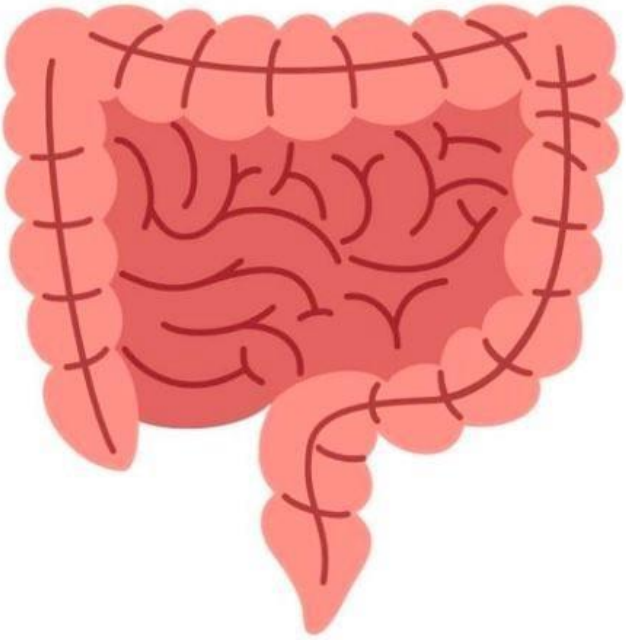
GIS

Sheet no. 1

Anatomy



Done by: Doctor 018 + Baker Shiha
Correction: Hadeel abuatiyeh
Doctor: Mohammad AlMohtaseb

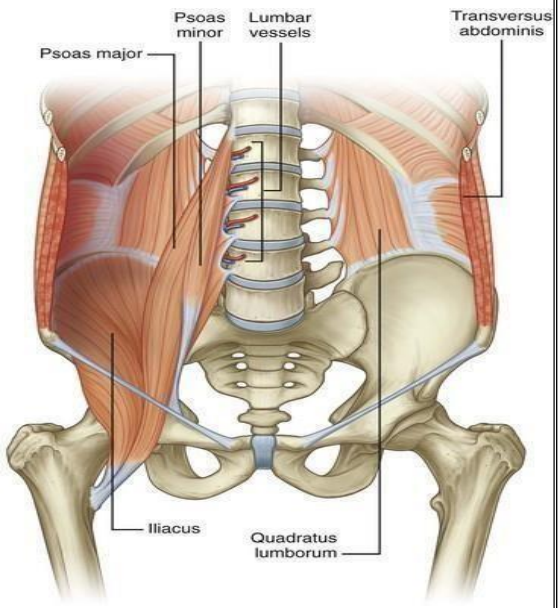
Posterior abdominal wall

Structures of Post. Abdominal wall:

- **5 lumbar vertebra** & their **intervertebral disc**.
- **12th ribs** (floating ribs).
- Upper part of bony pelvis (**iliac crest**, which is used for bone biopsy).
- **Muscles**:

- psoas major inserted on lesser trochanter.
- psoas minor in front of psoas major (usually absents).
- Quadratus lumborum.
- Iliacus which lies in the iliac fossa, inserted into lesser trochanter.

- **Aponeurosis of transversus abdominis muscles**.



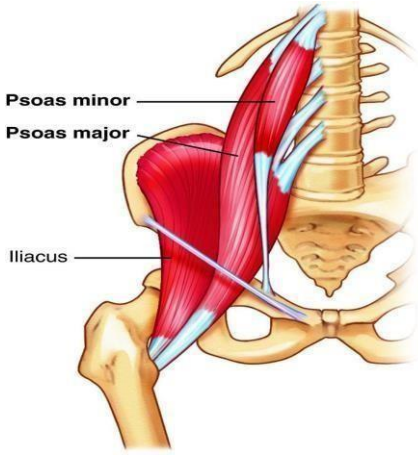
Muscles of posterior abdominal wall

1) Psoas major:

- Origin: body (lateral side) & transverse process of lumbar vertebra & intervertebral disc.
- Insertion: It Meets with iliacus muscle and they are inserted together in **Lesser trochanter of femur (iliopsoas insertion).**
- Nerve supply: Nerve plexus (T12 subcoastal nerve, L1, L2, L3).
- Action: Flexion of hip & thigh.

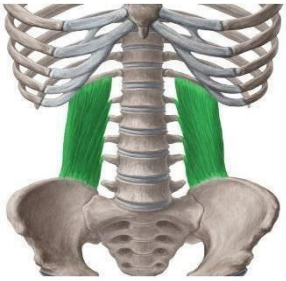
2) Iliacus muscle:

- Origin: Iliac fossa.
- Insertion: Lesser trochanter of femur (iliopsoas insertion).
- Nerve supply: Femoral nerve.
- Action: Lateral flexion of hip & thigh for lying position.



3) Quadratus lumborum:

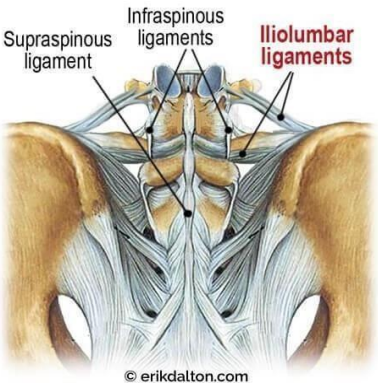
- Origin: Iliolumbar ligament & iliac crest.
- Insertion: 12th rib.
- Nerve supply: Nerve plexus (T12 subcoastal nerve, L1, L2, L3).
- Action: Fixation of 12th rib during inspiration & lateral flexion of the trunk.



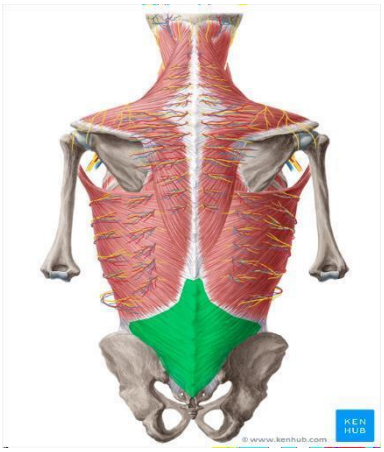
❖ Iliolumbar ligament

The Iliolumbar ligament is a strong ligament passing from the tip of transverse process of L5 to the posterior part third of the inner lip of the iliac crest.

*It gives origin for quadratus lumborum muscle.



❖ NOTE: The intercoastal nerves descend from the thorax to the abdomen, between transversus abdominis muscle and internal oblique muscle.



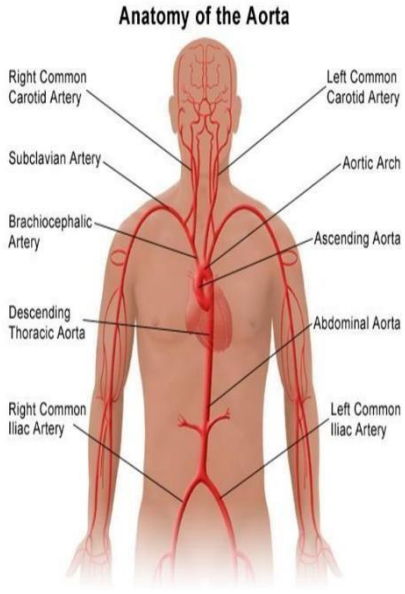
Arteries of the Posterior Abdominal Wall

❖ Aorta

Location and description:

- It originates from the left ventricle of the heart as ascending aorta; it gives the left and right coronary arteries which are the main blood supply to the heart.
- It then arches to form the arch of the aorta, giving 3 branches:
  1. Left subclavian.
  2. Left common carotid.
  3. Right Brachiocephalic, it branches to:
     a. Right common carotid.
     b. Right subclavian.

This is the only asymmetrical part in our body

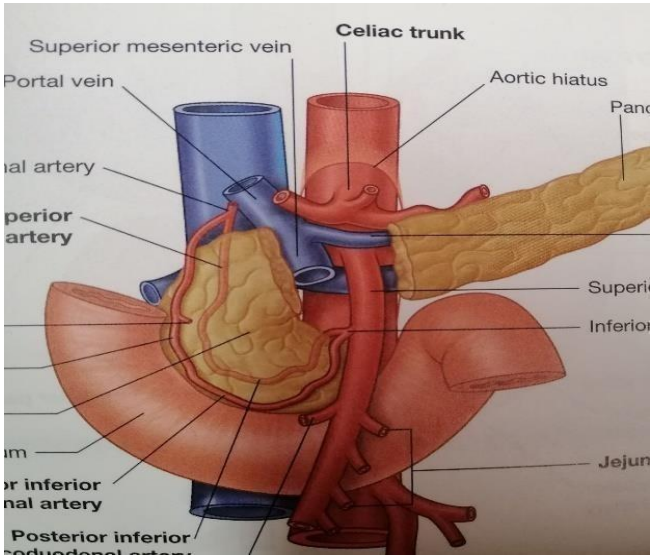


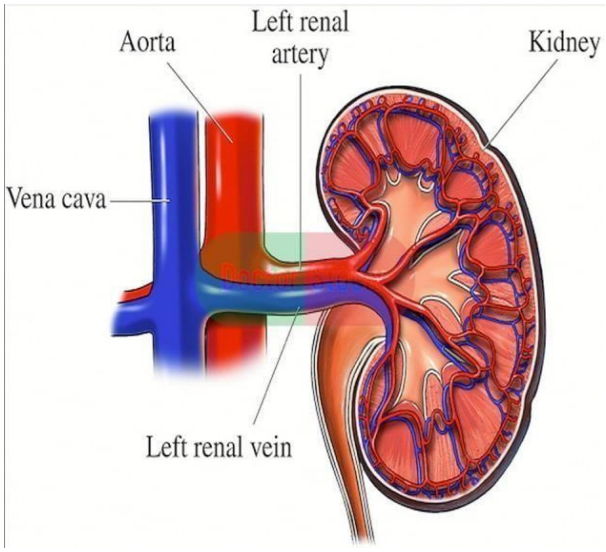
- Aorta then descends to form the descending thoracic aorta that enters the abdomen through the aortic orifice at the midline of the diaphragm on the level of T12 as abdominal aorta.
- Abdominal aorta ends on the **left side** on the level of L4 then it divides into two common iliac arteries, which branch into internal and external iliac arteries that go to the pelvis.

Relations of abdominal aorta (very important)

1- Anterior relations:

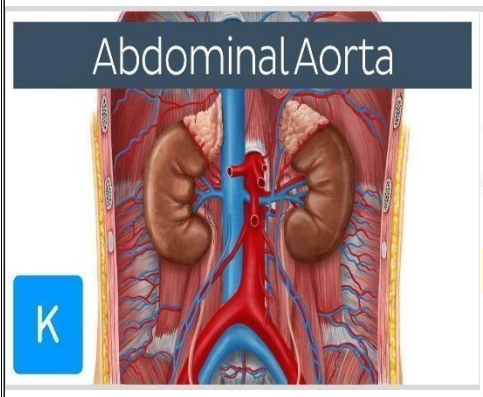
- Pancreas.
- 3rd (horizontal) part of the duodenum
- Coils of small intestine.
- Crossed by left renal vein draining into IVC.
  NOTE: right renal artery passes behind IVC.

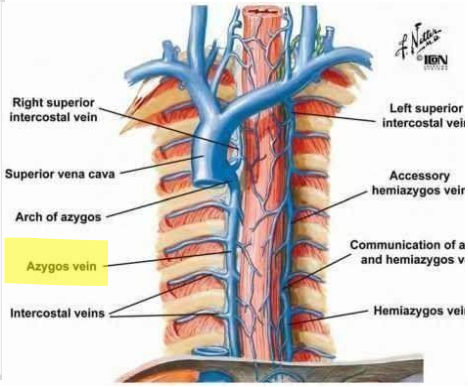


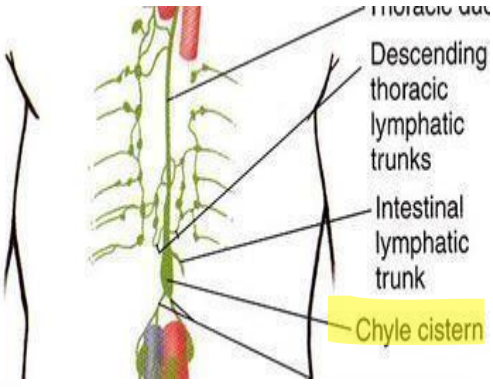


2- On the right side:

- The inferior vena cava
- The cisterna chyli (at the aortic orifice)
- The beginning of the azygos vein (at the aortic orifice)

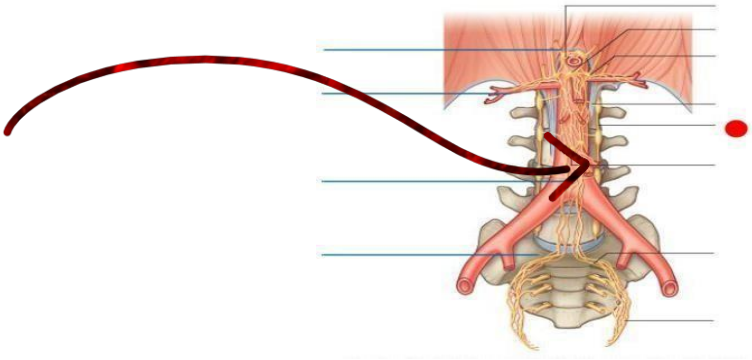






3- On the left side:

- The left sympathetic trunk.



❖ Branches of abdominal aorta

1- **Anterior**

a. Single branches:

1) Celiac Trunk. (Supplies the foregut)

2) Superior mesenteric artery. (Supplies the midgut)

3) Inferior mesenteric artery. (Supplies the hindgut)

b. Paired branches:

Testicular arteries (males) or ovarian arteries (females) at the level of L2.

NOTE: The right vein drains directly into the IVC while the left one drains into the left renal vein.

2- **Posterior**

a. Single branches:

Median sacral artery >>It's considered the continuation of abdominal aorta.

b. Paired branches:

4 lumbar arteries anterior to the lumbar vertebrae.

3- **Lateral**

1) Inferior phrenic arteries that supply the diaphragm.

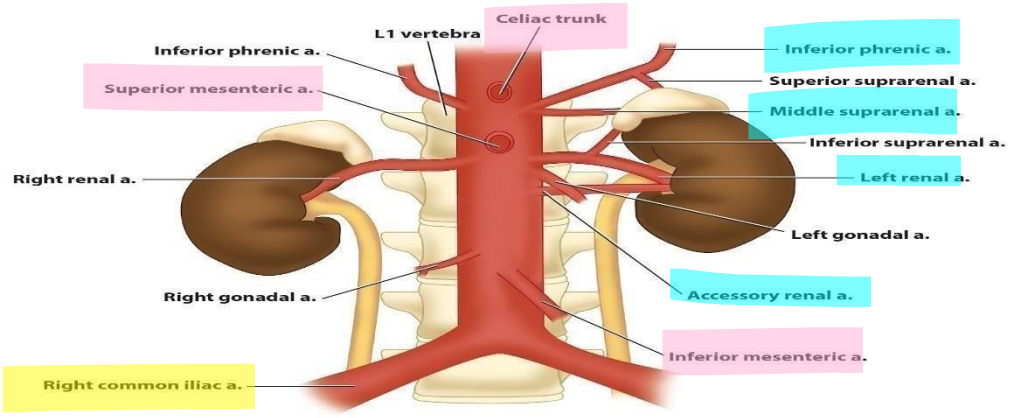
2) Middle suprarenal arteries that supply the suprarenal glands.

NOTE: Superior suprarenal arteries branches from Inferior phrenic arteries.
Inferior suprarenal arteries branches from renal arteries.

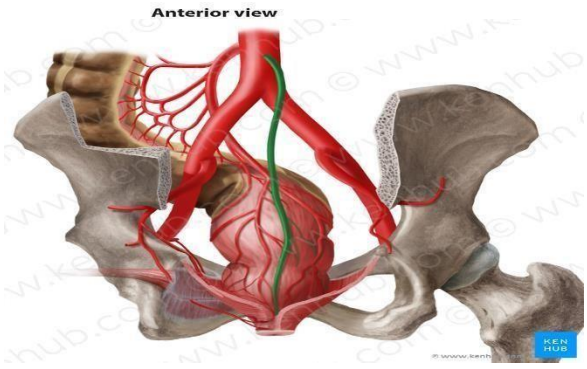
3) Renal arteries at the level of L2 to supply the kidneys.

NOTE: The right renal artery is longer than the left because the aorta is more to the left side.

***Right & left Common iliac arteries are the terminal branches of abdominal aorta.



Median sacral artery >>



❖ Celiac artery at the level of L1

>>The celiac artery is very short and originates from the commencement of the abdominal aorta between **T12** (*lower border*) & **L1** (*upperborder*) above the superior border of pancreas, it is surrounded by the celiac plexus and lies behind the lesser sac of peritoneum.

>> It supplies mainly the **foregut**

- It has 3 terminal branches:

1- The left gastric.

>>It runs towards the cardiac end of the stomach.
>>Few esophageal branches (lower third of esophagus).
>> Then it turns back to the right along the lesser curvature of the stomach.
>>It anastomoses with the right gastric artery.

2- Splenic artery

It is tortuous and runs on the upper border of pancreas.
>>It divides to 4 or 5 branches in the hilum of the spleen.
Its branches are:

a. **Pancreatic branches.**
B. **Short gastric arteries** in the gastrosplenic ligament to the fundus of the stomach.
C. **Left gastroepiploic artery** in the greater omentum and runs along the greater curvature of the stomach.

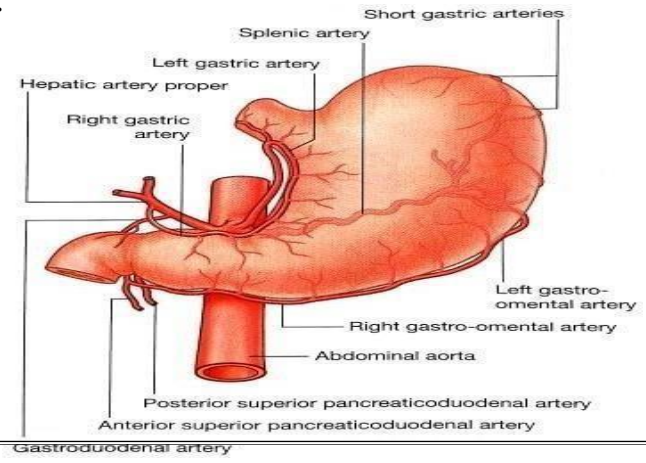
3- Hepatic artery

It has 3 branches:

a. **The right gastric artery.**
>> It arises from the upper border of the pylorus and runs to the left in the lesser omentum along the lesser curvature of the stomach.
>>It anastomoses with the left gastric artery.

b. **The gastroduodenal artery**
>> It divides into right gastroepiploic artery that runs along the greater curvature of the stomach between the layers of the greater omentum, then continues as the superior pancreaticoduodenal artery that descends between the second part of the duodenum and the head of the pancreas.

C. **The right and left hepatic arteries.**
>> Moves inside the free edge of the lesser omentum and enters the porta hepatis to give right and left haptic arteries.
>> The **right hepatic artery** usually gives offthe cystic artery, which runs towards the neck of the gallbladder.



❖ Superior mesenteric artery at the level of L2

>>It originates behind the **body of pancreas** at the level between L1 (*lower border*) and L2 (*upper border*) .

- It gives many branches that supply mainly the **midgut**:

1) The inferior pancreaticoduodenal artery.

Gives the lower part of the duodenum (**below ampulla of vater**) lower part of the head of pancreas, and theuncinate process of pancreas.

2) The middle colic artery.

Runs forward in the transverse mesocolon to supply the proximal two thirds of transverse colon and divides into right and left branches.

3) The right colic artery.

It is often a branch of the ileocolic artery. It passes to the right to supply the ascending colon and divides into ascending and descending branches.

4) The ileocolic artery.

Passes downward and to the right to supply the distal part of ileum near the ileocecal junction.

>>It gives rise to:

*** Superior branch that anastomoses with the right colic artery

*** Inferior branch that anastomoses with the end of the superior mesenteric artery.

>>The inferior branch gives rise to the anterior and posterior cecal arteries.

>>The appendicular artery which is a branch of the posterior cecal artery.

5) The jejunal and ileal branches.

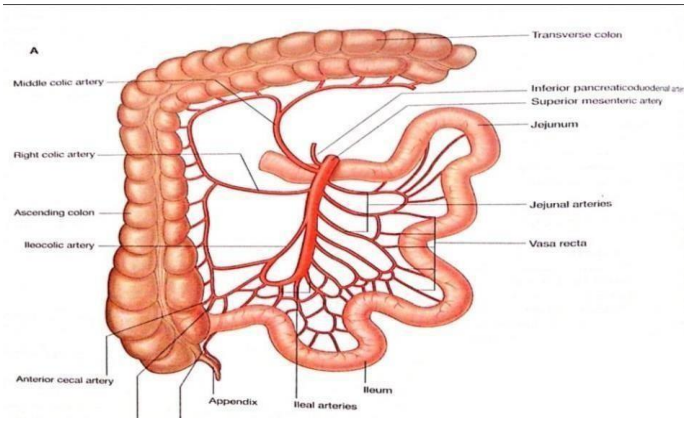
Run through the mesentery, and they are 12 to 15 in number and arise from the left side of the superior mesenteric artery.

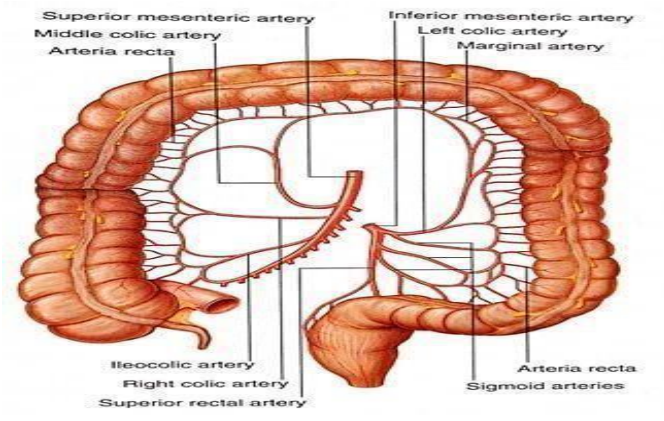
>> Each artery divides into two vessels, which unite with adjacent branches to form a series of arcades.

>> Branches from the arcades divide and unite to form a second, third, and fourth series of arcades.

>> Fewer arcades supplying the jejunum than supplying the ileum.

>> From the terminal arcades, small straight vessels (vasa recta) supply the intestine.





❖ Inferior mesenteric artery.

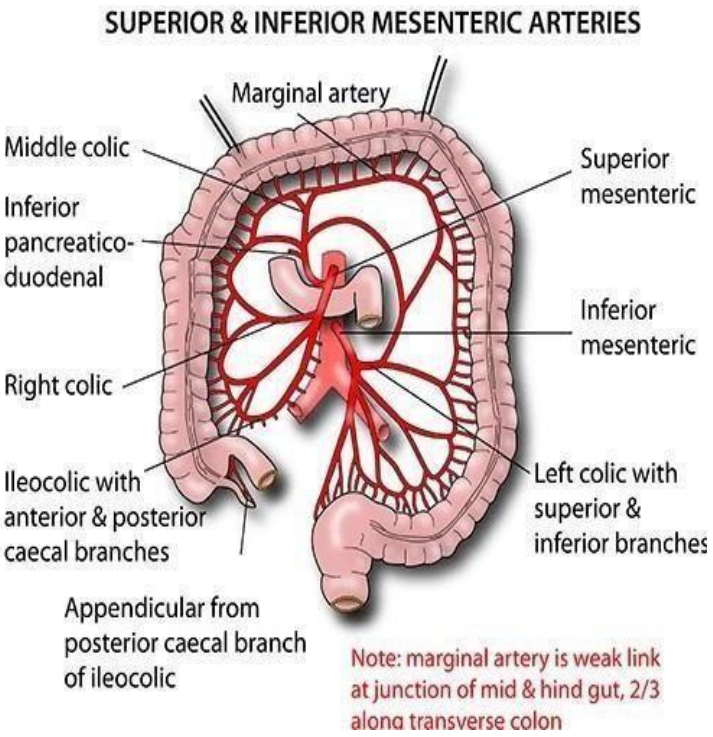
»It originates behind the **horizontal part of duodenum** at the level of **L3**.

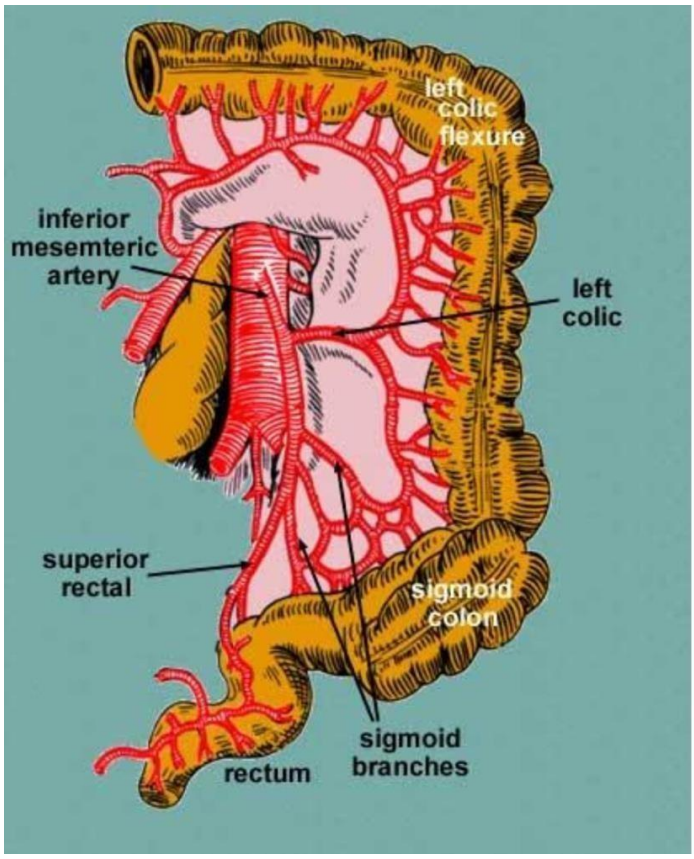
- It branches into:

1) **The left colic artery**.
   Runs upward to the left and supplies the distal third of the transverse colon, the left colic flexure, and the upper part of the descending colon.
   » It divides into ascending and descending branches.

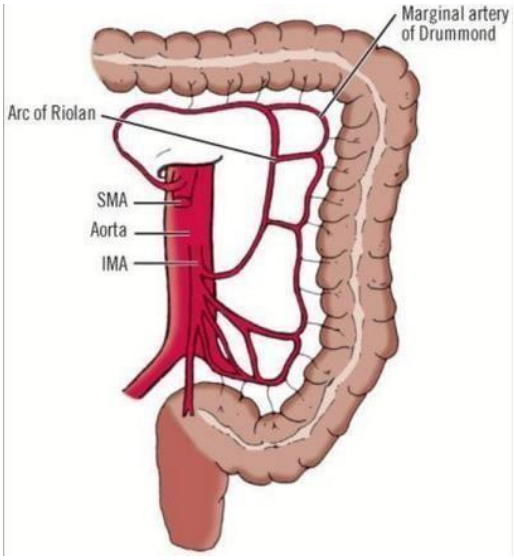
2) **The sigmoid arteries.**
   Two or three in number and supply the lower part of descending colon as well as the sigmoid colon.

3) **The superior rectal artery**
   » It's a continuation of the inferior mesenteric artery as it crosses the left common iliac artery.
   »It descends into the pelvis behind the rectum.
   » It supplies the rectum and upper half of the anal canal and anastomoses with the middle rectal and inferior rectal arteries.





❖ Marginal artery



»It's the anastomosis between of the colic arteries around the concave margin of the large intestine.

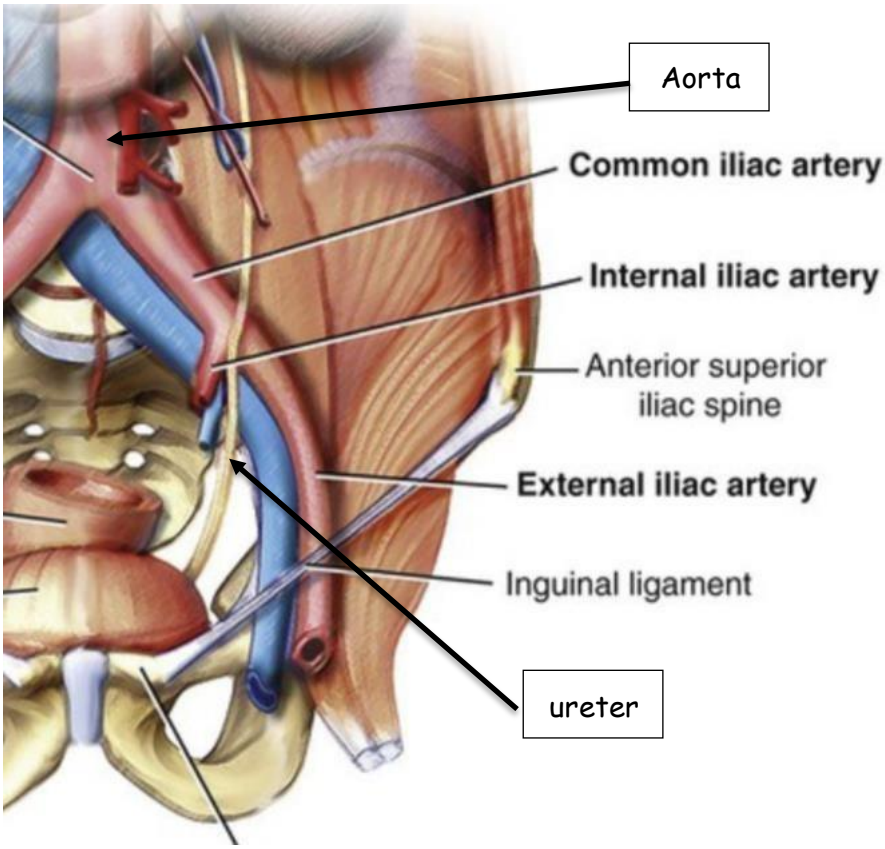
»The superior mesenteric artery gives 2 branches, right colic and middle colic.
»The inferior mesenteric artery branches into left superior and left inferior colic arteries, and sigmoid branch.

»It begins at the ileocecal junction, where it anastomoses with the ileal branches of the superior mesenteric artery, and it ends where it anastomoses less freely with the superiorrectal artery.

»Any obstruction in the superior or inferior mesenteric, the blood circulation to the large intestine won't be affected due to the presence of the **marginal artery**.

❖ Common iliac arteries

»The right and left common iliac arteries are the terminal branches of the abdominal aorta.
»They arise at the inlet of the pelvis on the level of L4 and run downward and laterally along.
»They are found on the medial border of the psoas major muscle.
»Each common iliac artery ends in front of the sacroiliac joint by dividing into the **external iliac arteries** (to the lower limp) and **internal iliac arteries** (to the pelvic viscera).
»At the bifurcation, the common iliac artery on each side is crossed anteriorly by the ureter.



❖ External iliac artery

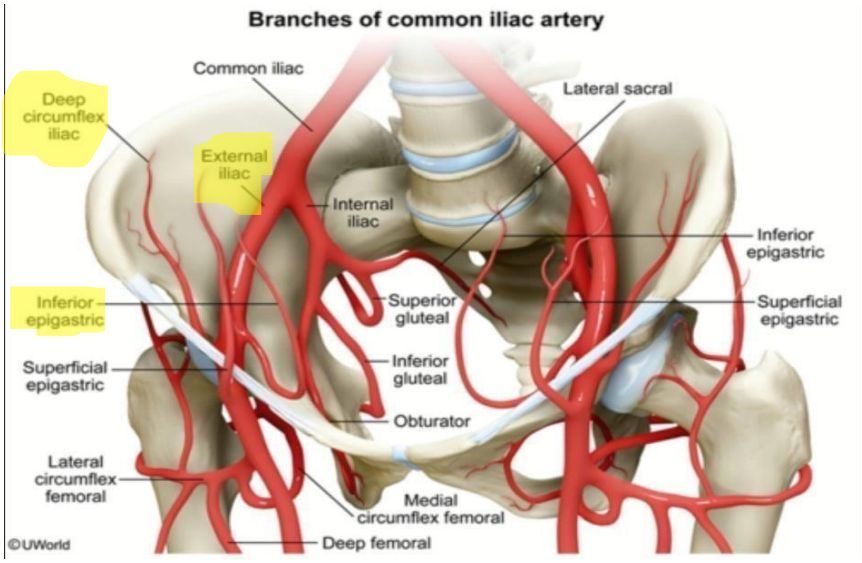
Runs along the medial border of the psoas major muscle following the pelvic brim.

>>It is the **main** blood supply to the lower limb.

>>The artery enters the thigh by passing under the inguinal ligament to become the femoral artery then popliteal artery in the popliteal fossa, it then divides into anterior and posterior tibial arteries in the leg.

Branches:

1) The inferior epigastric artery: Arises just above the inguinal ligament, it passes upward and medially along the medial margin of the deep inguinal ring and enters the rectus sheath behind the rectus abdominis muscle.
2) The deep circumflex iliac artery: Arises close to the inferior epigastric artery, it ascends laterally to the anterior superior iliac spine and the iliac crest,supplying the muscles of the anterior abdominal wall.



❖ Internal iliac artery

>>The **internal iliac artery** passes down into the pelvis in front of the sacroiliac joint to supply the pelvic viscera and pelvic wall. It divides into **anterior** and **posterior divisions.**

A. **Posterior branches:**
   1) **Iliolumbar artery.** It supplies the iliolumbar ligament (muscular artery) .
   2) **Lateral sacral arteries.** They are 2 in number; each one divides into 2 (4 in total) and enter the sacral foramina.
   3) **Superior gluteal artery** - greater sciatic foramen above the piriformis muscle. It supplies the 3 gluteus muscles, maximus, Medius, and Minimus.

B. **Anterior branches:**
   1) **Obturator artery** (occasionally from inferior epigastric artery) - moves with the obturator nerve through obturator canal. It supplies the medial compartment of the thigh.

2) **Inferior gluteal artery** - greater sciatic foramen below piriformis muscle.
3) **Umbilical artery**, the proximal part is the superior vesical artery (usually, but sometimes it branches directly from anterior trunk) which supplies the urinary bladder from above. Its distal part is obliterated to form the medial umbilical ligament.
4) **Uterine artery (females)** superior and vaginal branches to the uterus or **deferential artery (males)** to the vas deferens.
5) **Vaginal artery** (females, can also arise from uterine artery) - vagina
6) **Inferior vesical artery** - urinary bladder
7) **Middle rectal artery** - (at the end of internal iliac artery) - rectum
8) **Internal pudendal artery**, (at the end of internal iliac artery) - it gives **inferior rectal artery.**

Accordingly, the rectum is supplied by 3 arteries:

1-**Superior rectal artery >> from inferior mesenteric.**
2-**Middle rectal artery >> from internal iliac artery.**
3- **Inferior rectal artery >> from Internal pudendal artery >> from internal iliac artery**

****

Veins of the posterior abdominal Wall

❖ **The venous drainage of the abdomen is of two types:**

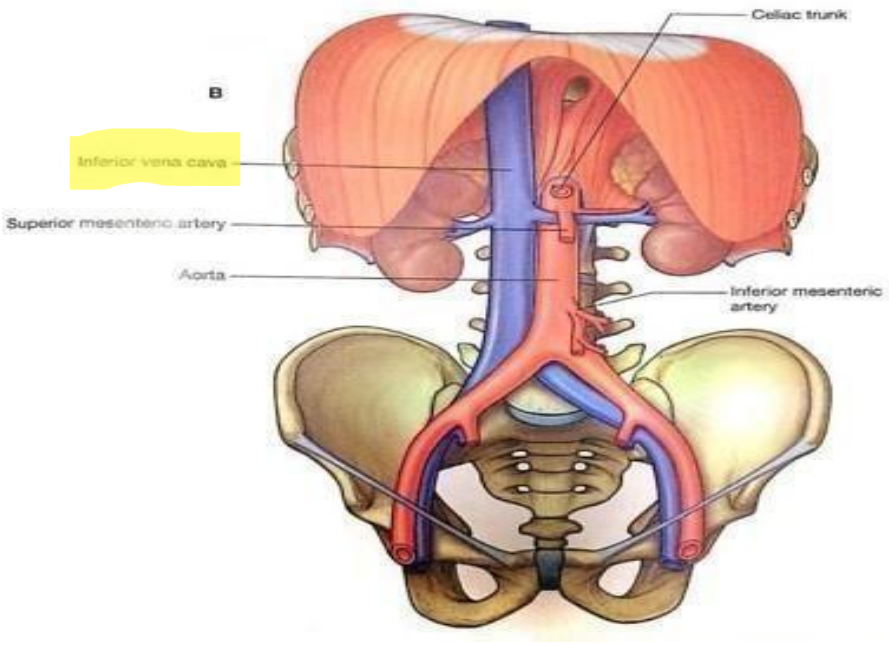
1) Portal circulation of the portal vein to the liver.
2) Systemic circulation of IVC to the heart.

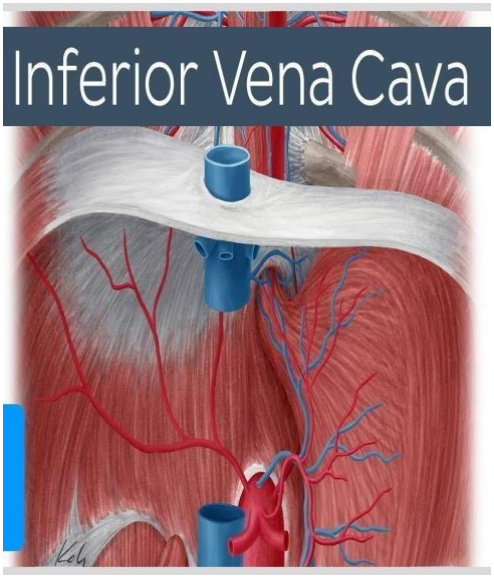
❖ **Inferior vena cava:** (underlined sentences are not mentioned by the doctor)

>>It is formed by the union of the common iliac veins behind the right common iliac artery at the level of L5.
>>The blood that moves in the IVC is called systemic venous blood. Systemic means that it's going to the heart.

>>It's the opposite of the abdominal aorta.
>>It ascends on the right side of the aorta, pierces the central tendon of the diaphragm at the level of T8.
>>Ascends then separated from the aorta by the right crus of the diaphragm
>>Drains into the right atrium of the heart.

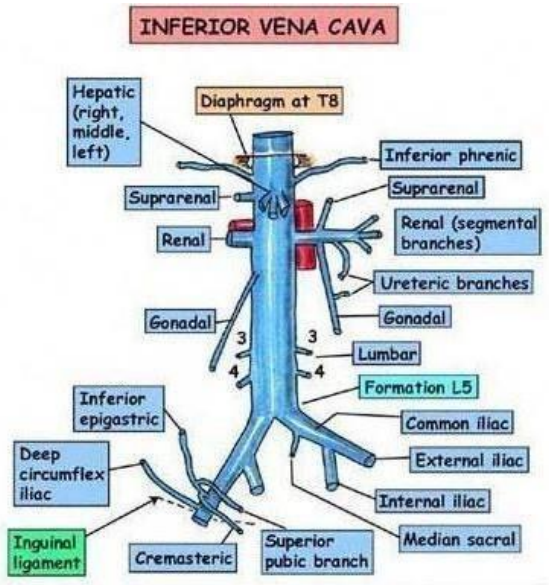
>>The right sympathetic trunk lies behind its right margin and the right ureter lies close to its right border. The entrance into the lesser sac separates the inferior vena cava from the portal vein.





❖ Tributaries of I.V.C

- Two anterior visceral tributaries: the hepatic veins. (in fact, they are 3 hepatic veins, but the doctor mentioned in his slides that they are 2!).
- Three lateral visceral tributaries:
  a. The right suprarenal vein (the left vein drains into the left renal vein).
  b. Renal veins (right & left).
  c. Right testicular or ovarian vein (the left vein drains into the left renal vein).
- Five lateral abdominal wall tributaries: the inferior phrenic vein and four lumbar veins.
- Three veins of origin: two common iliac veins and the median sacral vein.

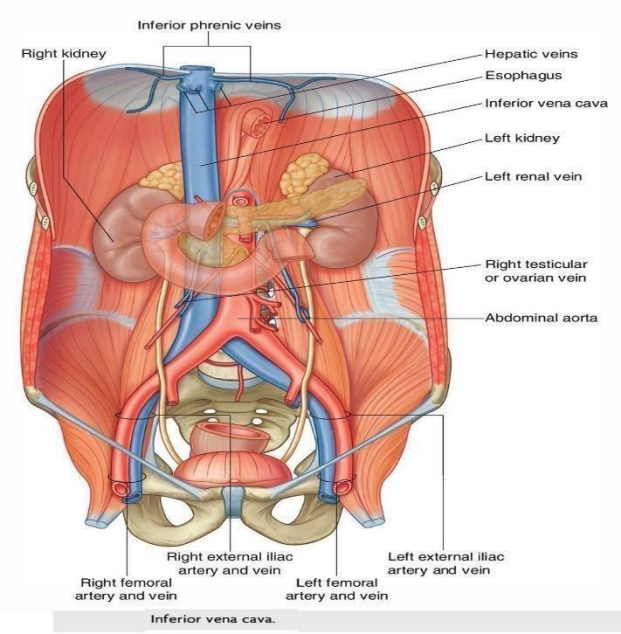


>>The rest of the veins, superior and inferior mesenteric, gastric, and duodenal, drain in the portal vein to the liver.

>>WHY?

To transfer the simple absorptive materials of digestion to the liver so it can do its function of metabolism of absorptive materials.

❖ Relations:



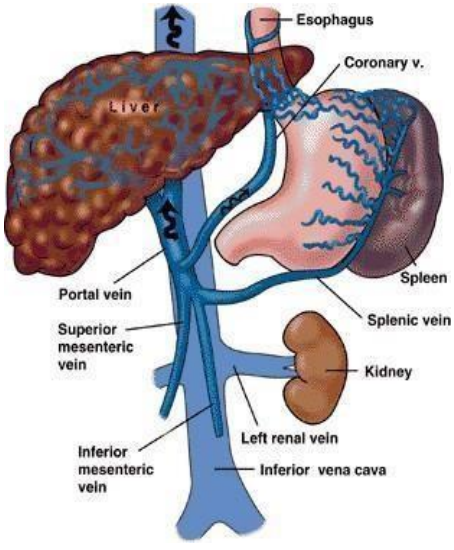
-Anterior:

- Coils of small intestine.
- 3rd part & 1st part of duodenum.
- Head of pancreas & common bile duct.
- Foramen of Winslow.
- Portal vein.
- Lies in a deep groove in liver (IVC groove).

❖ Inferior mesenteric vein

>>It is a tributary of the portal circulation.
>>It drains the **hindgut**; it receives drainage from rectum, anal canal, descending colon to the lateral third of transverse colon.
>>It begins halfway down the anal canal as the superior rectal vein.
>>It passes up the posterior abdominal wall on the left side of the inferior mesenteric artery and the duodenojejunal flexure.
>>It drains into the splenic vein behind the pancreas. (It may drains directly into the junction between splenic and superior mesenteric arteries)
>>It receives tributaries that correspond to the branches of the inferior mesenteric artery.

❖ The splenic vein



>>It is a tributary of the portal circulation.
>>It drains the **foregut** and **midgut**.
>>It begins at the hilum of the spleen by the union of several veins and is then joined by the short gastric and the left gastroepiploic veins.
>>It passes to the right within the splenicorenal ligament and runs behind the pancreas. (not mentioned).
>> It joins the superior mesenteric vein behind the neck of the pancreas to form the portal vein.
>>It is joined by veins from the pancreas and the inferior mesenteric vein.

❖ Superior mesenteric vein (underlined sentences are not mentioned by the doctor)

»It is a tributary of the portal circulation.
»It drains the **midgut**.
»It begins at the ileocecal junction and runs upward on the posterior abdominal wall within the root of the mesentery of the small intestine and on the right side of the superior mesenteric artery.
»It passes in front of the third part of the duodenum and behind the neck of the pancreas, where it joins the splenic vein to form the portal vein.
»It receives tributaries that correspond to the branches of the superior mesenteric artery, also it receives the inferior pancreaticoduodenal vein and the right gastroepiploic vein.

❖ Portal vein

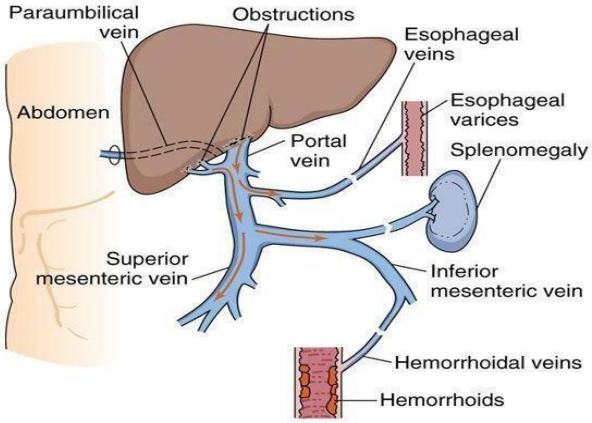
» It drains the **foregut**.
»The portal vein drains blood from:

1. the abdominal part of the gastrointestinal tract from the lower third of the esophagus to halfway down the anal canal.
2. It also drains blood from the spleen, pancreas, and gallbladder.

»The portal vein enters the liver and divides into sinusoids, from which blood passes into the hepatic veins that join the inferior vena cava.
»It is about 2 in. (5 cm) long and is formed behind the neck of pancreas by the **union** of the superior mesenteric and splenic veins.

»It ascends to the right, behind the first part of the duodenum, and enters the lesser omentum.
»It then runs upward in front of the opening into the lesser sac to the porta hepatis, where it divides into right and left terminal branches.
»The right branch receives drainage from the cystic vein.

»The portal circulation begins as a capillary plexus in the organs, it drains and ends by emptying its blood into sinusoids within the liver.



❖ Tributaries:

1) Splenic vein:
This vein leaves the hilum of the spleen and passes to the right in the splenicorenal ligament. It unites with the superior mesenteric vein behind the neck of the pancreas to form the portal vein. **It receives** the short gastric, left gastroepiploic, inferior mesenteric, and pancreatic veins.

2) Inferior mesenteric vein:
This vein ascends on the posterior abdominal wall and joins the splenic vein behind the body of the pancreas. **It receives** the superior rectal veins, the sigmoid veins, and the left colic vein.

3) Superior mesenteric vein:
This vein ascends in the root of the mesentery of the small intestine. It passes in front of the third part of the duodenum and joins the splenic vein behind the neck of the pancreas. **It receives** the jejunal, ileal, ileocolic, right colic, middle colic, inferior pancreaticoduodenal, and right gastroepiploic veins.

4) Left gastric vein:
This vein drains the left portion of the lesser curvature of the stomach and the distal part of the esophagus. It opens directly into the portal vein.

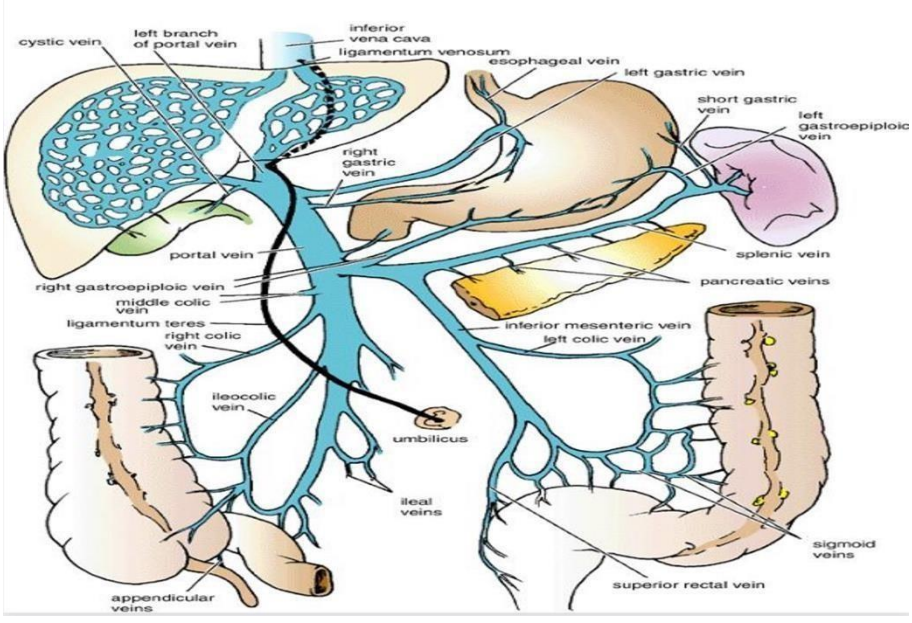
5) Right gastric vein:
This vein drains the right portion of the lesser curvature of the stomach and drains directly into the portal vein.

6) Cystic veins:
These veins either drain the gallbladder directly into the liver or join the portal vein (right branch).

Notes:

Notice the ligamentum venosum which is an obliterated ductus venosum

Notice the ligamentum teres which is an obliterated umbilical vein



Portal systemic anastomosis

»It also known as porta caval anastomosis or portal caval system.

»It is a specific type of anastomosis that occurs between the veins of portal circulation and those of systemic circulation.

❖ Causes

a. Liver diseases → Cirrhosis, fibrosis (bilharzial).
b. Valvular diseases of the heart.
c. Congenital patent. (Potent ductus venosus)

»These anastomoses are found naturally in normal people, the systemic part drains into the IVC and the portal part drains in the portal vein, there would be **no problems** or clinical manifestations as long as there is **no obstruction**

» If there is an obstruction in the portal circulation hindering the blood from moving forward (portal hypertension as in the case of cirrhosis of liver) , blood moves in the **opposite direction** and it goes to where it originated from, entering the **portosystemic anastomosis.**

»This **leads** to engorgement of blood, dilation of veins, and might rupture causing bleeding.

Region	Name of clinical condition	Portal circulation	Systemic circulation
Lower third of esophagus	Esophageal Varices, **treated** by endoscope using sclerosing material.	Esophageal branch of **left gastric vein**	Esophageal branches of **azygos vein**
Rectum and anal canal	**Hemorrhoids** (Piles), fresh blood after defecation.	**Superior rectal vein,** continuation of inferior mesenteric	**Middle** rectal and **inferior** rectal veins
Paraumbilical	**Caput medusae** (dilated veins radiating from the umbilicus, star shaped)	**Paraumbilical veins**	**Superficial epigastric vein,** moves in rectus sheath
Retroperitoneal	No clinical name	Right colic, middle colic, and left colic vein	Renal, Suprarenal, paravertebral, and gonadal veins
Intrahepatic	Patent ductus venosus	Left branch of portal vein	Inferior vena cava

Lymphatics on the Posterior Abdominal Wall

>>The lymph nodes are closely related to the aorta and form a pre-aortic and a right and left lateral aortic (para-aortic or lumbar) chains which drains into the cisterna chyli

❖ The pre-aortic lymph nodes

>>**They are 3 in number.**

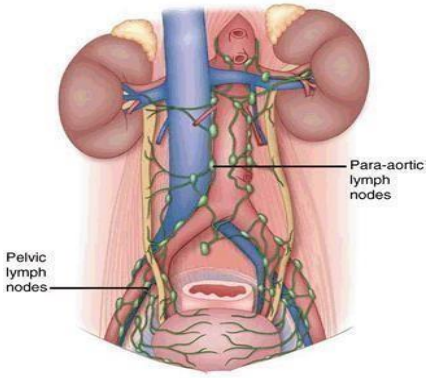
1- Around the origin of celiac trunk >> celiac lymph node.
2- Around the origin of superior mesenteric artery>> superior mesenteric lymph node.
3- Around the origin of inferior mesenteric artery >> inferior mesenteric lymph node.

>> **They drain lymph from:** gastrointestinal tract, extending from the lower third of the esophagus to the anal canal. + spleen, pancreas, gallbladder, and greater part of the liver.

>> The efferent lymph vessels form the **intestinal trunk>>** cisterna chyli.

❖ The lateral aortic (para-aortic or lumbar) lymph nodes:

>> <u>They drain lymph from</u>:
kidneys and suprarenal glands; from the testes in the male and from the ovaries, uterine tubes, and fundus of the uterus in the female; from the deep lymph vessels of the abdominal walls; and from the common iliac nodes.



>> The efferent lymph vessels form **the right and left lumbar trunk>>** cisterna chyli.

❖ Thoracic duct

>> Begins in the abdomen, arising from an elongated lymph sac, the cisterna chyli (final destination of all the lymphatics of the abdomen and lower limb), which lies just below the diaphragm at the opening of the aorta.

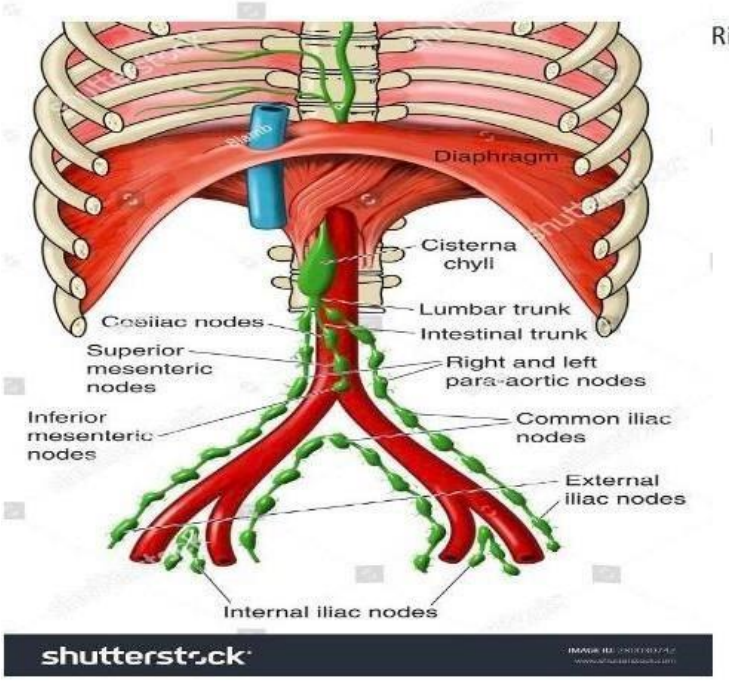
>>Found at the right side of the aorta.

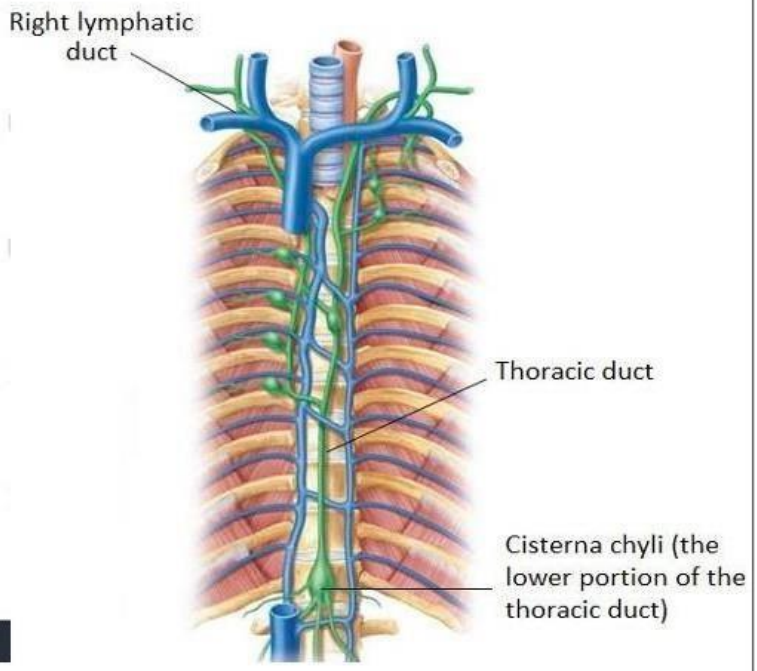
>>The thoracic duct ascends upwards at the left side and ends at the junction of left subclavian and left internal jugular veins (beginning of the left brachiocephalic vein).

❖ The cisterna chyli

>><u>Receives lymph from</u>: (they aren't mentioned by the doctor).

1. The right and left lumbar trunks under the diaphragm on the side of the aorta.
2. The intestinal trunk.
3. Some small lymph vessels that descend from the lower part of the thorax.
4. Right & Left vessels from lower thorax.


Diaphragm
Cisterna chyli
Lumbar trunk
Coeliac nodes
Intestinal trunk
Superior mesenteric nodes
Right and left para-aortic nodes
Inferior mesenteric nodes
Common iliac nodes
External iliac nodes
Internal iliac nodes
shutterstock


Right lymphatic duct
Thoracic duct
Cisterna chyli (the lower portion of the thoracic duct)

Good Luck