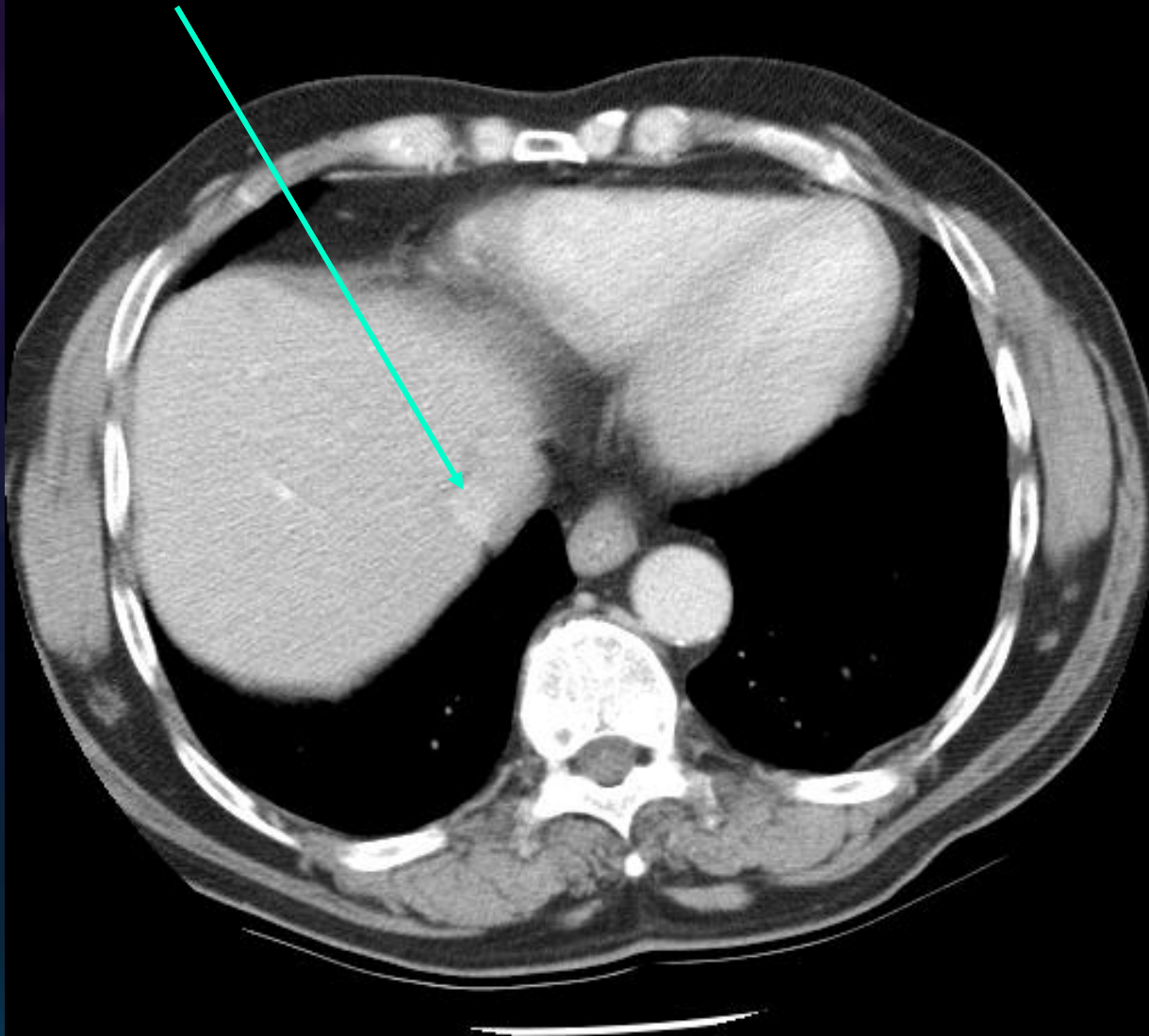
incidental hepatic cyst!



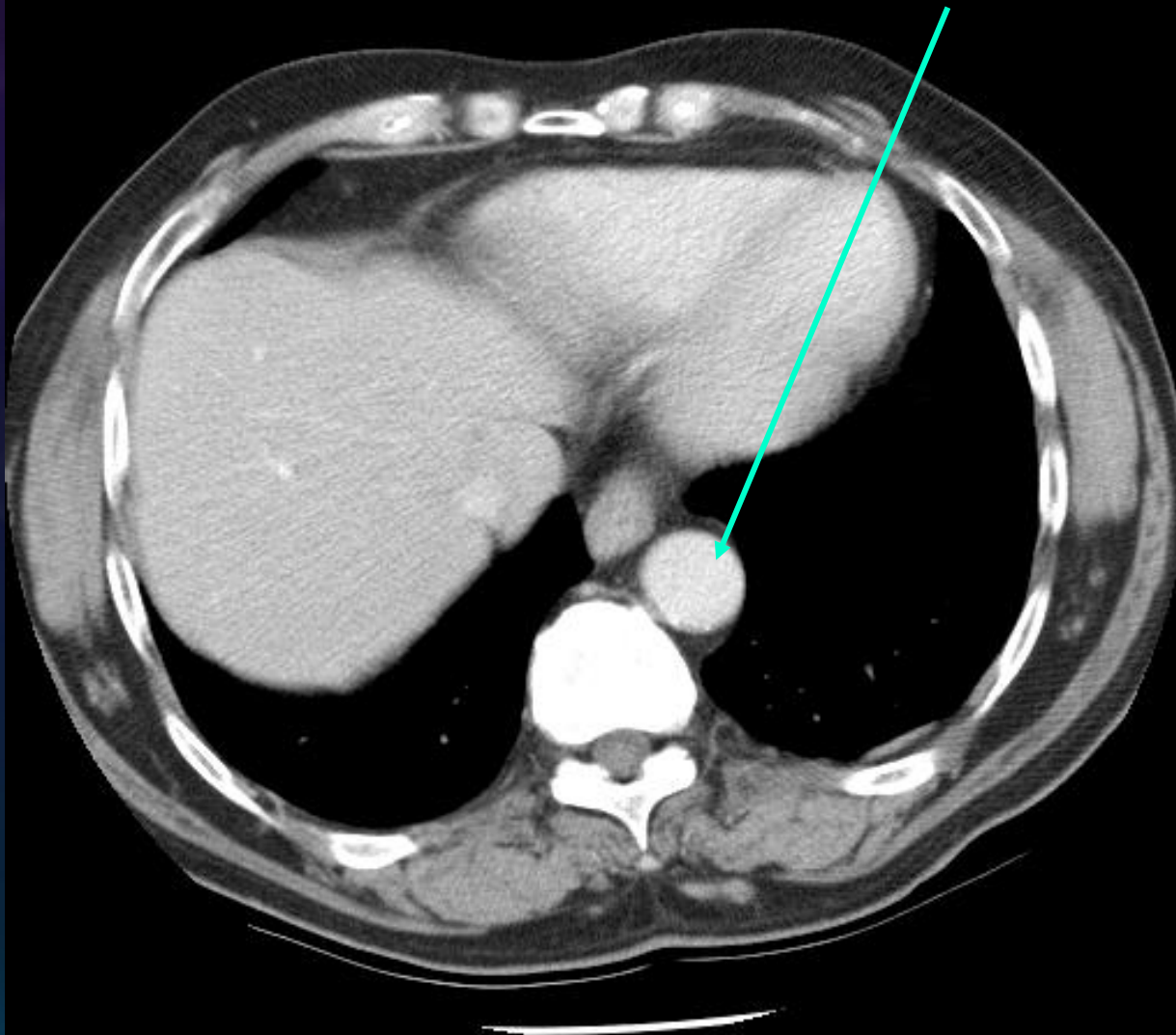
Oesophagus



IVC (Transhepatic Segment)



Descending Aorta

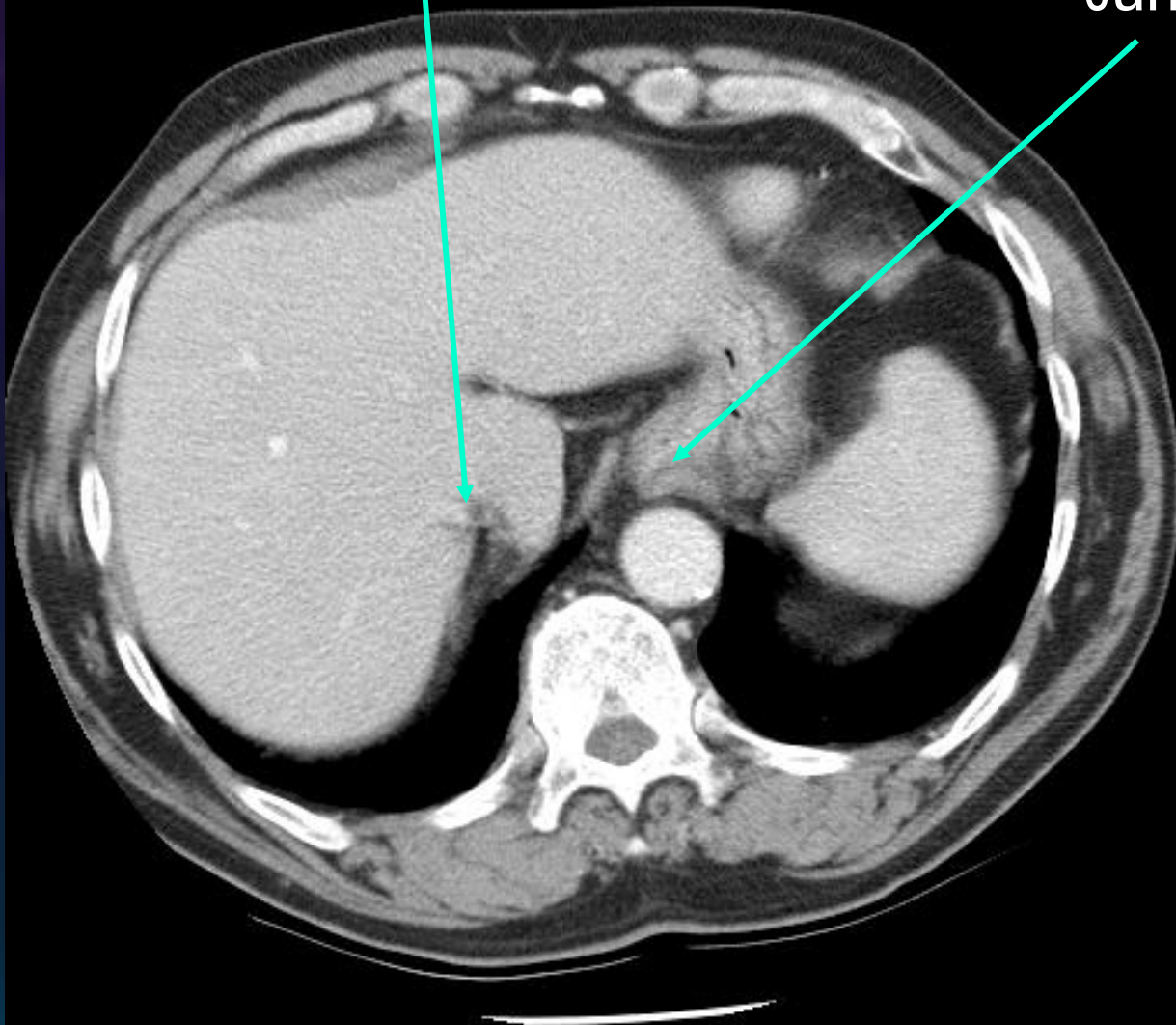


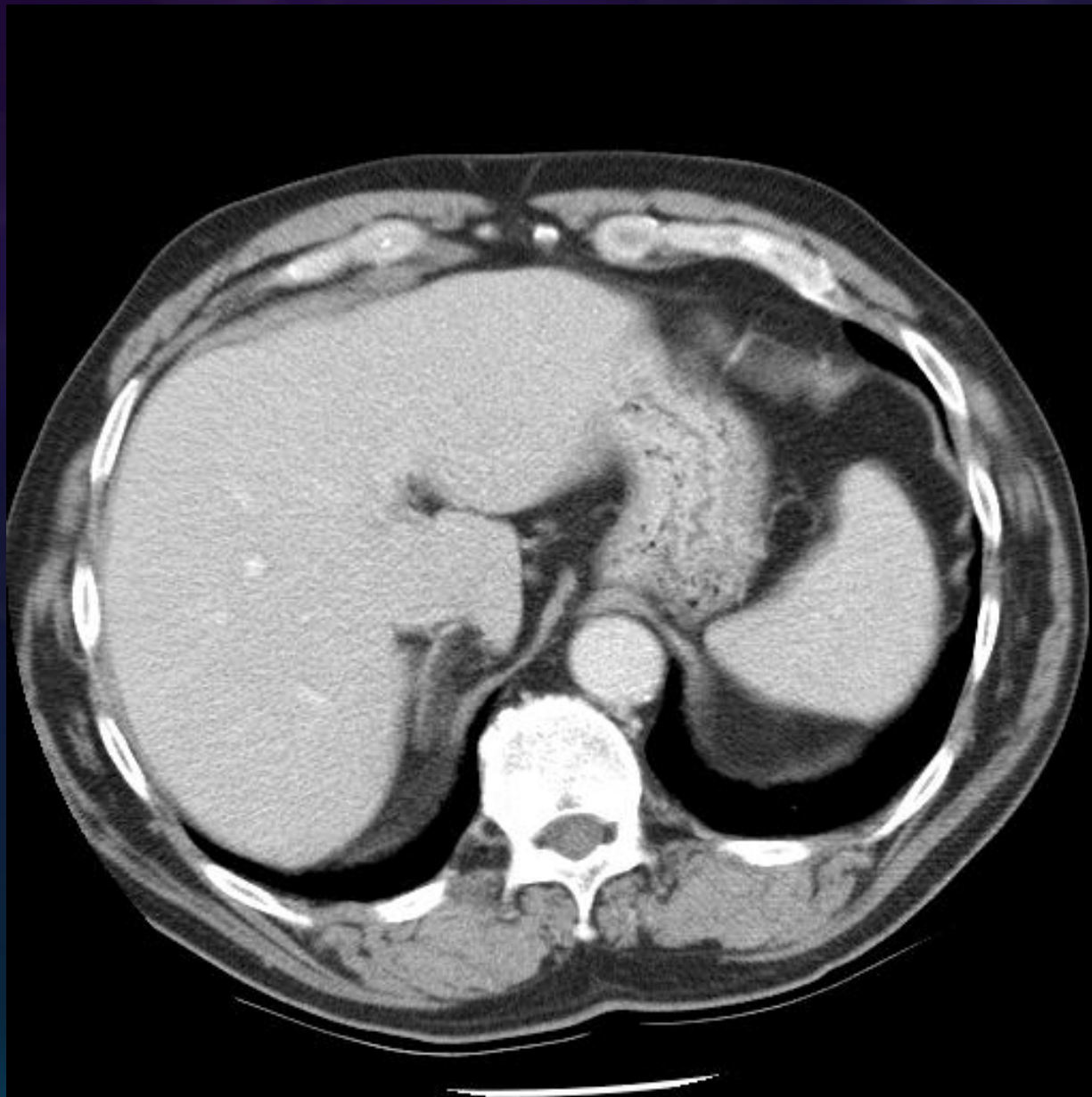




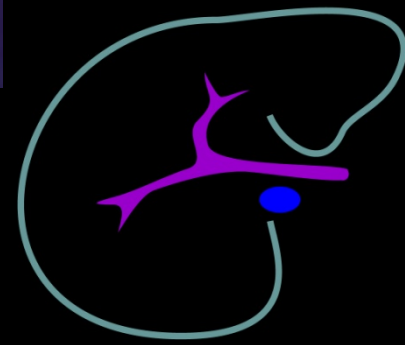
IVC (Transhepatic Segment)

Gastro-Oesophageal
Junction

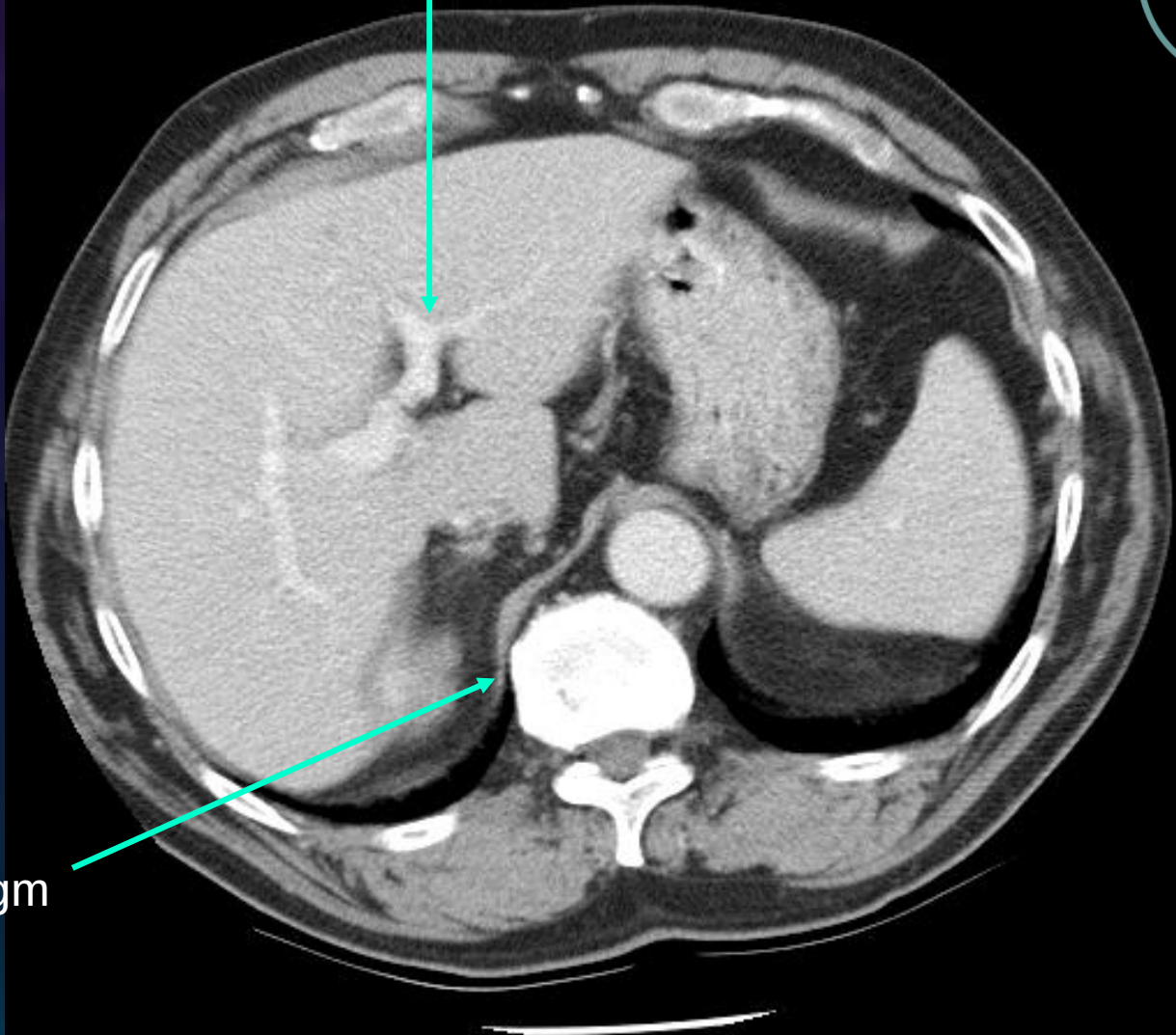




Left Portal Vein

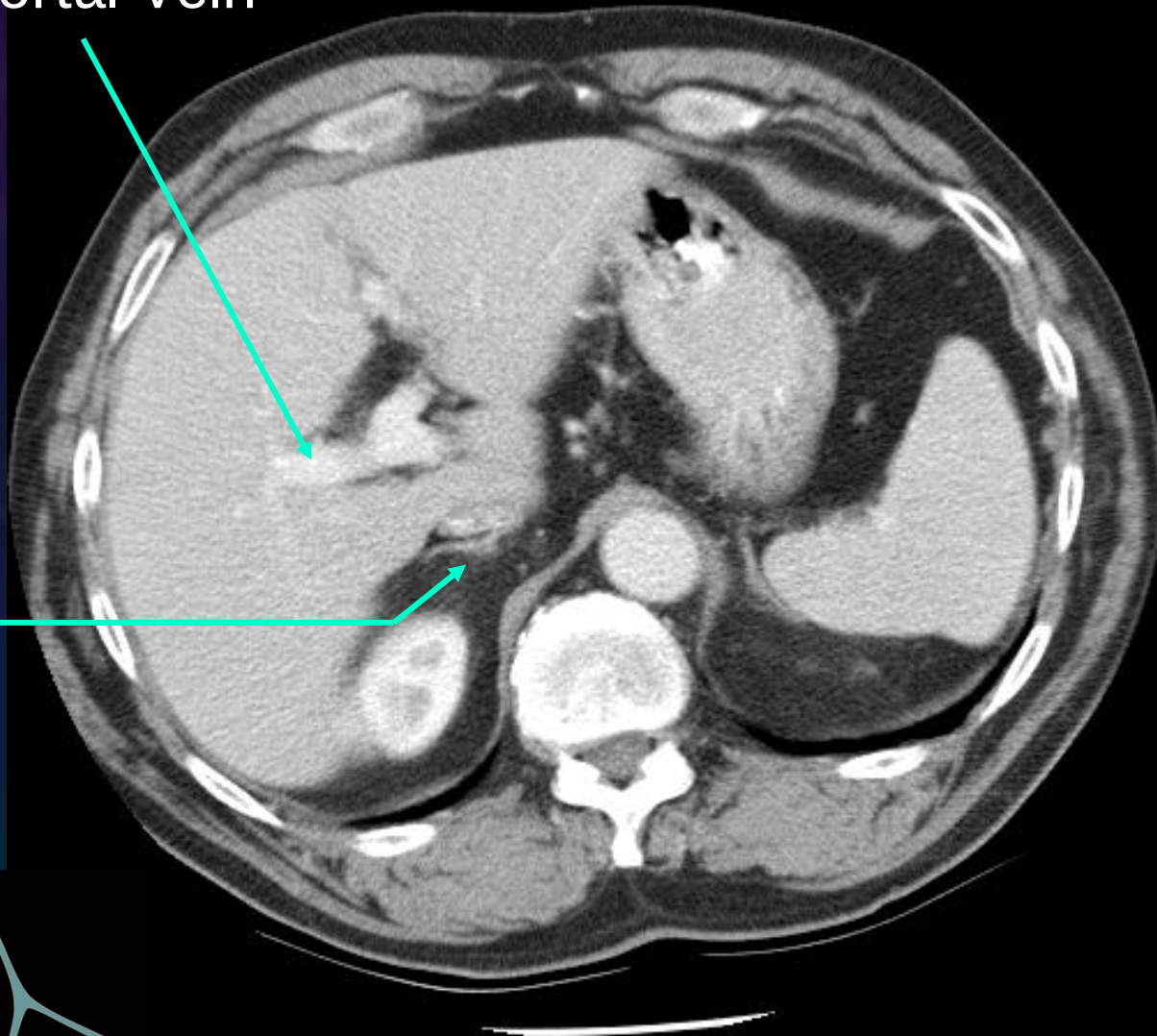
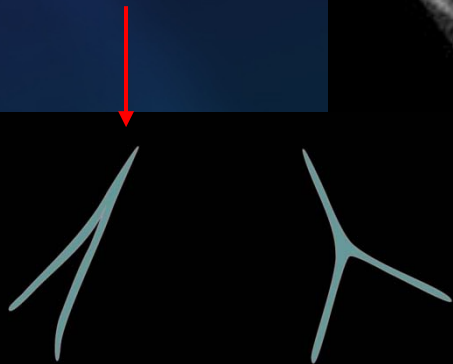


Right
Hemidiaphragm



Right Portal Vein

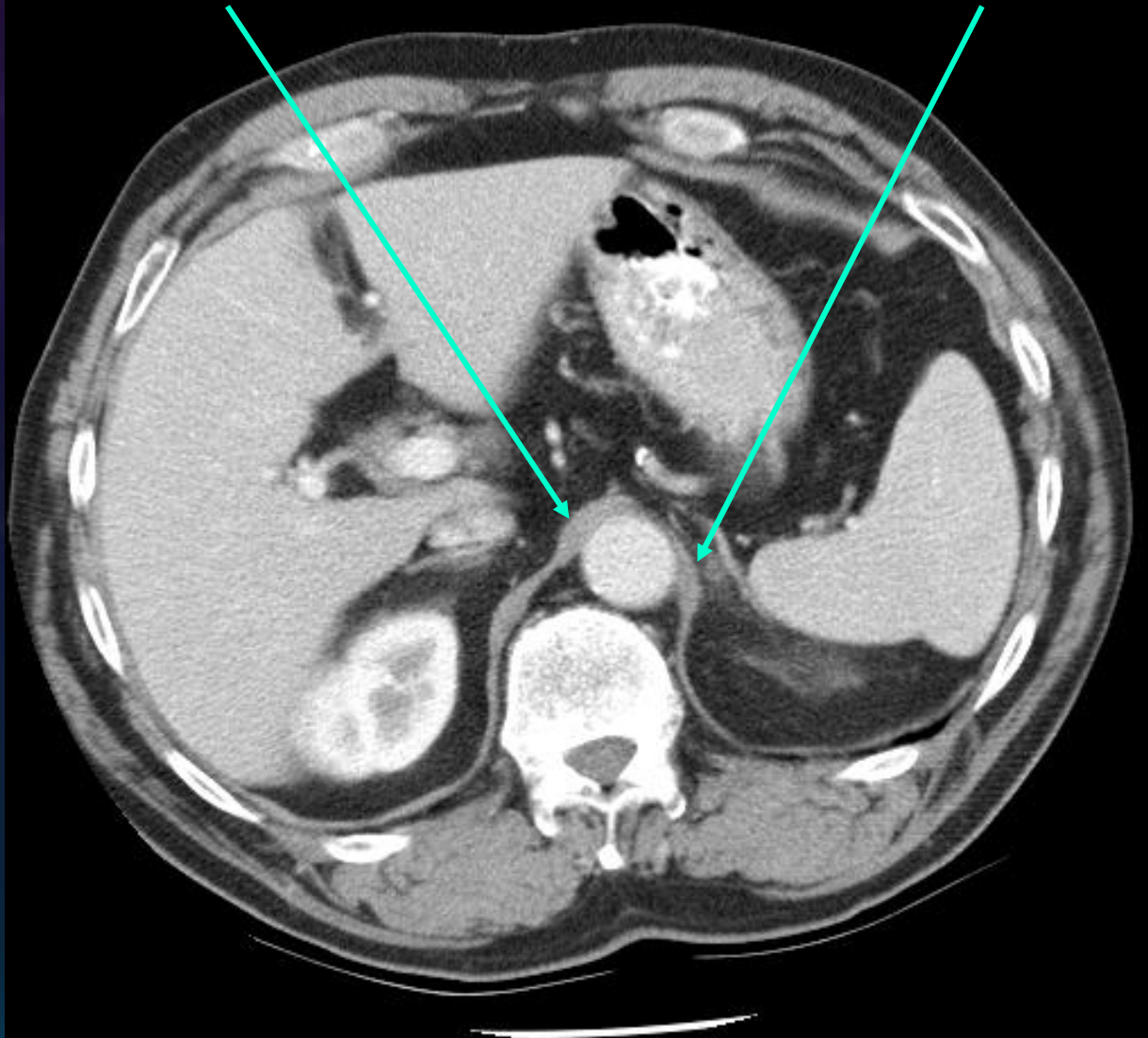
Right
Adrenal



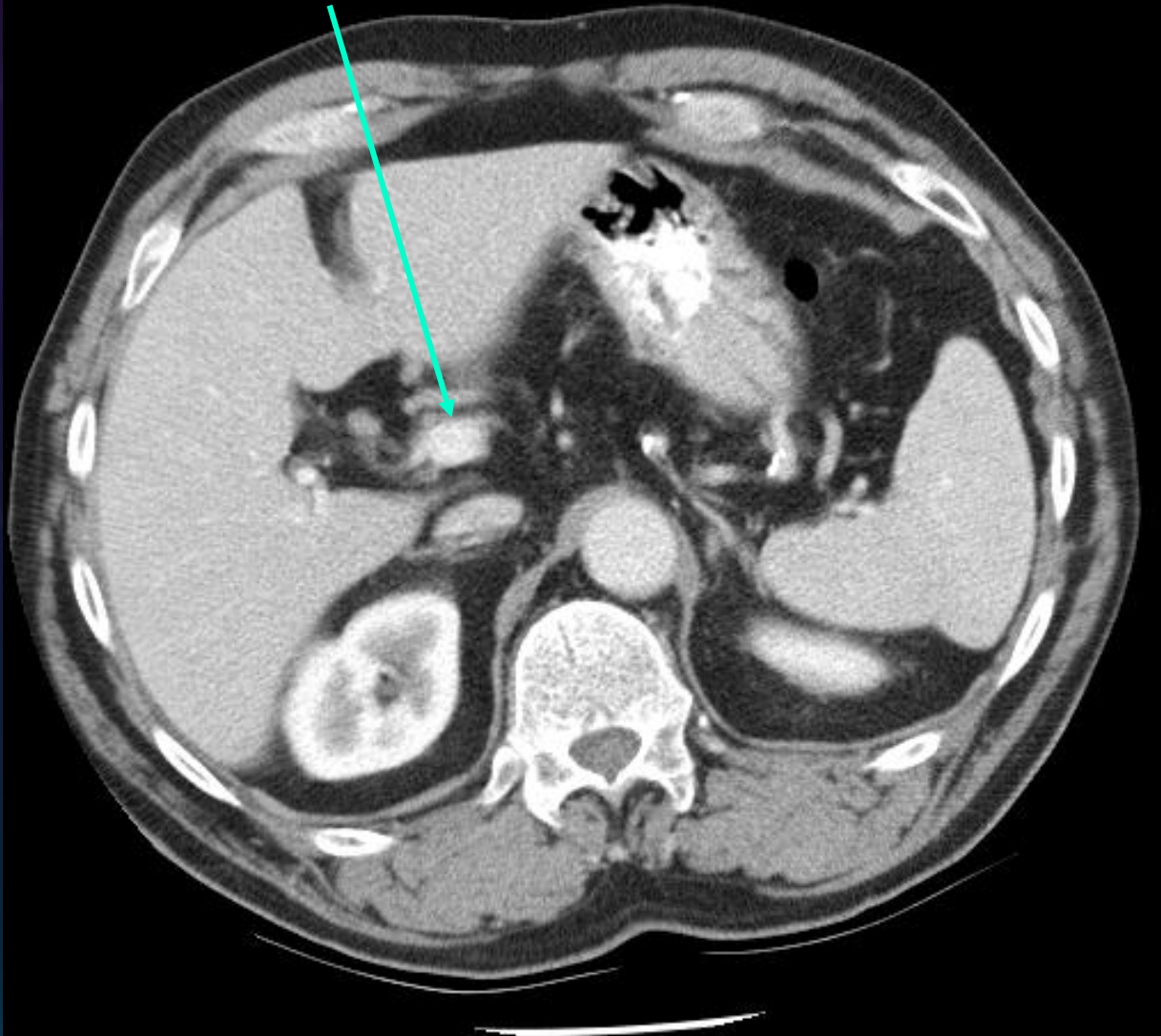
Diaphragmatic Crura

Rt

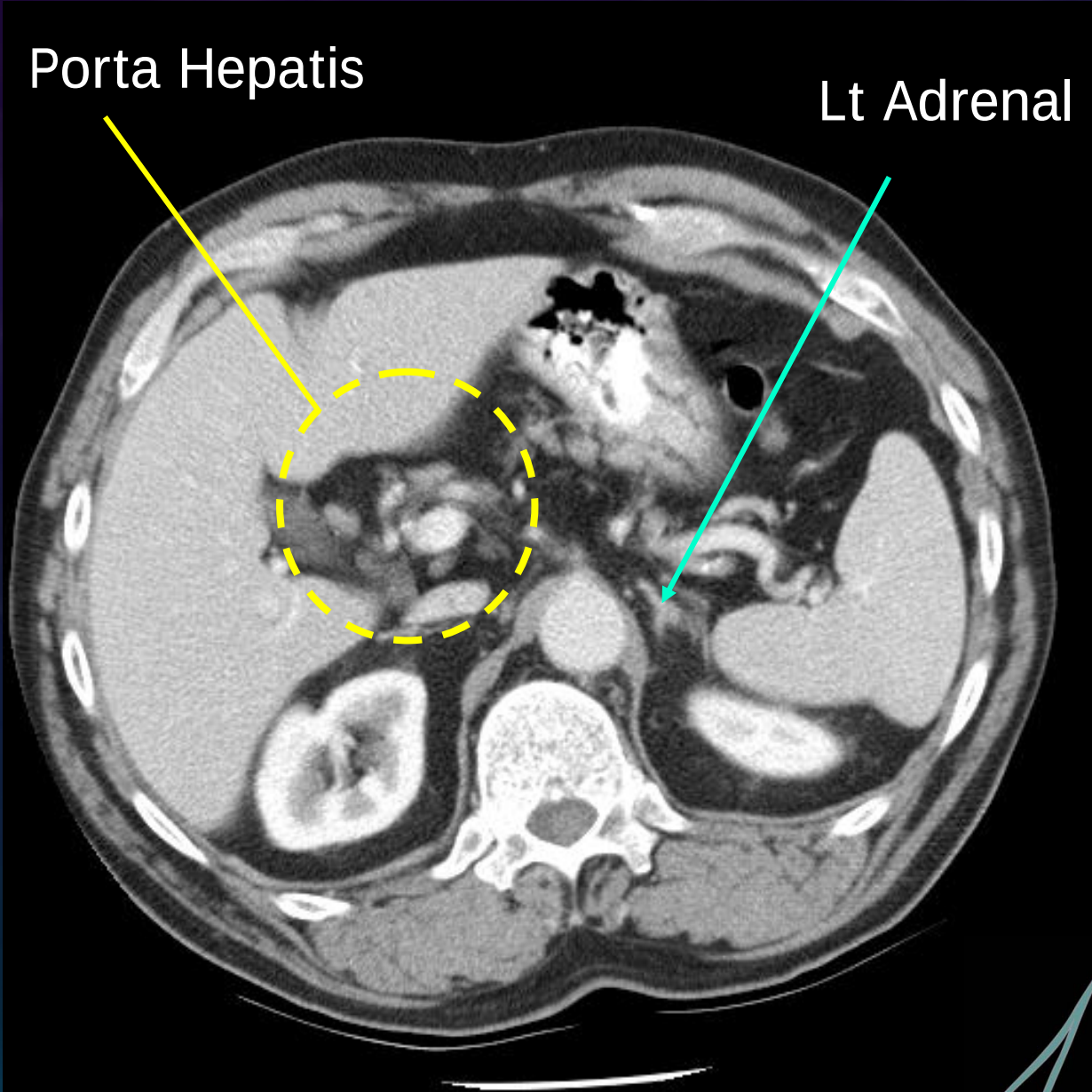
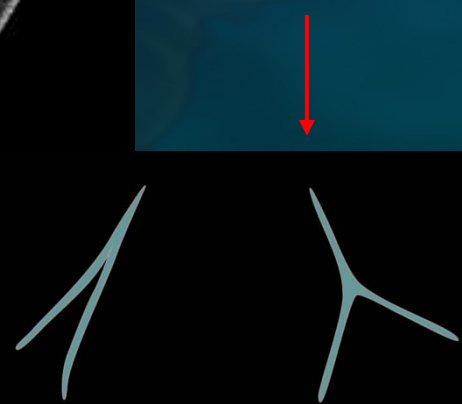
Lt



Main Portal Vein

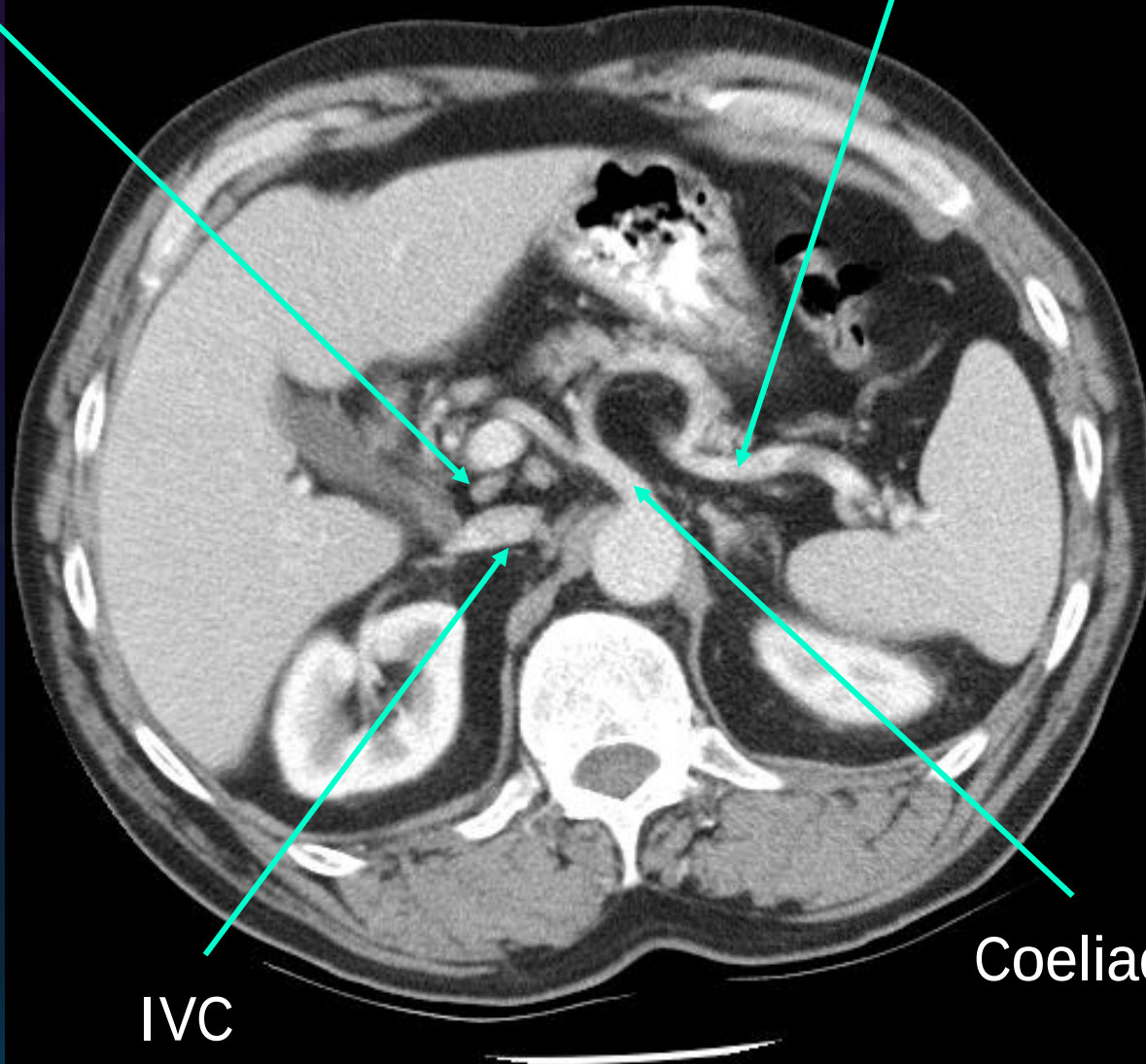


Relation within the porta hepatis from behind forwards are portal vein, hepatic artery and bile duct.



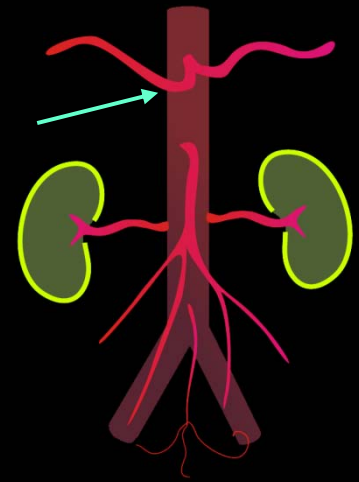
Portocaval Node

Splenic Vein



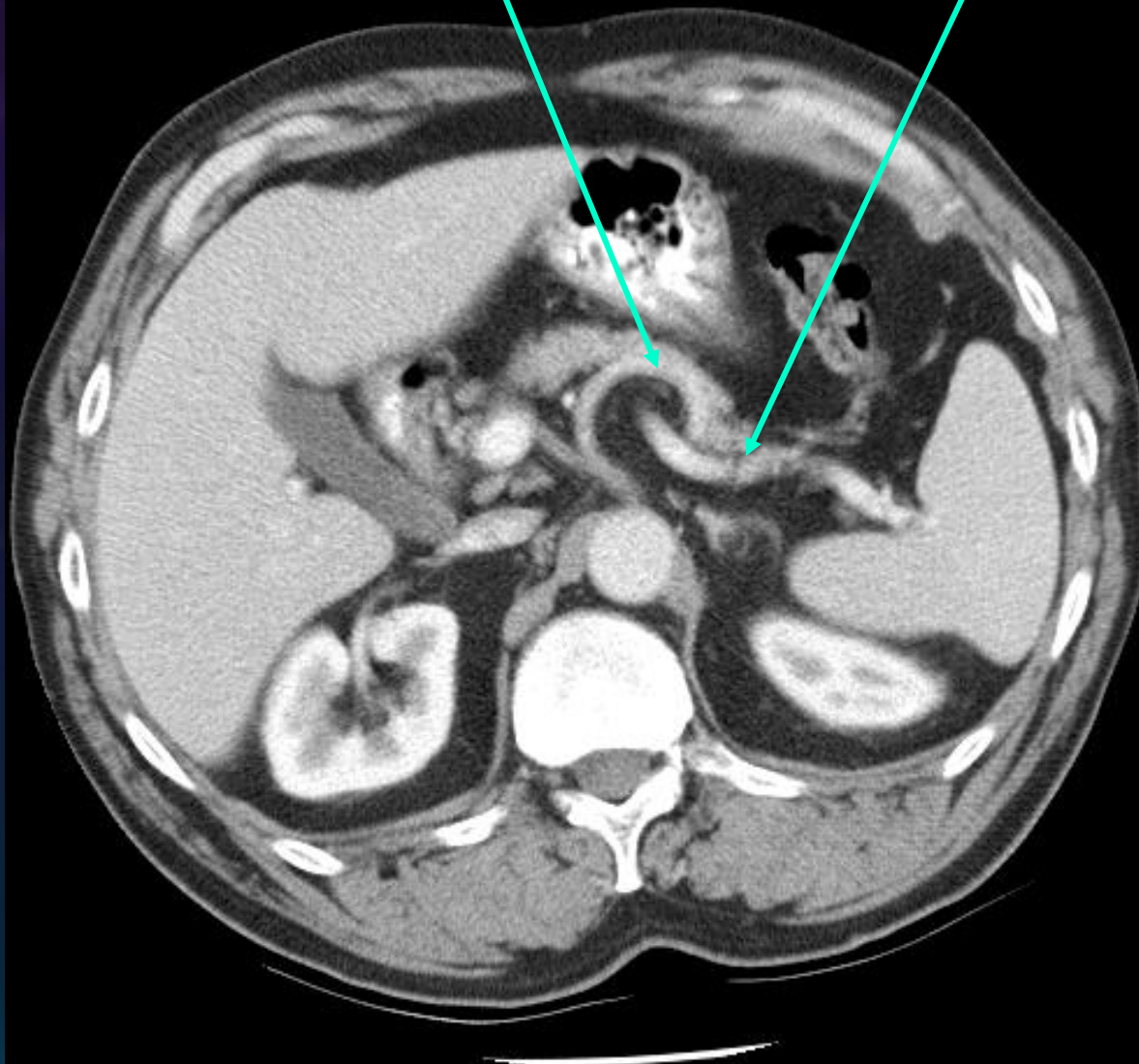
IVC

Coeliac Axis



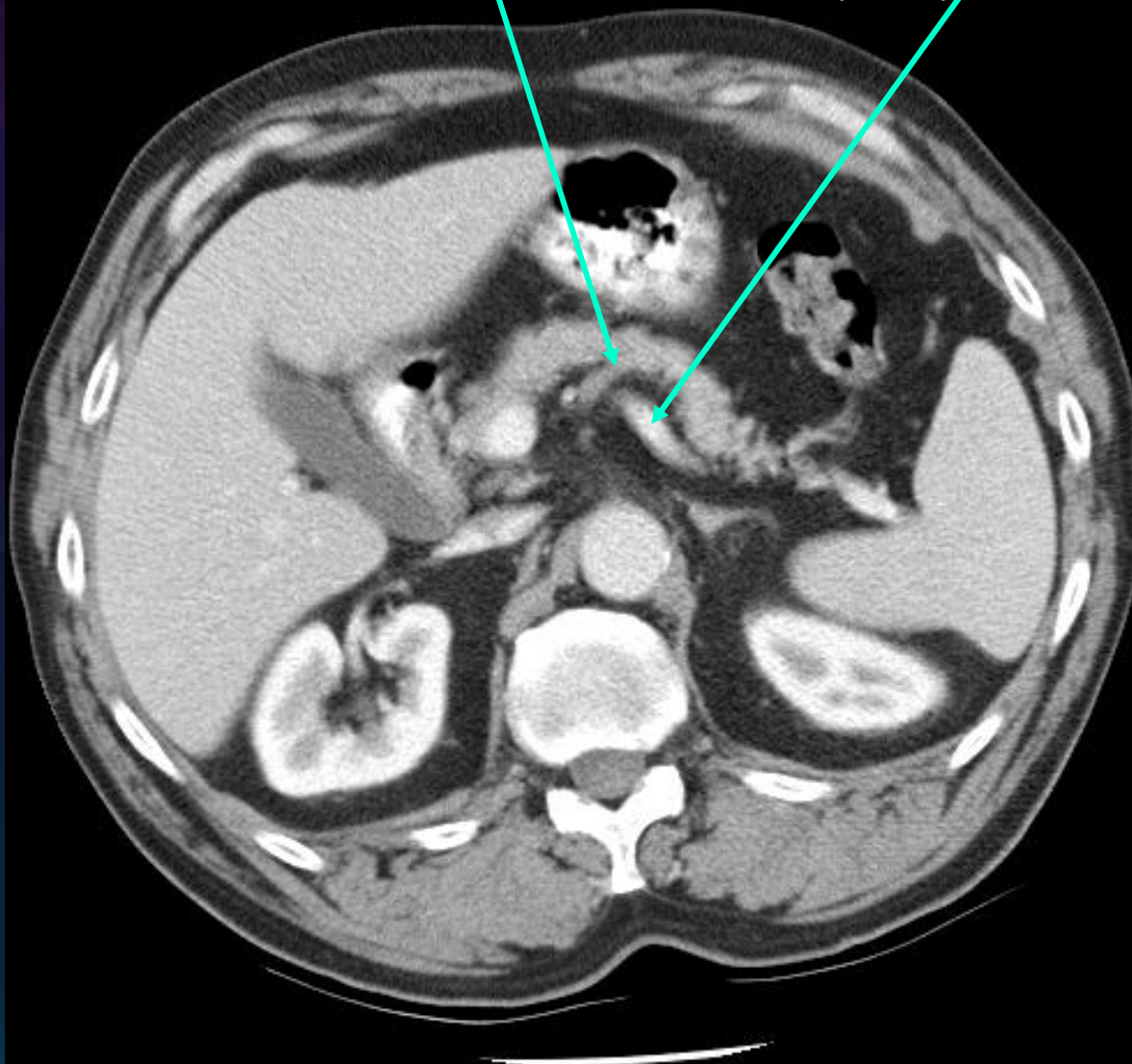
Splenic Artery
(superior)

Splenic Vein
(inferior)

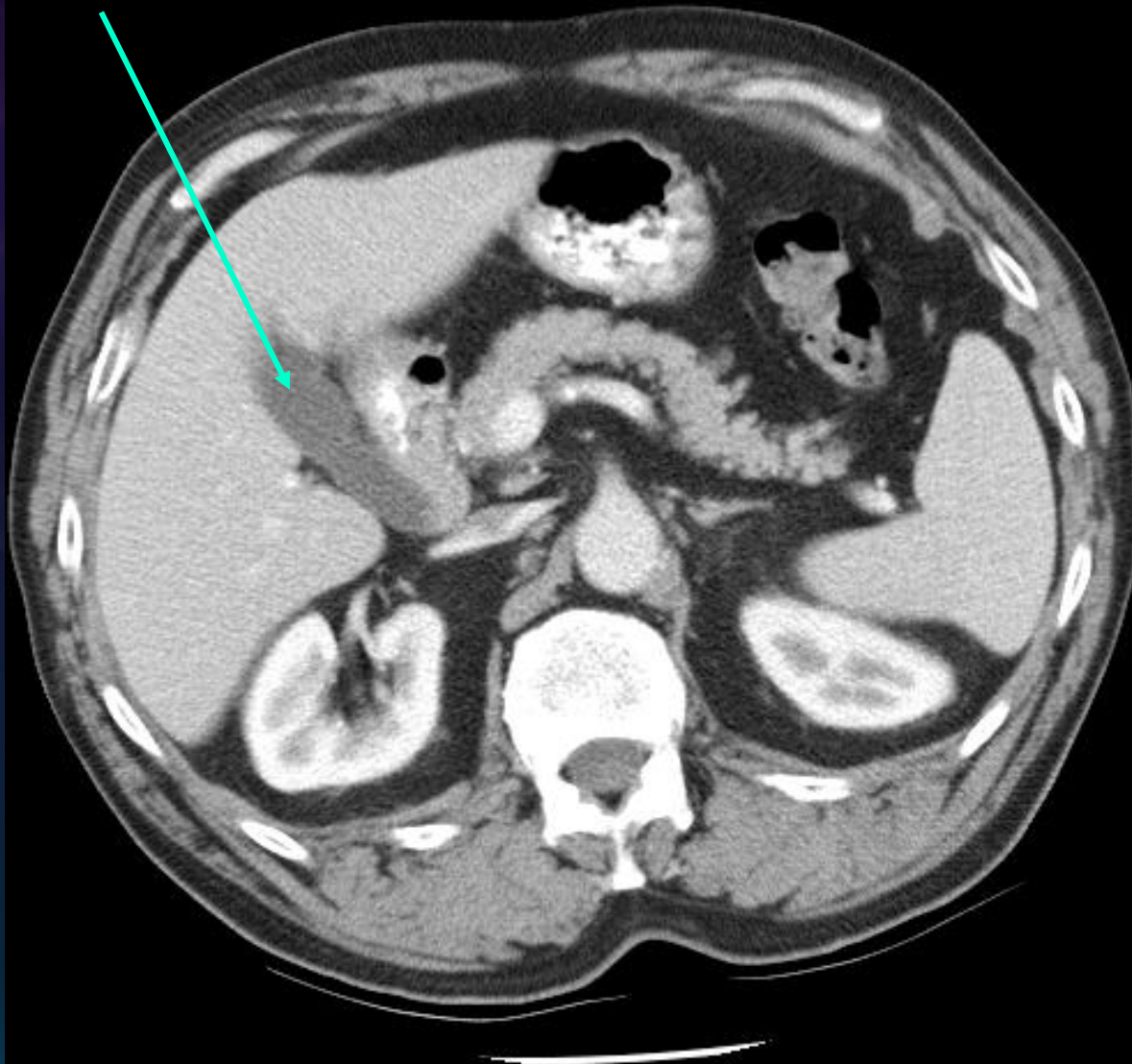


Splenic Artery
(superior)

Splenic Vein
(inferior)



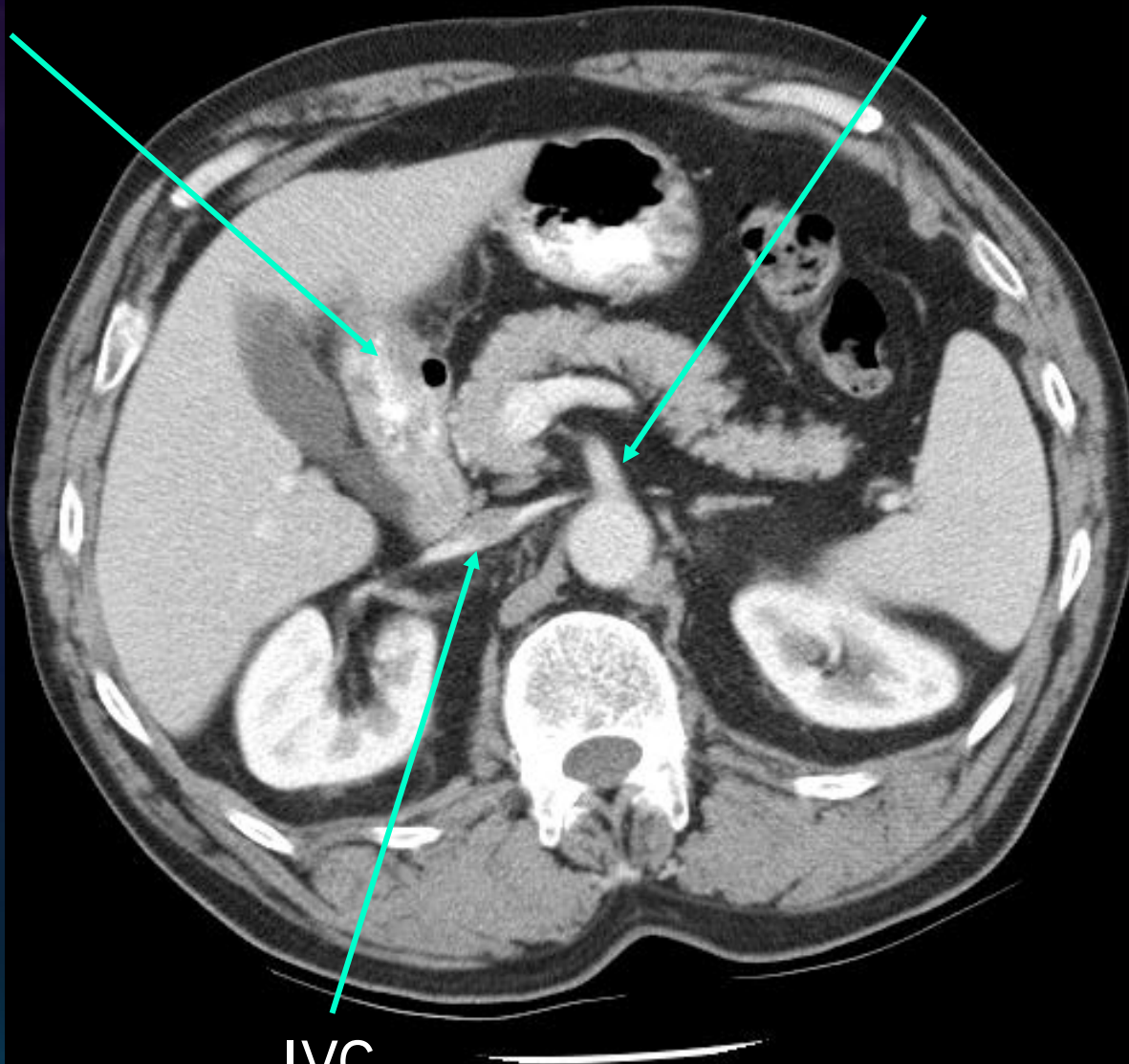
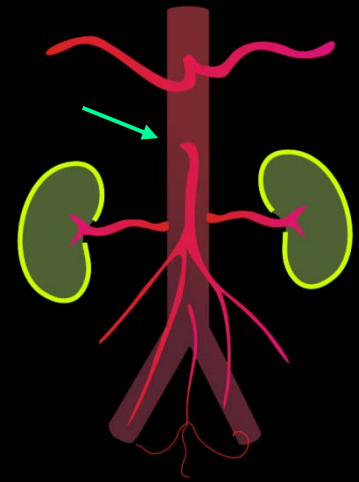
Gallbladder

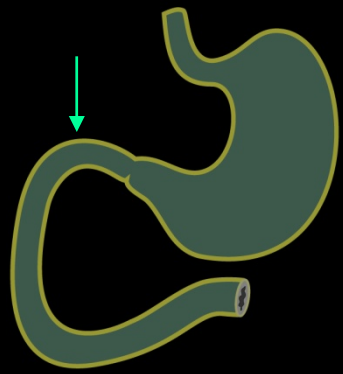


D1

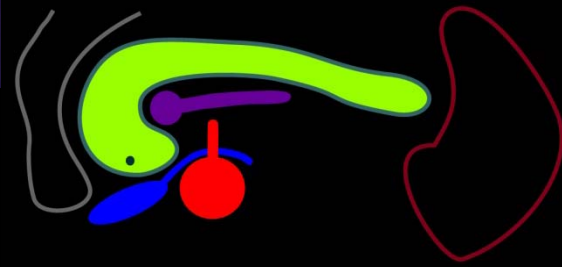
SMA

IVC

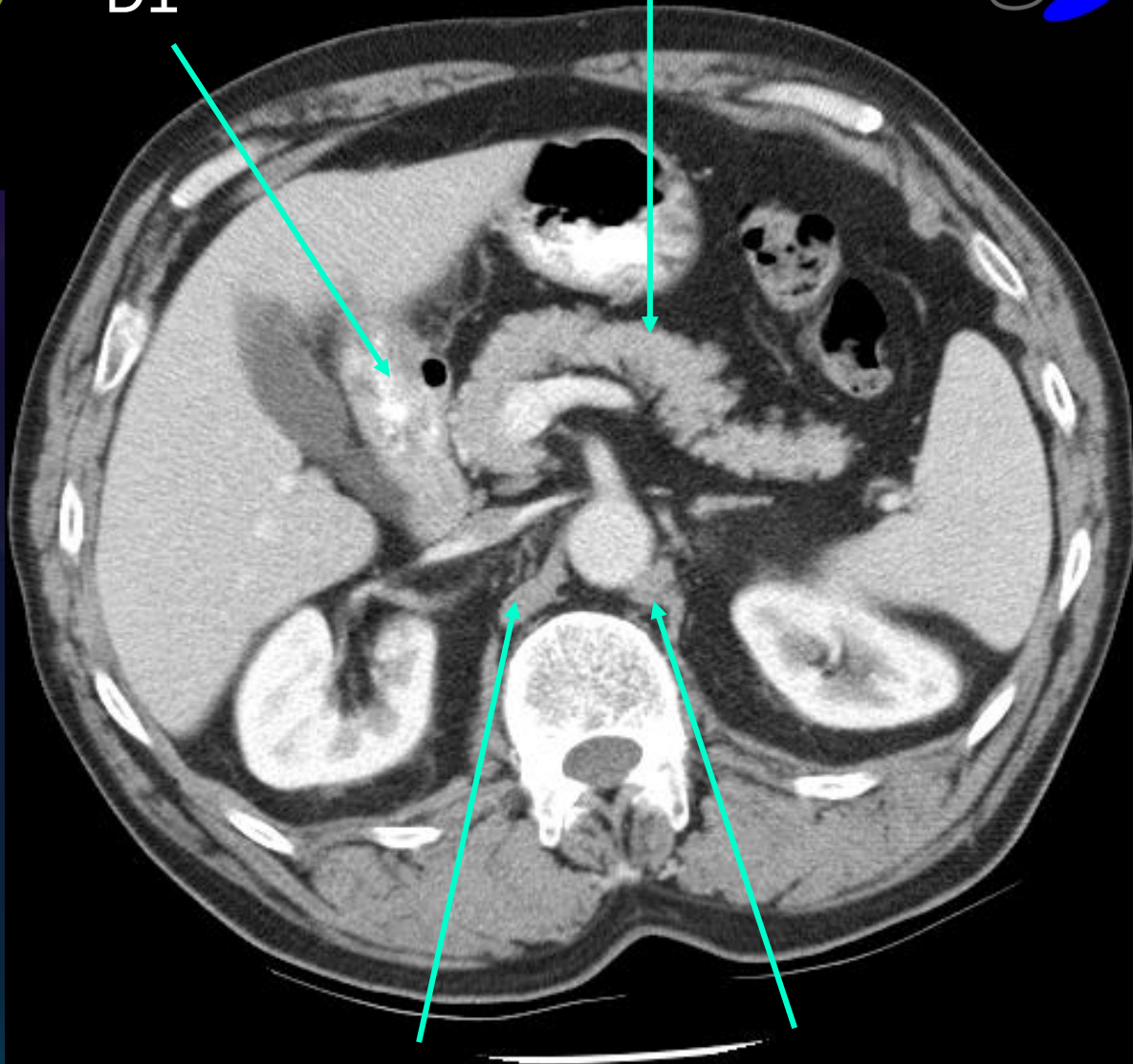




Pancreatic Body



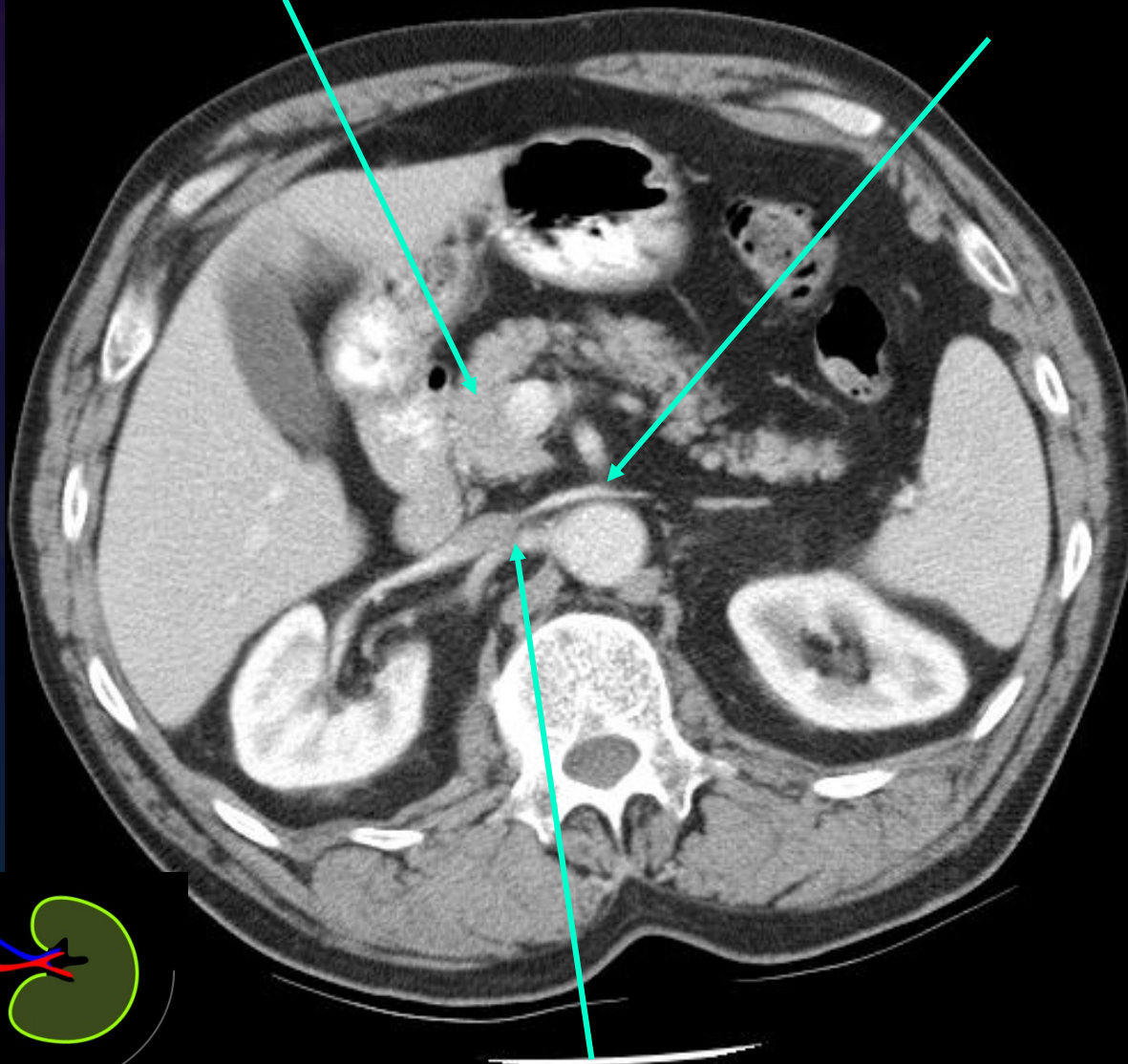
D1



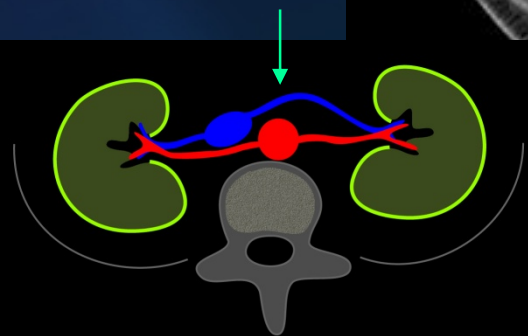
Diaphragmatic Crura

Pancreatic Head

Lt Renal Vein

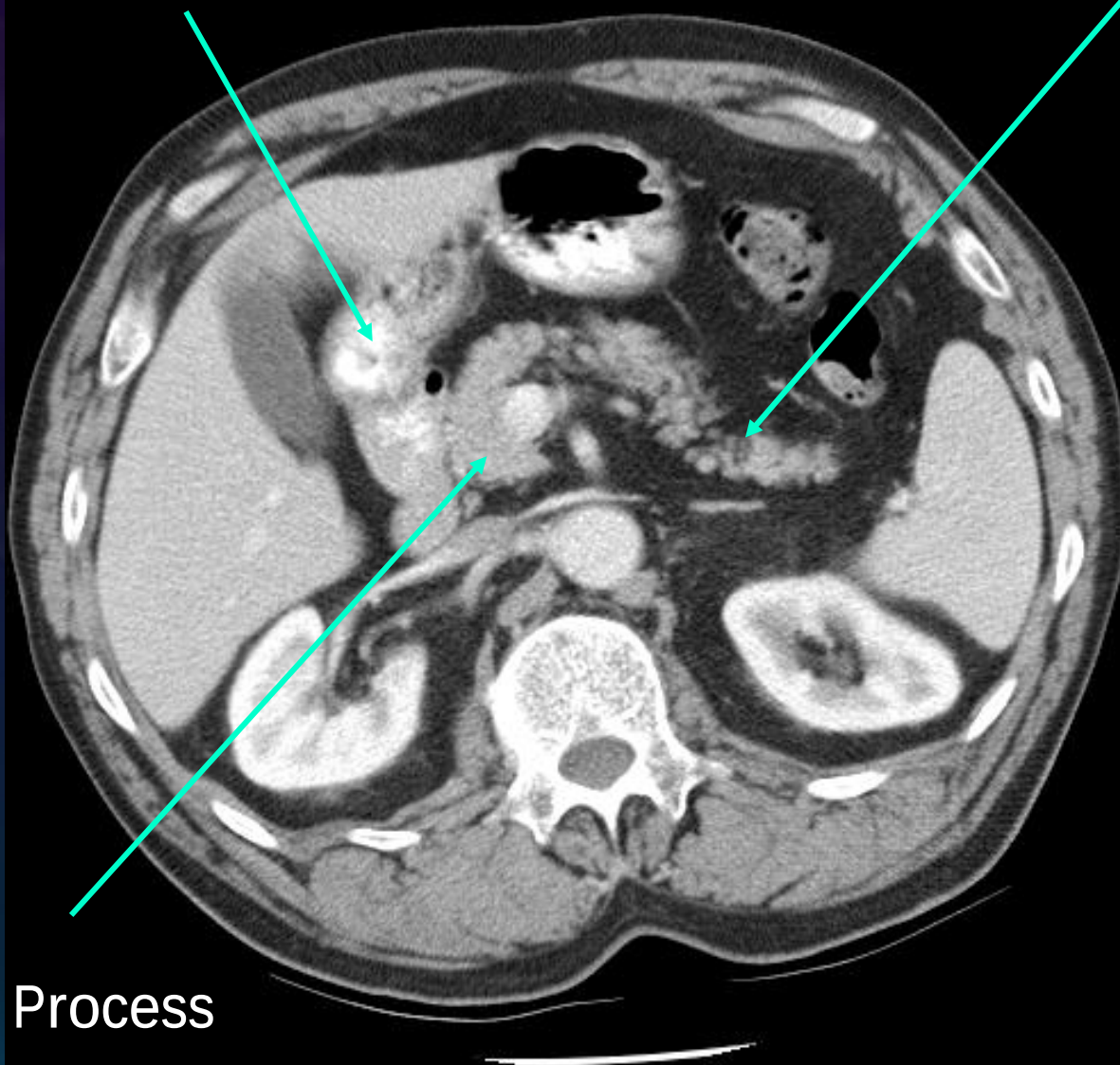


Rt Renal Artery



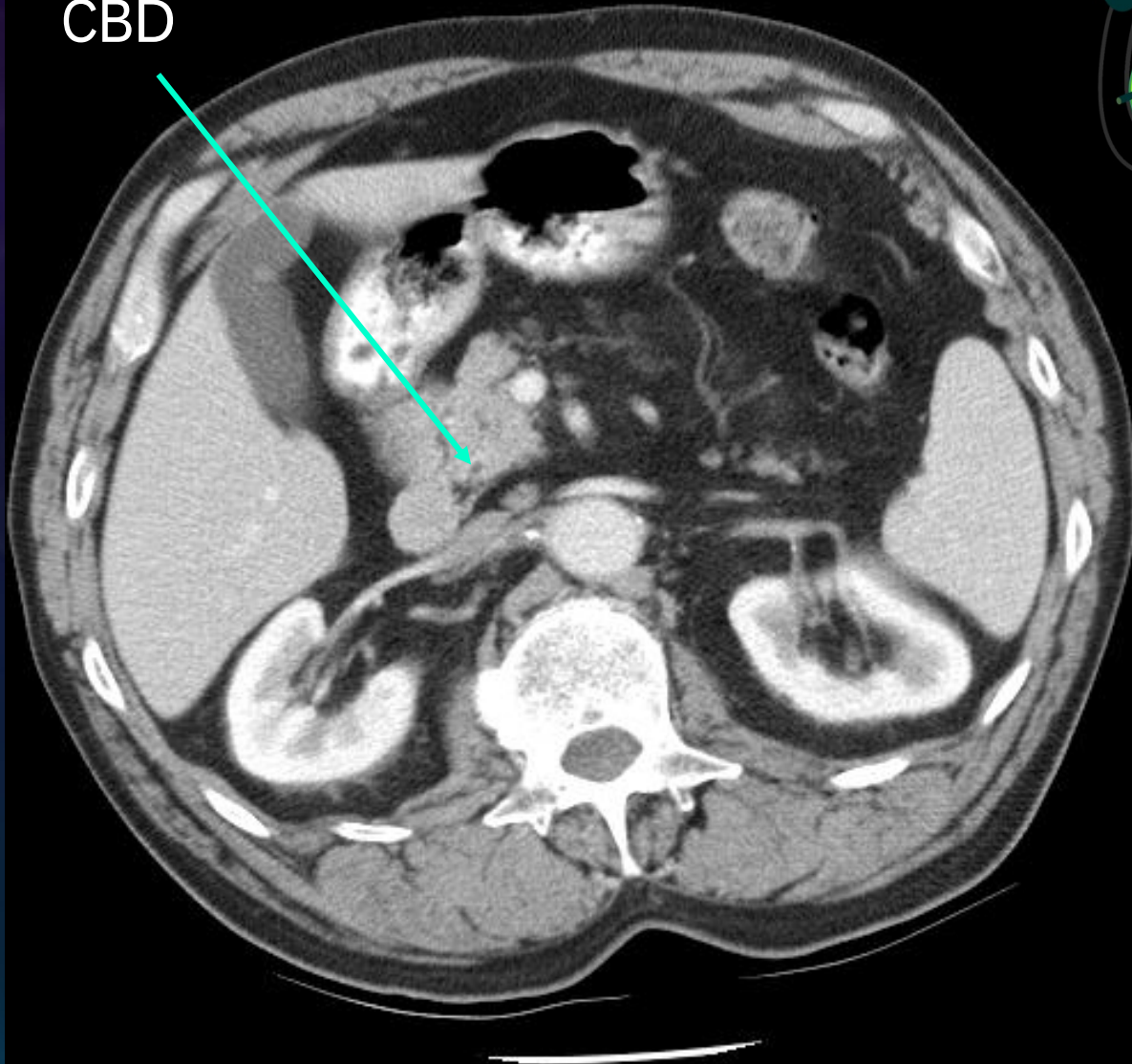
Gastric Outlet / D1

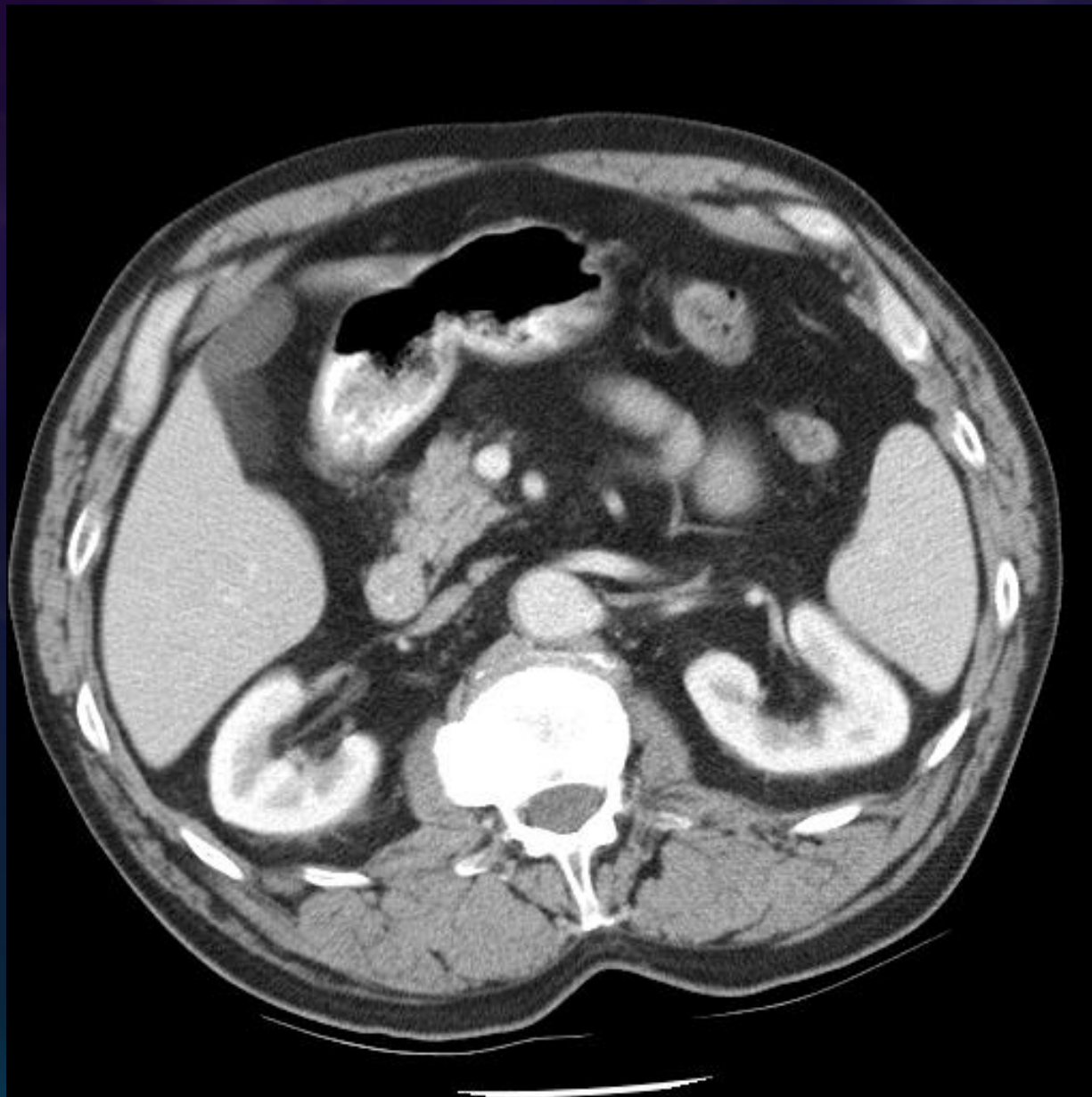
Pancreatic Tail

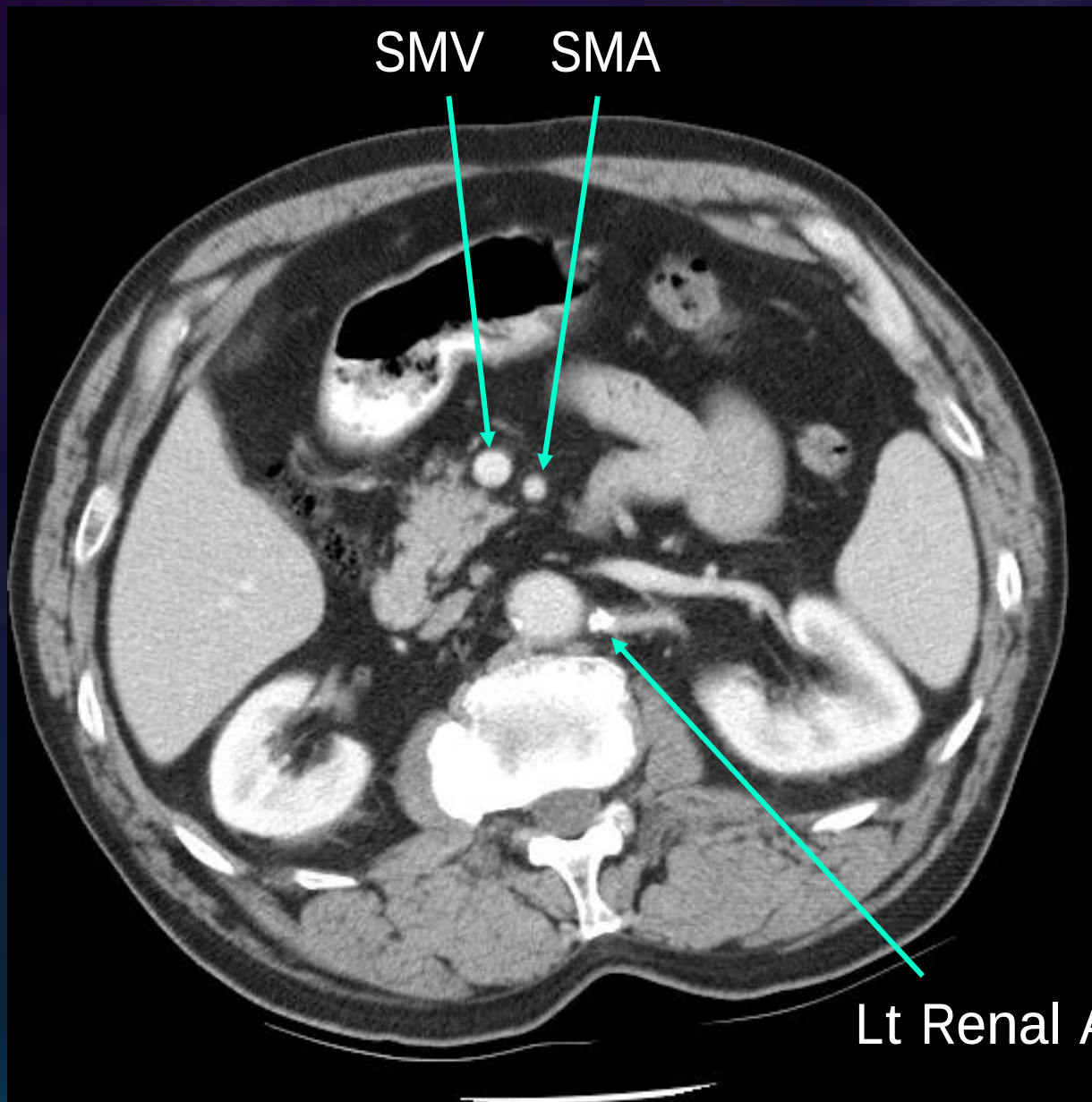


Uncinate Process

CBD







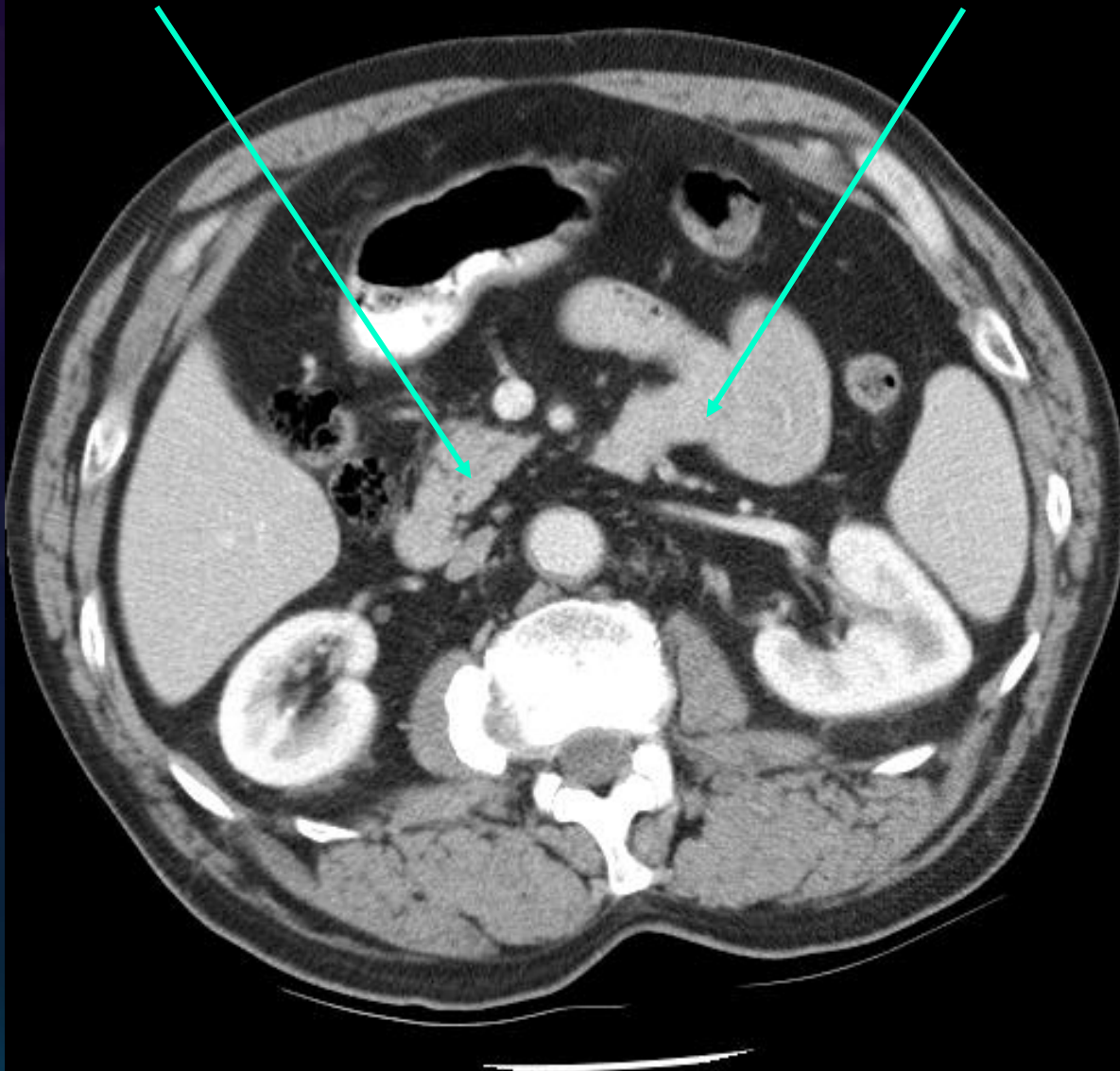
SMV

SMA

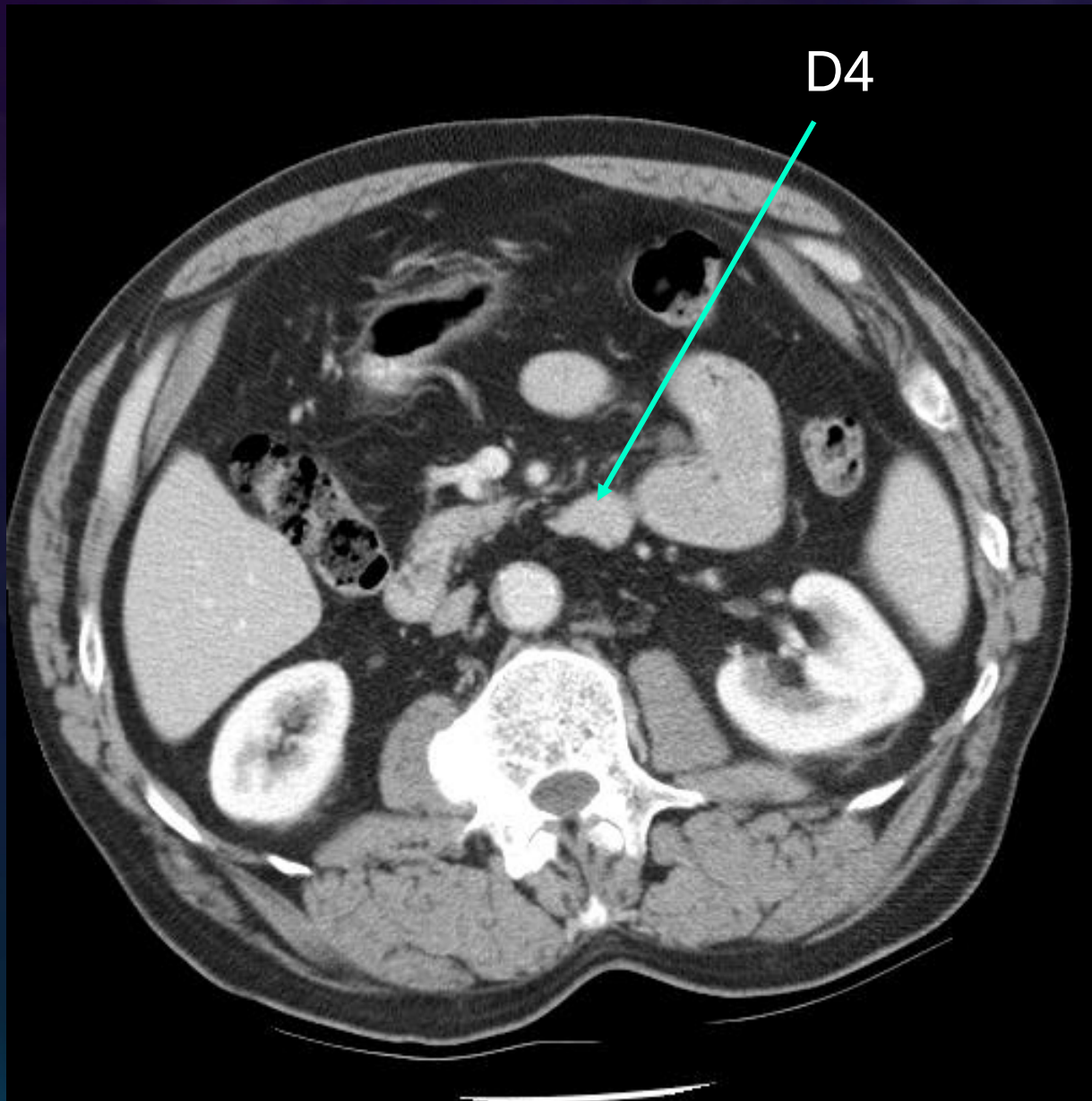
Lt Renal Artery

Uncinate Process

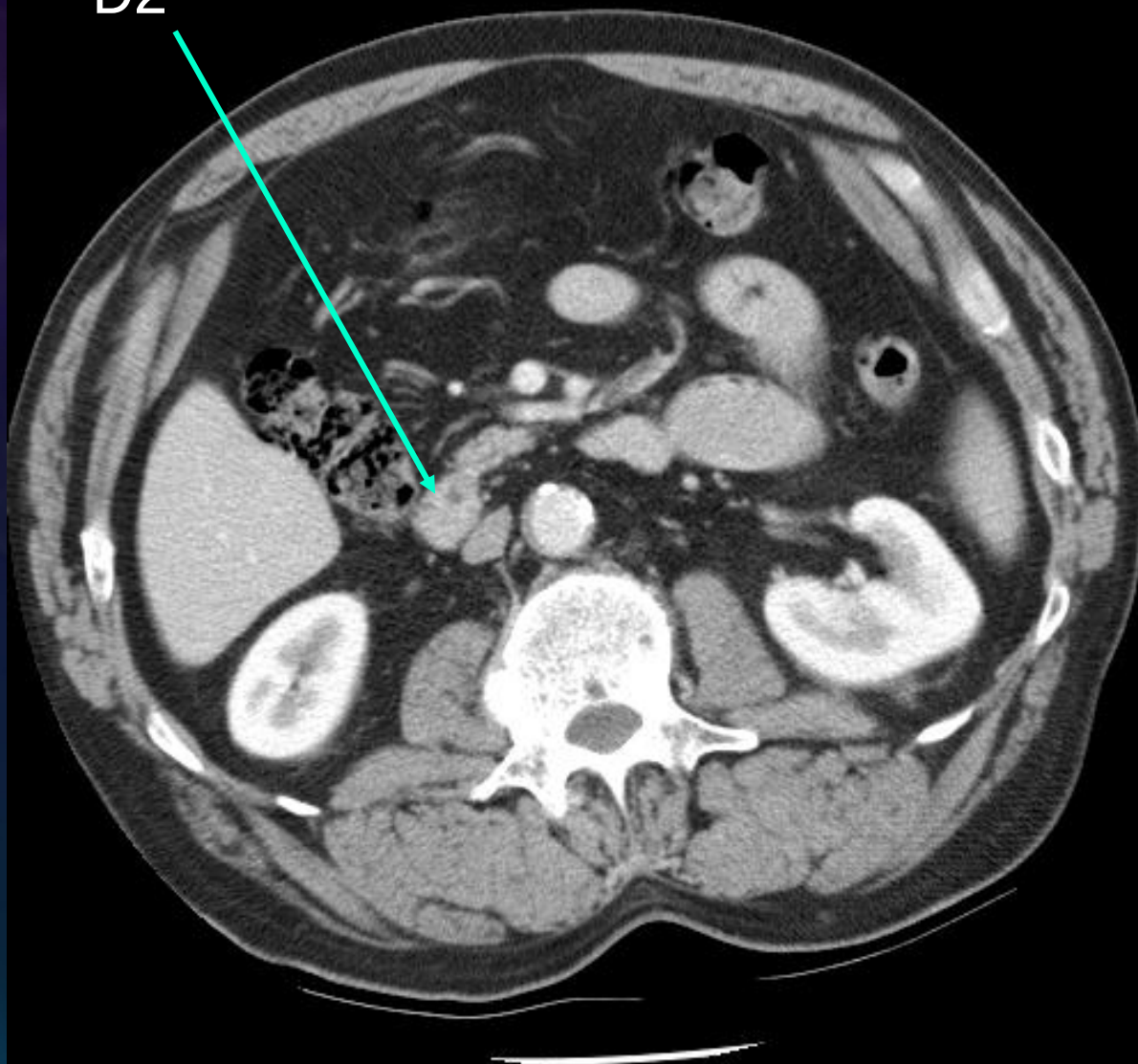
D-J Flexure





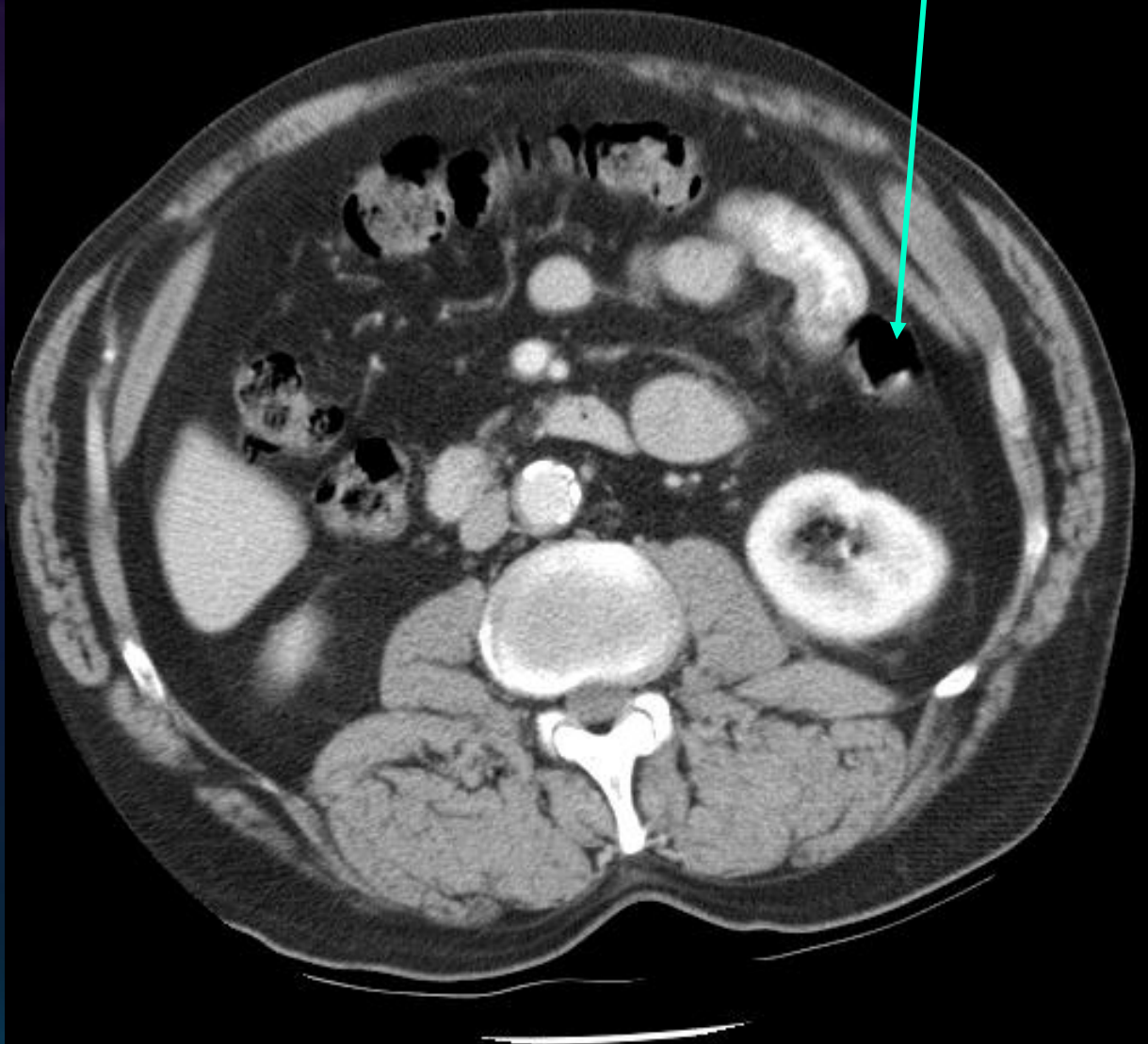


D2



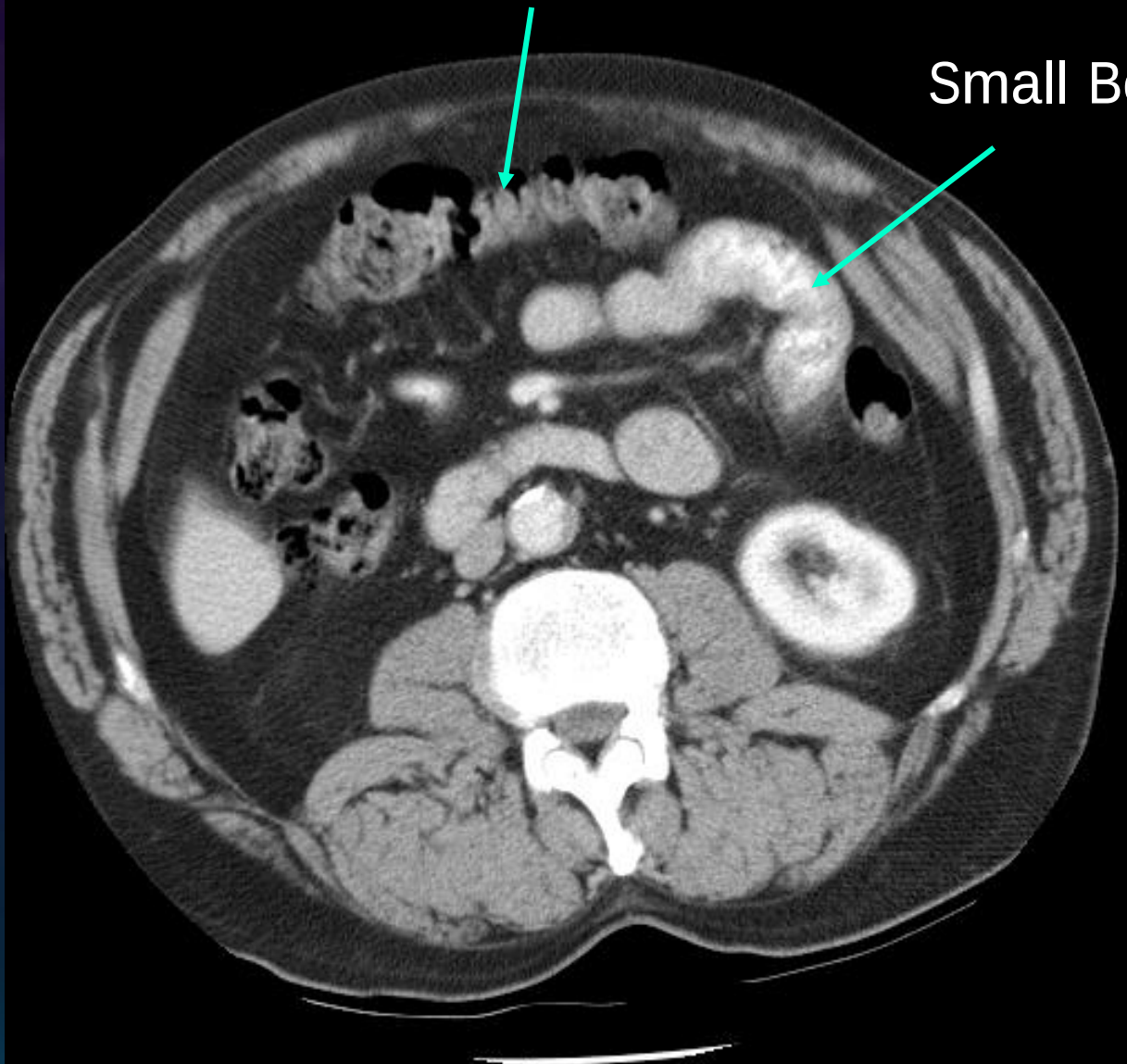


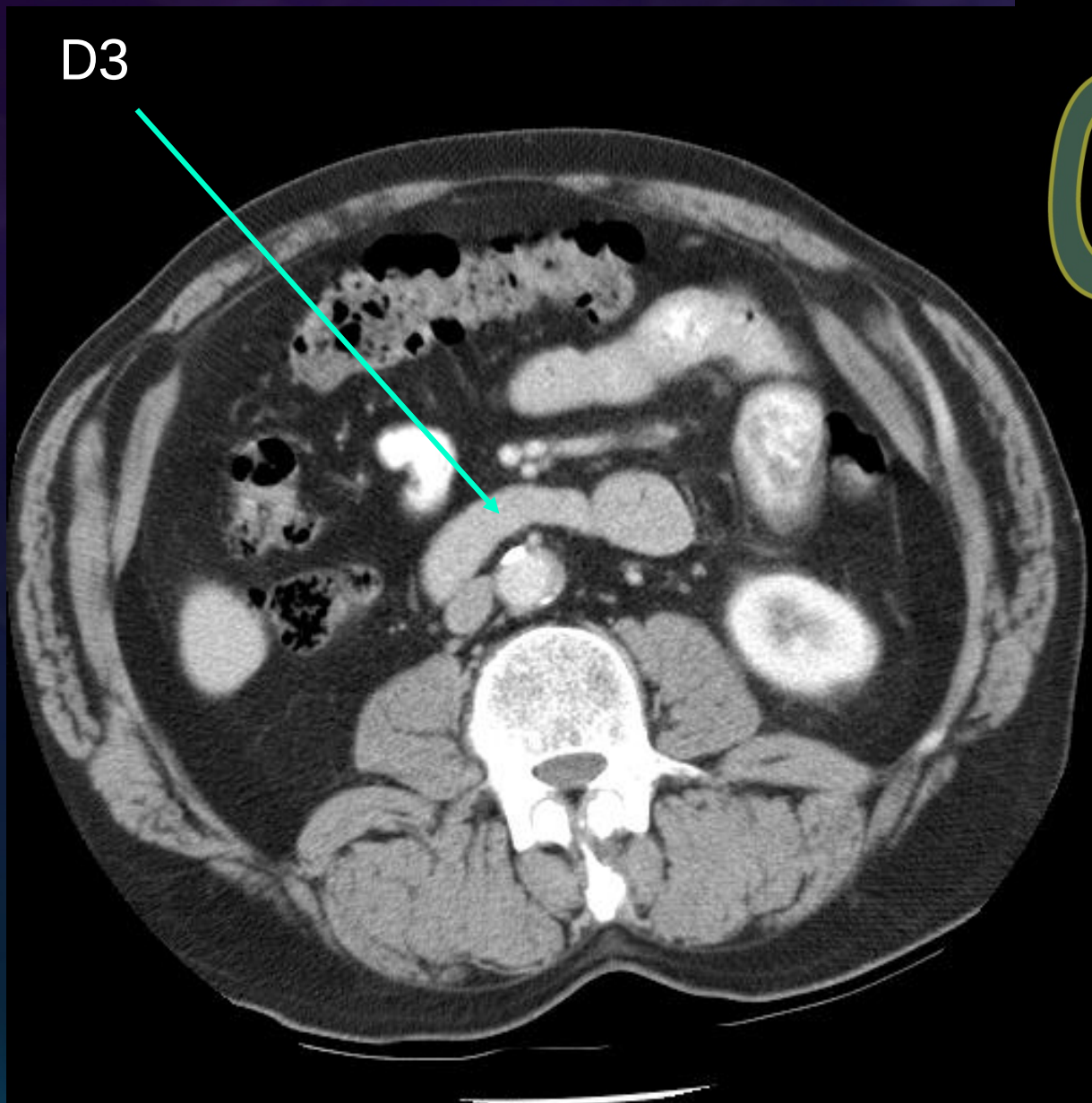
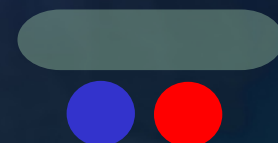
Descending (Left) Colon



Transverse Colon

Small Bowel



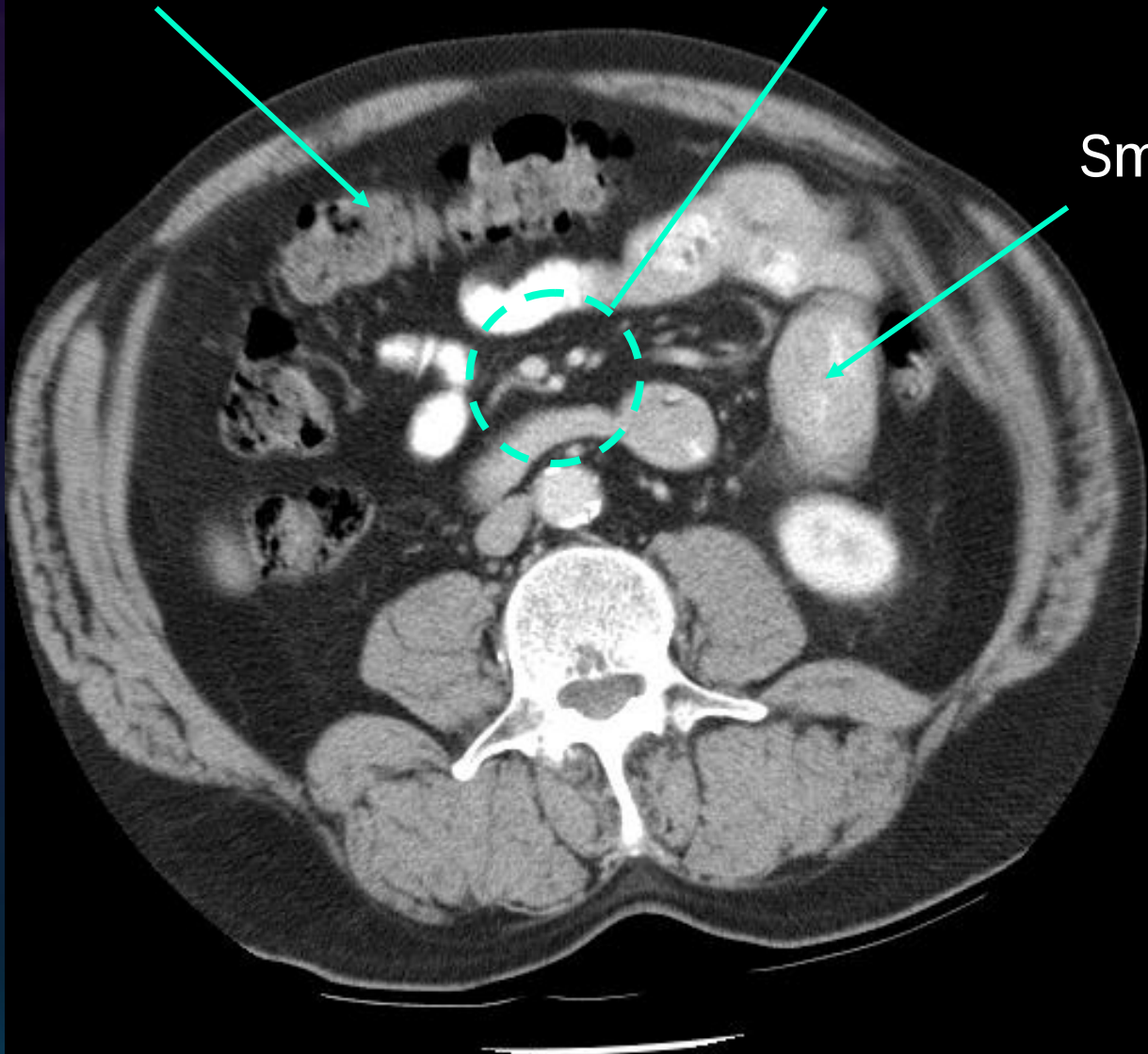




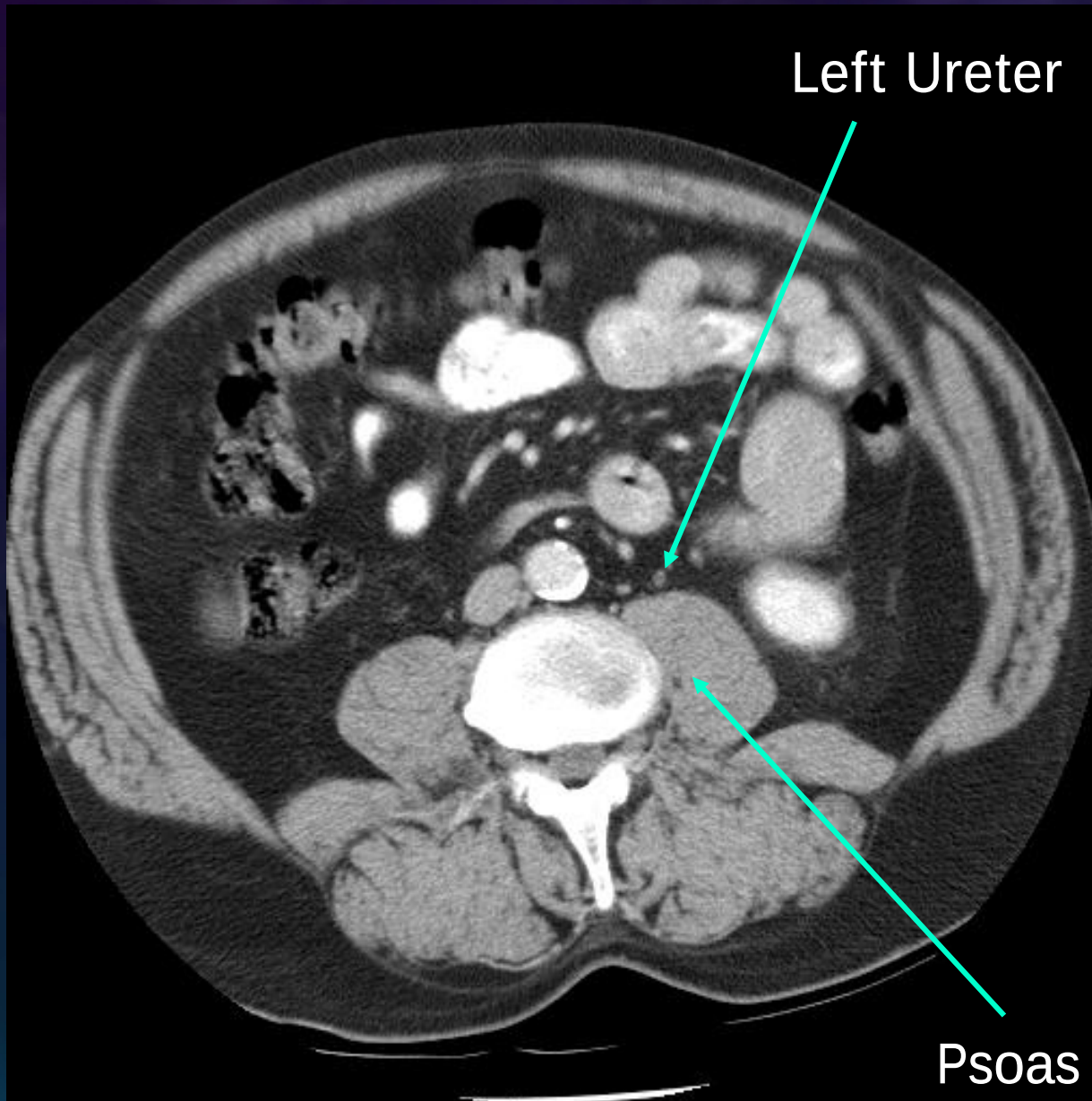
Transverse Colon

Mesenteric Vessels

Small Bowel

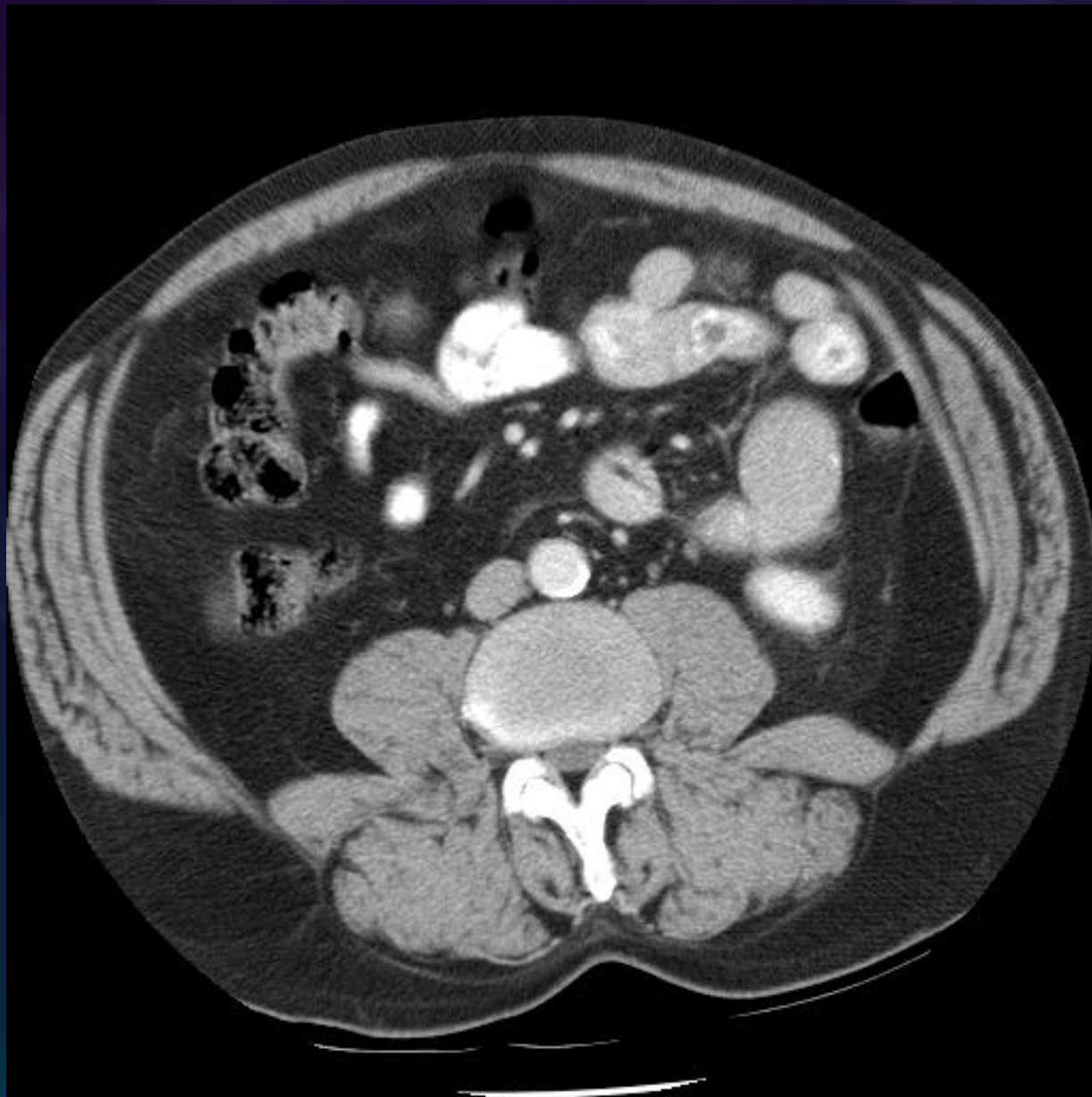






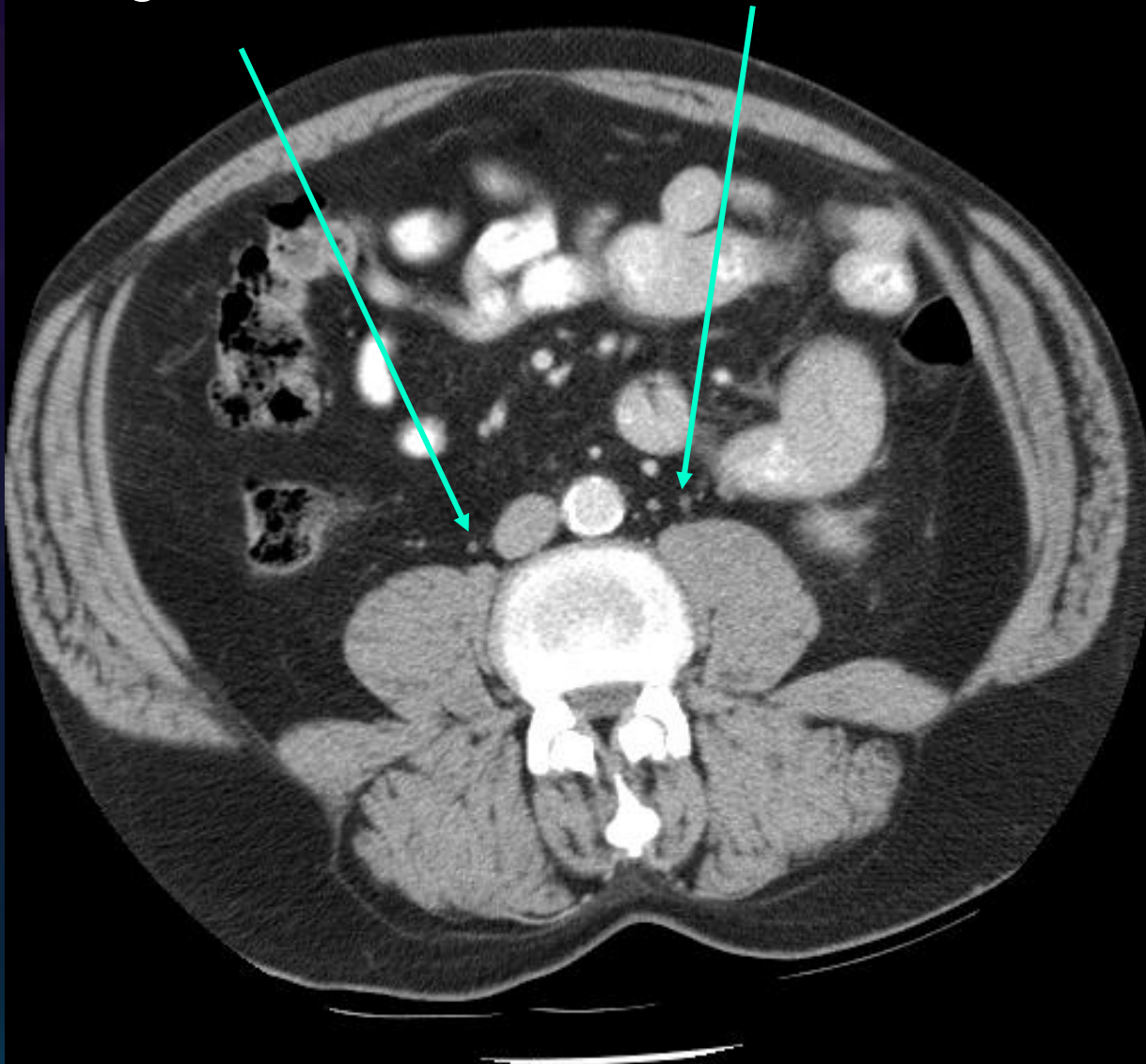
Left Ureter

Psoas Muscle



Right Ureter

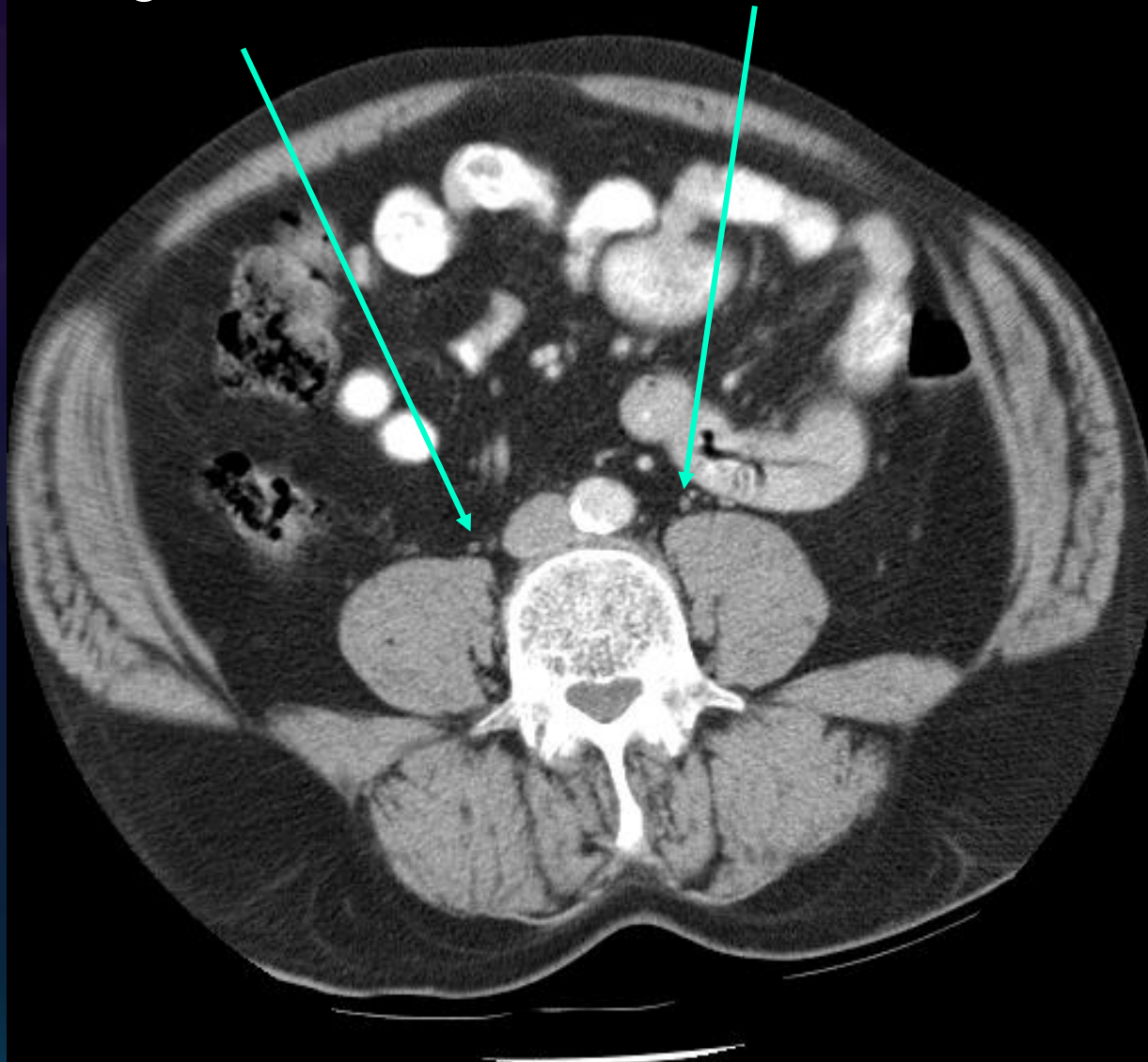
Left Ureter





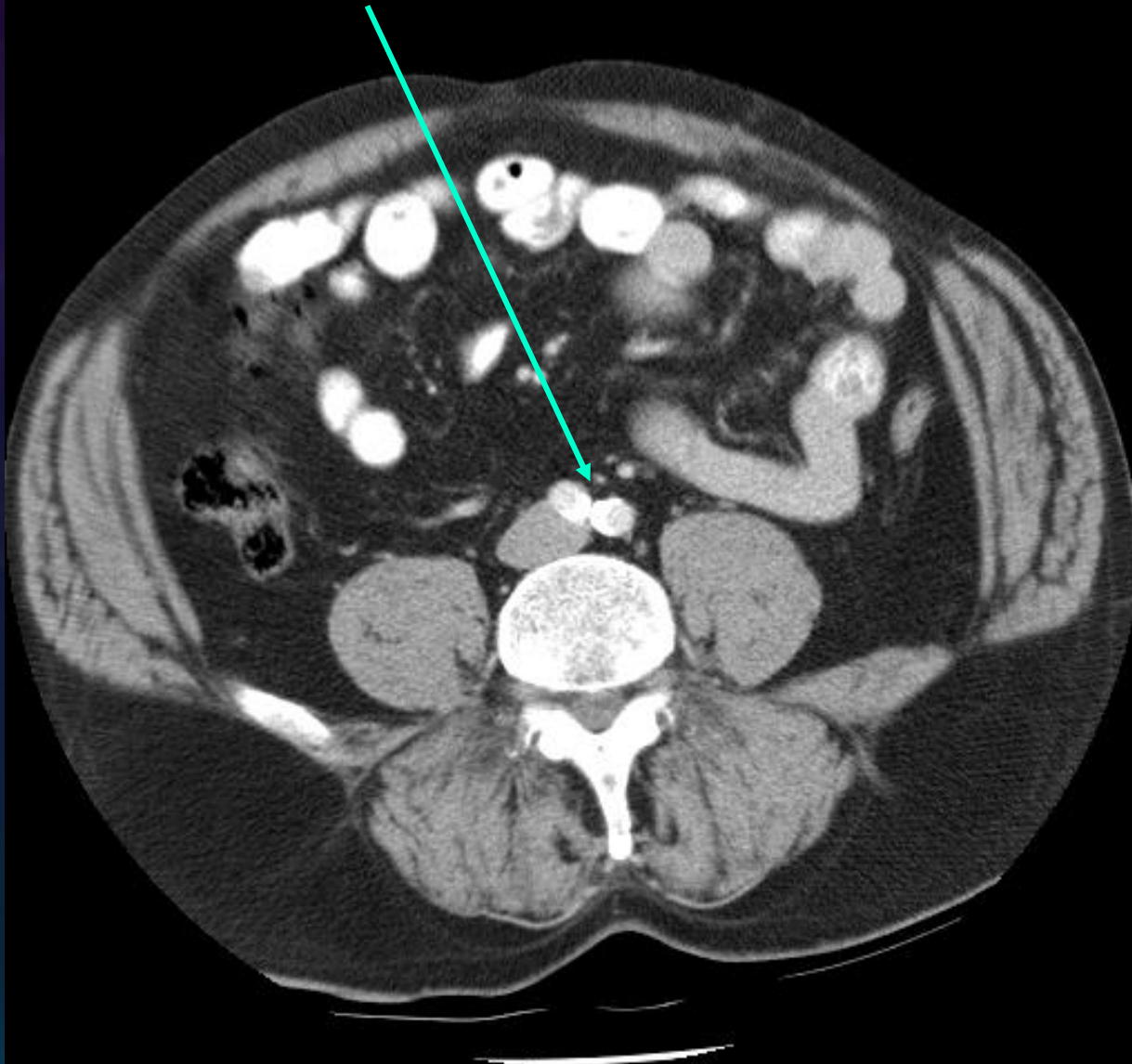
Right Ureter

Left Ureter



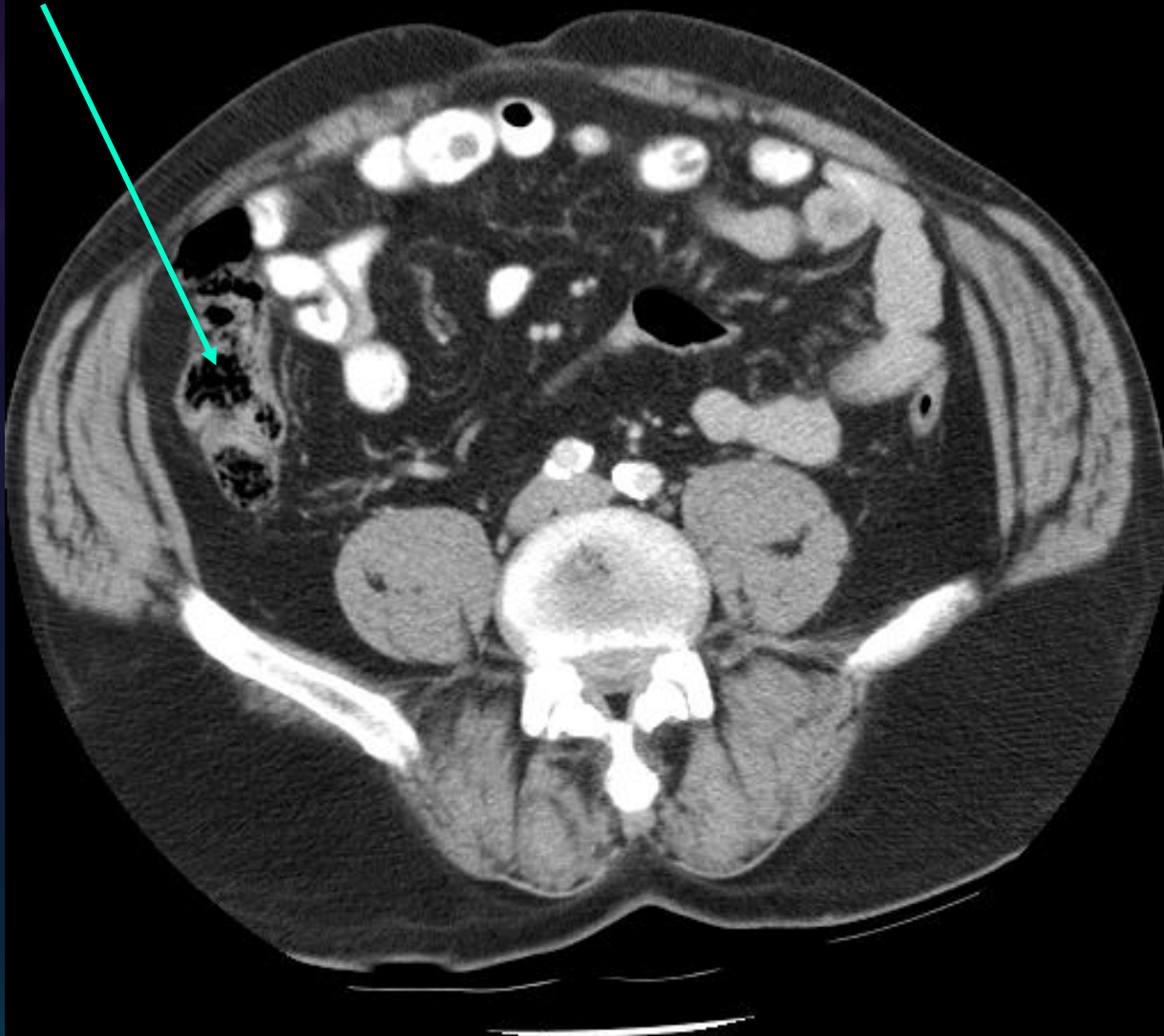


Common Iliac Origins





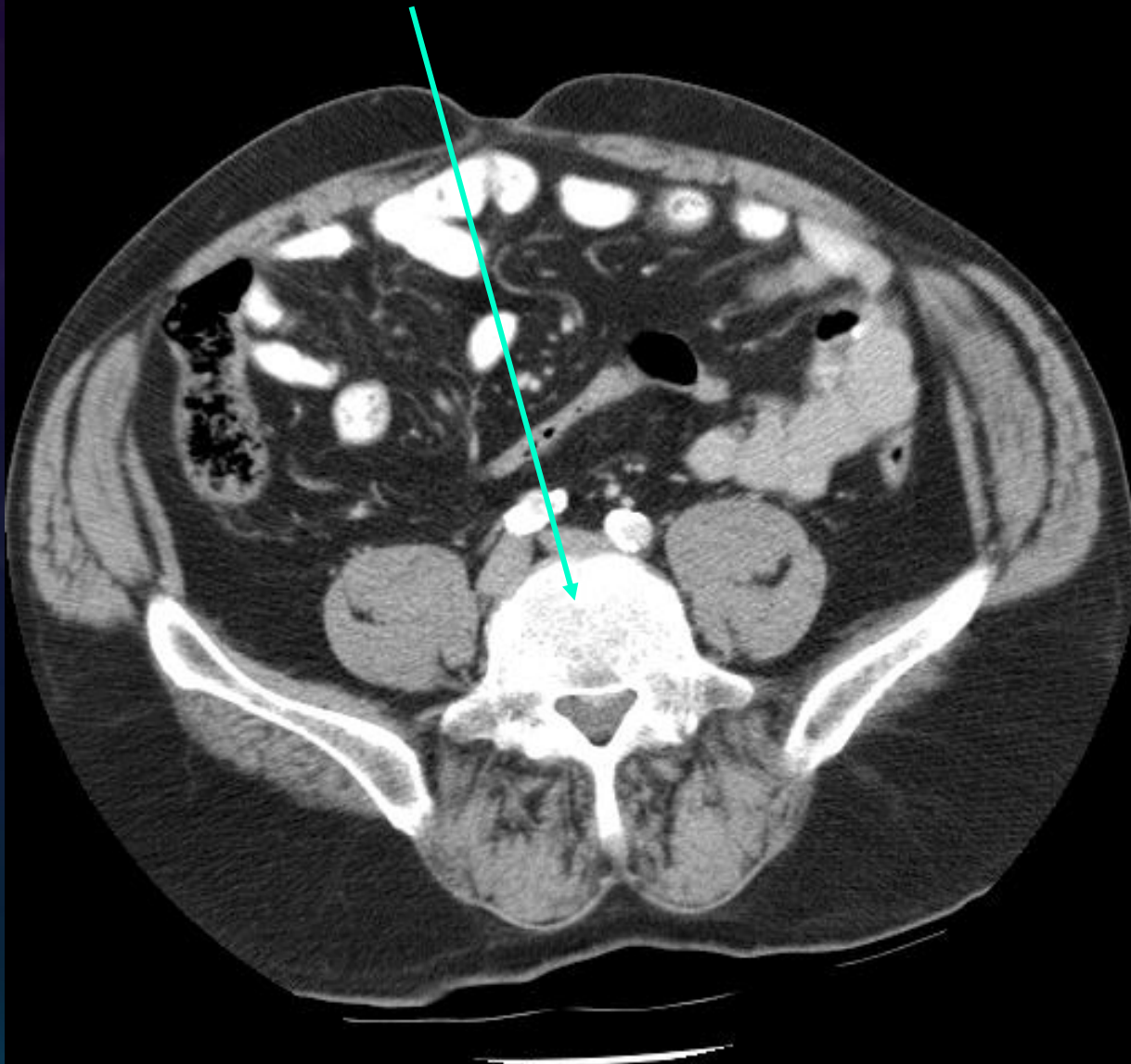
Ascending (Right) Colon





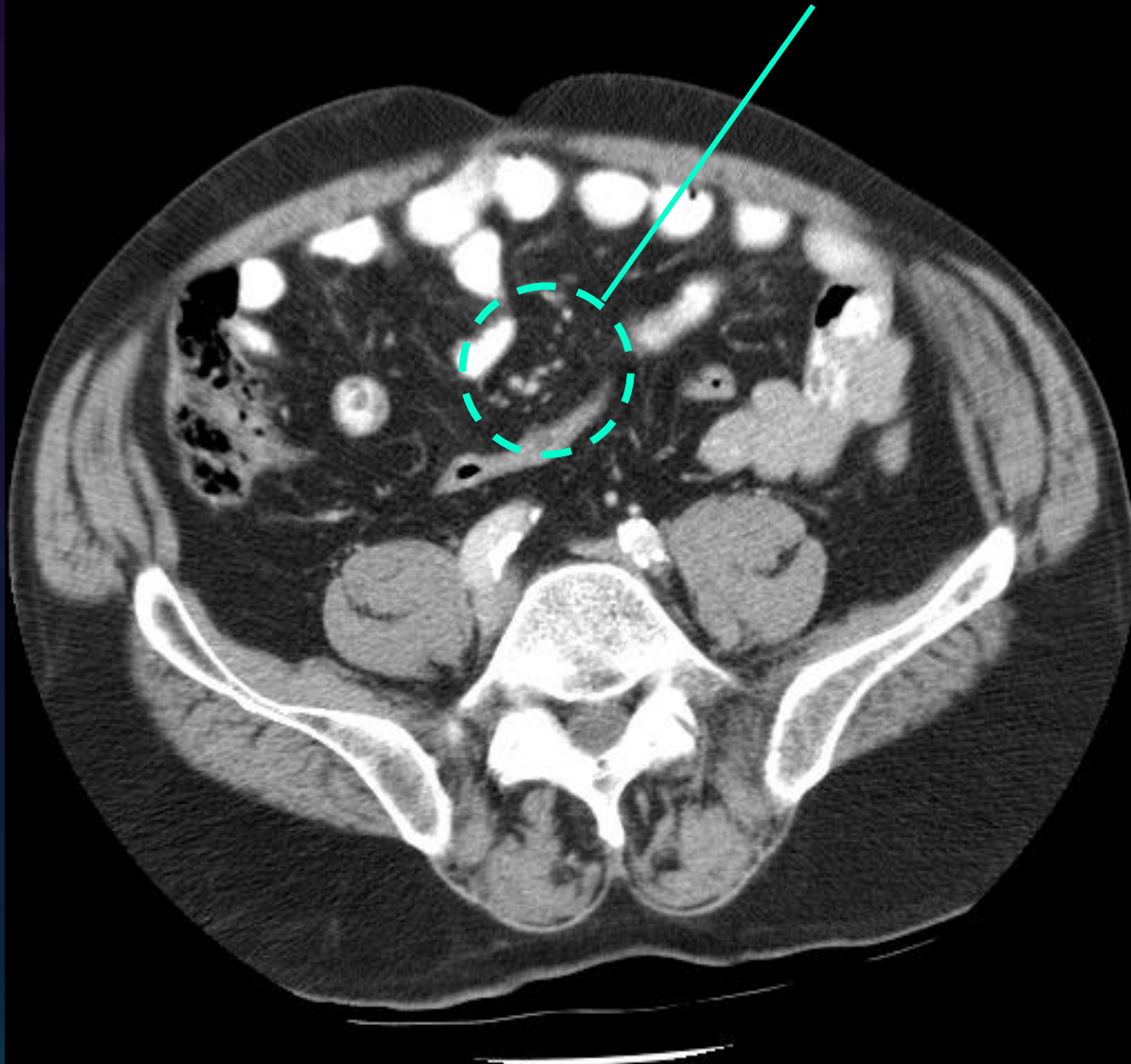


L5 Vertebra



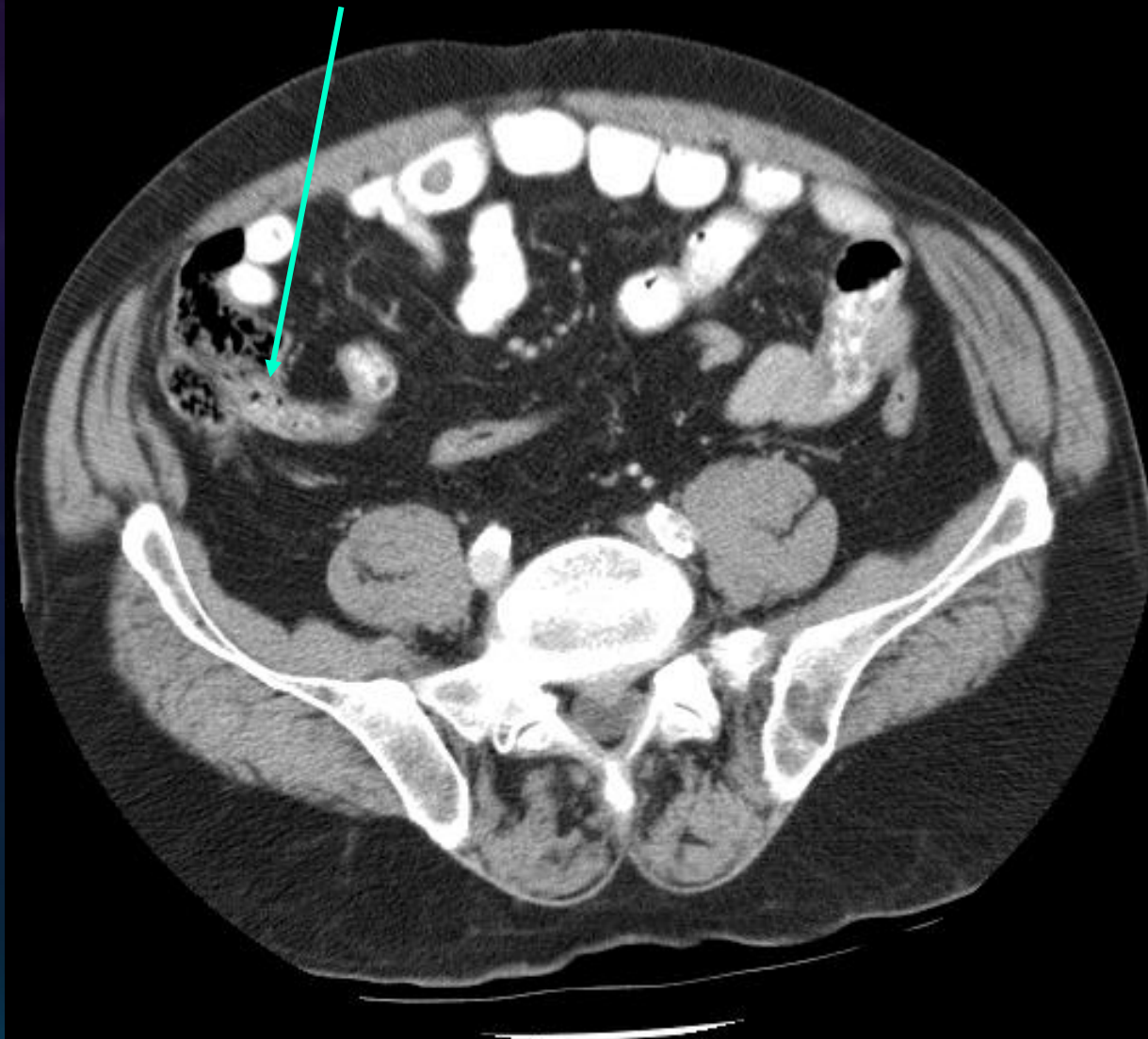


Mesenteric Vessels

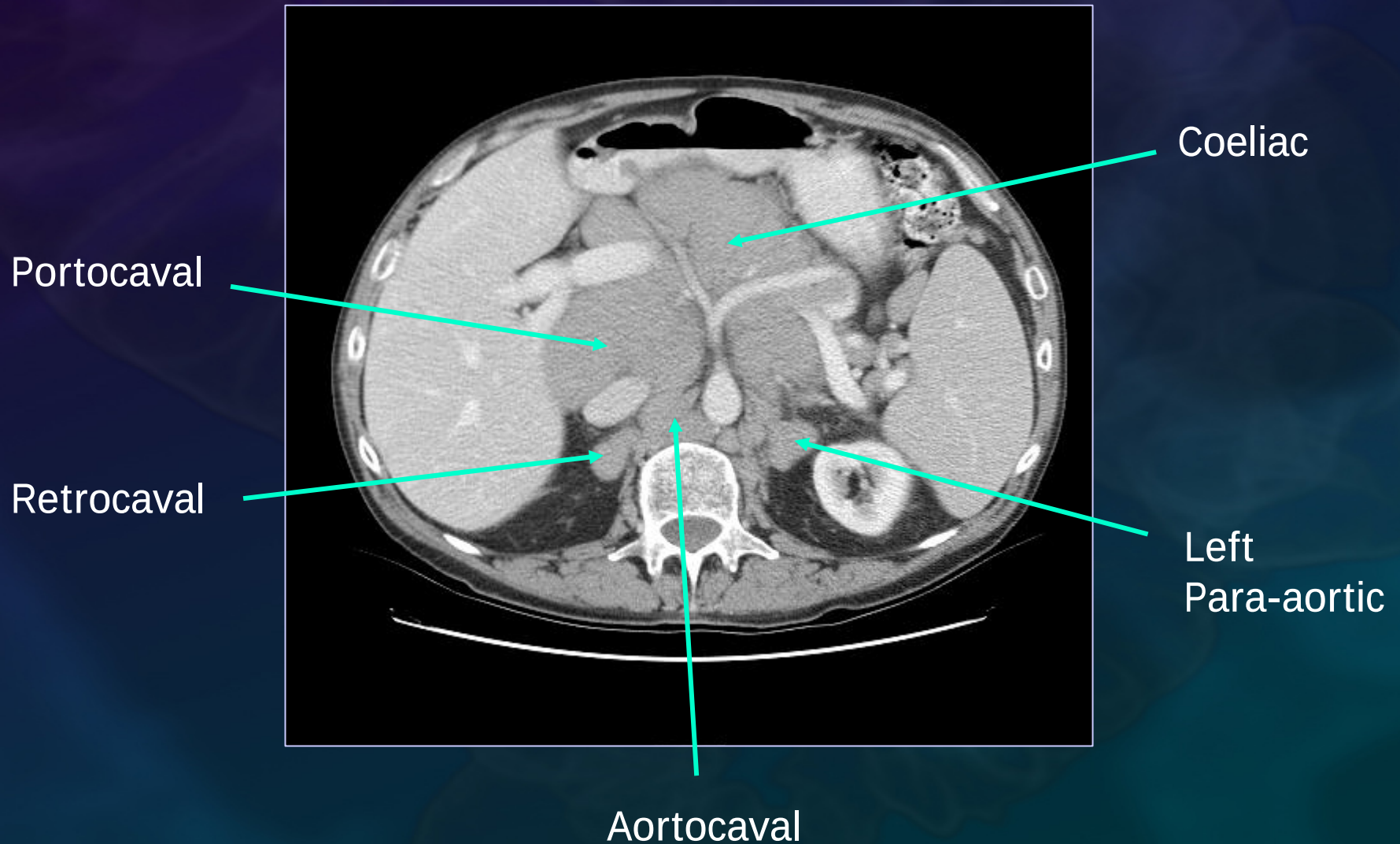




Ileocaecal Junction

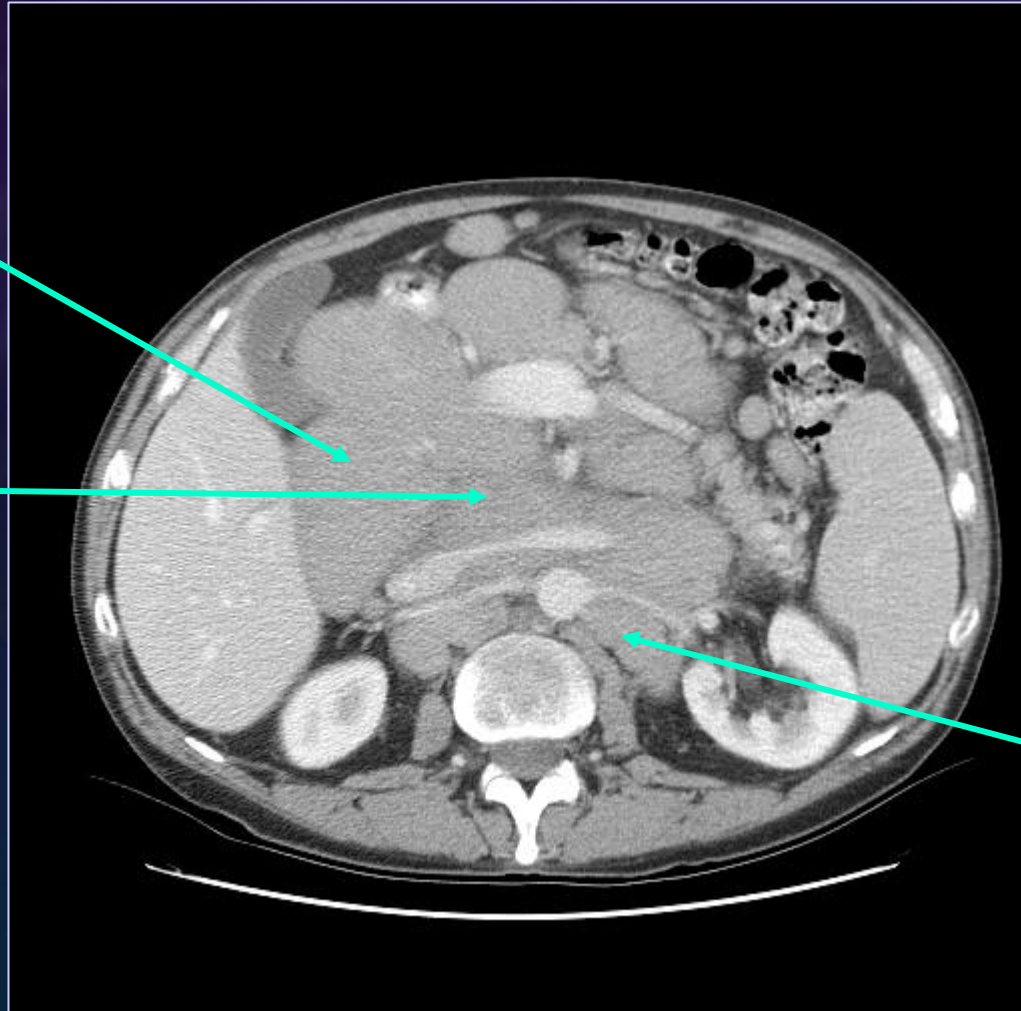


Lymphadenopathy - example



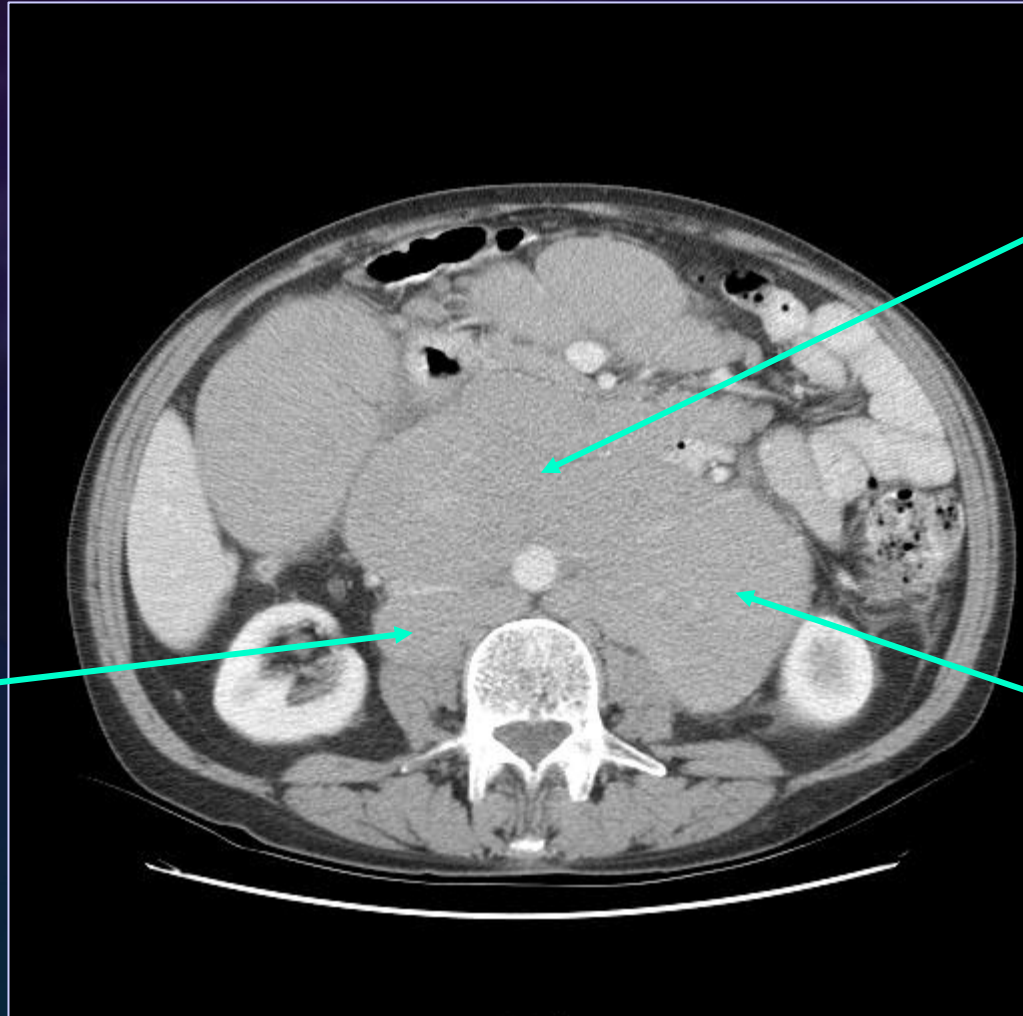
Periportal

Portocaval



Left
Para-aortic

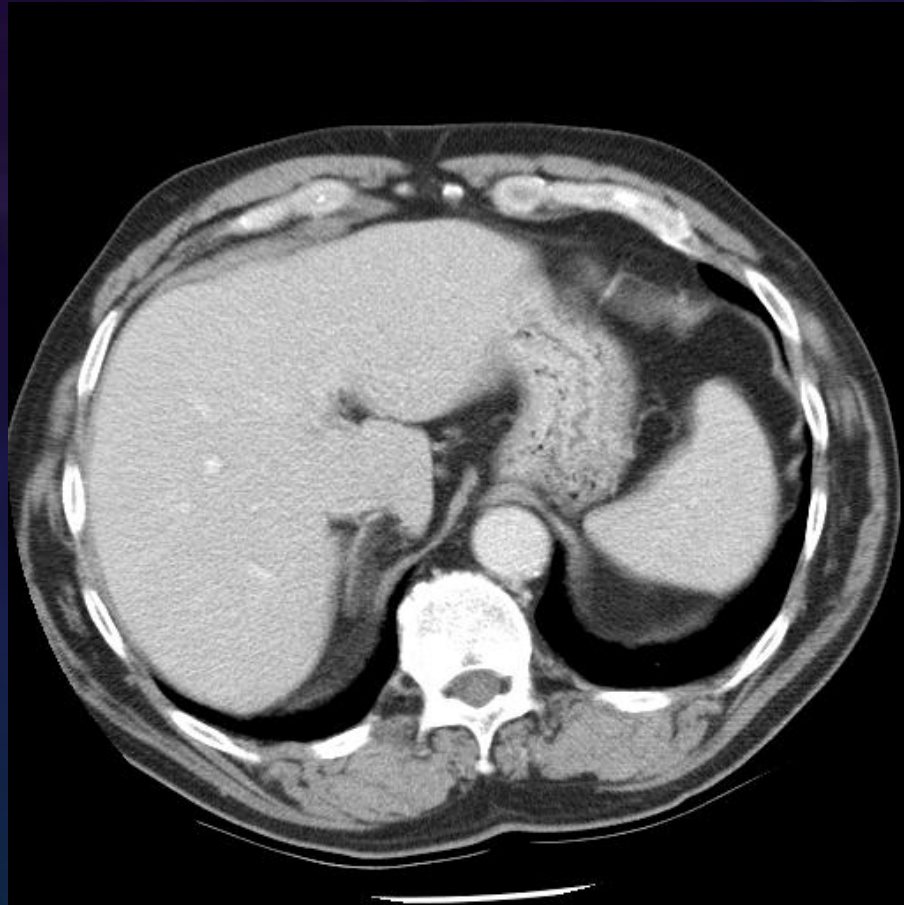
Retrocaval

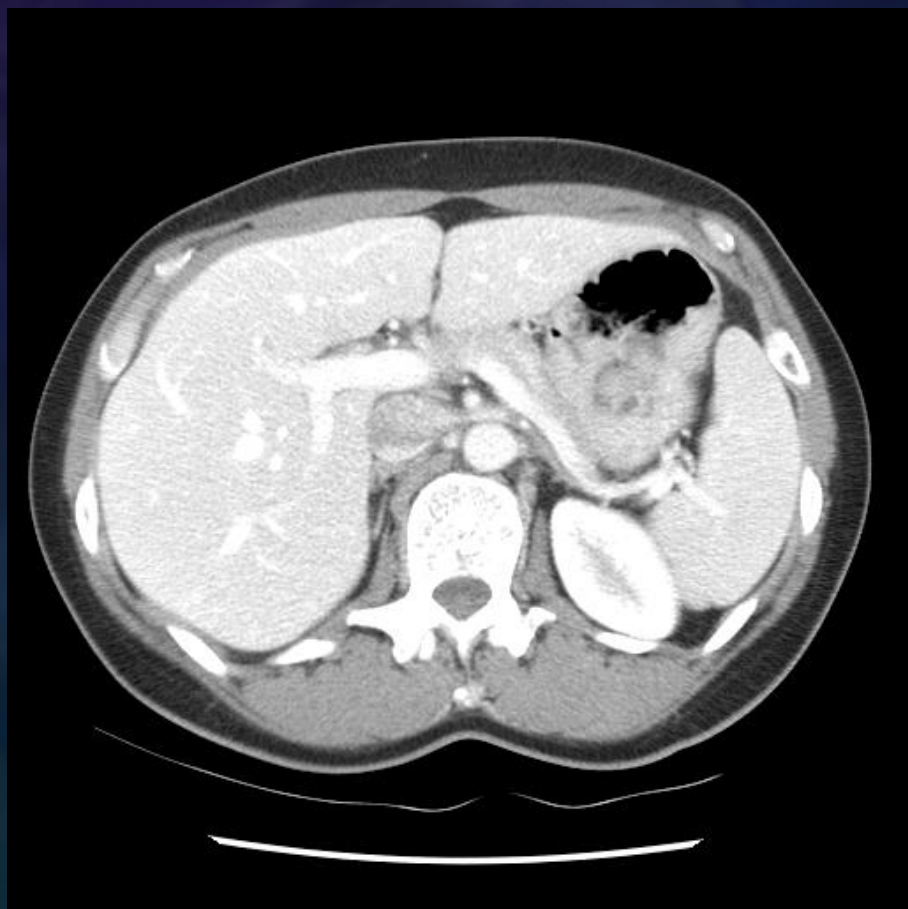


Mesenteric

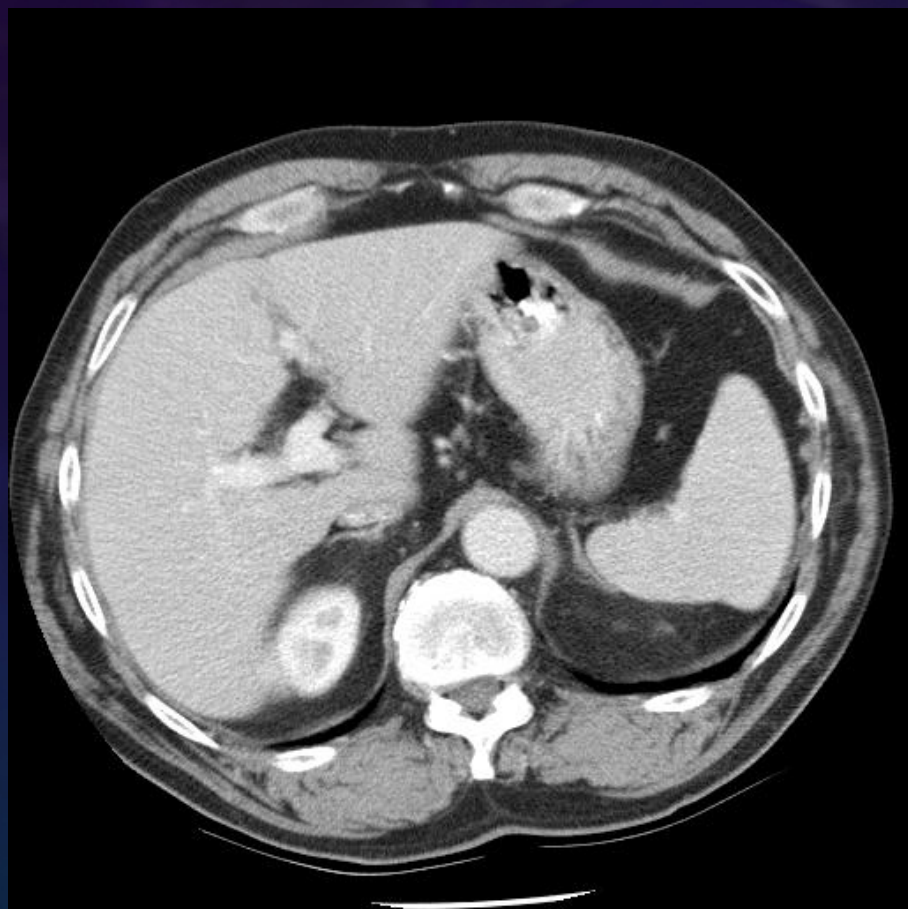
Left
Para-aortic

Normal Variation









Summary (1)

Upper Abdominal Cross-Sectional Anatomy Important Landmarks

- Aorta and IVC (longitudinal tubular vessels)
- Aorta has 4 main branches - most arise anteriorly
- IVC receives drainage from 4 main tributaries - hepatic, renal, gonadal and iliac veins
- Left renal vein crosses over aorta and has a longer course

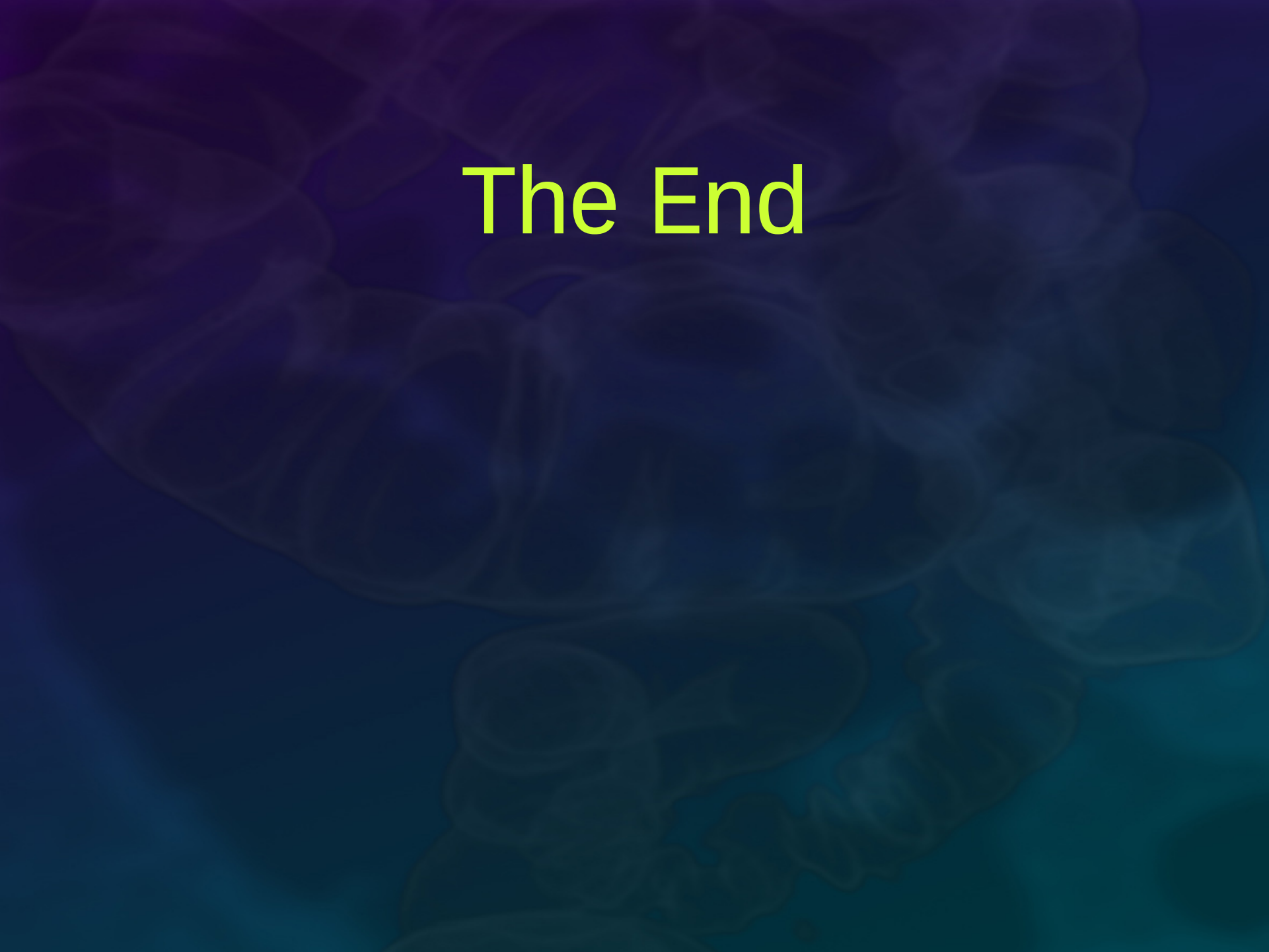
Summary (2)

- **Portal vein** is an important vessel, formed by junction of splenic vein and SMV
- **Portal and hepatic veins** are key landmarks for designation of hepatic segments
- **Duodenum** has 4 parts – remember that D4 lies at a higher axial level relative to D3
- **Pancreas** has 4 parts and oblique axial orientation – view over multiple slices
- Right and left **adrenal** have differing shapes (look for right side first, behind intrahepatic IVC)

Summary (3*)

Sagittal view may help to differentiate

- gastro-omentum lymph nodes: below the stomach
- pancreatic lymph nodes: retroperitoneal region
- porto-hepatic lymph nodes: porto-hepatic notch
- mesenteric lymph nodes: within the peritoneal cavity
- identify uterus



The End