



# GIS 12

ANATOMY



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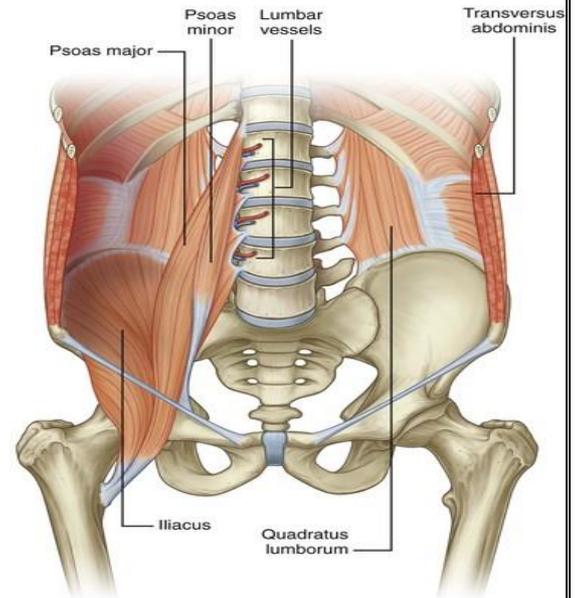
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**Doctor:** Mohammad Al-muhtaseb

# 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).
- **Muscles:**
  - **psoas major** inserted on lesser trochanter.
  - **psoas minor** in front of psoas major (usually absent).
  - **Quadratus lumborum**.
  - **Iliacus** which lies in the iliac fossa, inserted into lesser trochanter.
- Aponeurosis of transversus abdominis muscles.(not mentioned).



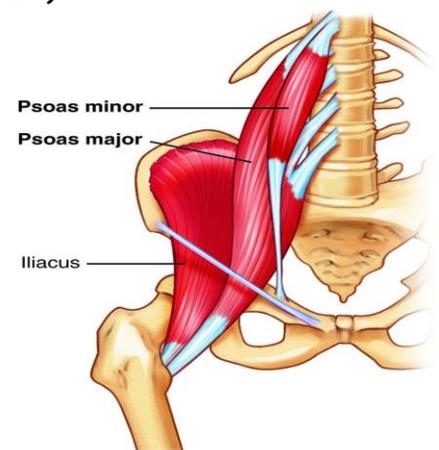
## Muscles of posterior abdominal wall

### 1) Psoas major:

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

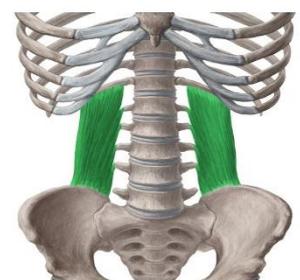
### 2) Iliacus muscle:

- **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:

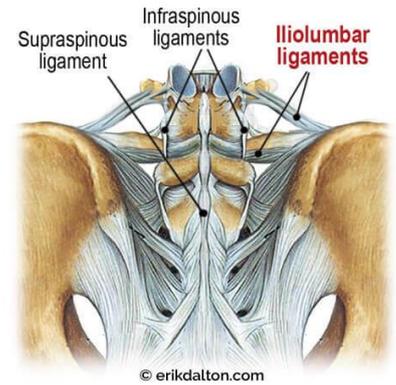
- **Origin:** Iliolumbar ligament & iliac crest.
- **Insertion:** 12th rib.
- **Nerve supply:** Nerve plexus (T12 subcostal nerve, L1, L2, L3).
- **Action:** Fixation of 12th rib during inspiration & lateral flexion of the trunk.



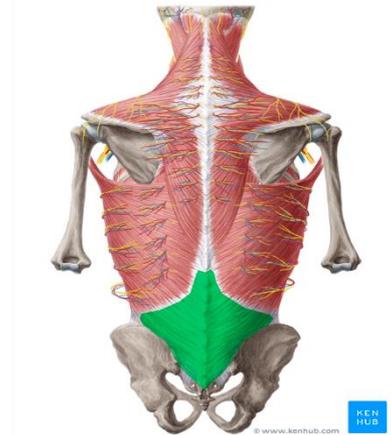
## ❖ Iliolumbar ligament

The **Iliolumbar ligament** is a strong ligament passing from the 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 intercostal 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**:

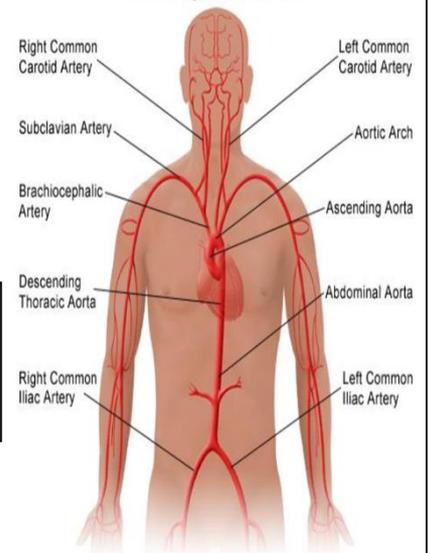
1. Left subclavian.
2. Left common carotid.
3. Right Brachiocephalic, it branches

to:

- a. Right common carotid.
- b. Right subclavian.

This is the only asymmetrical part in our body

#### Anatomy of the Aorta

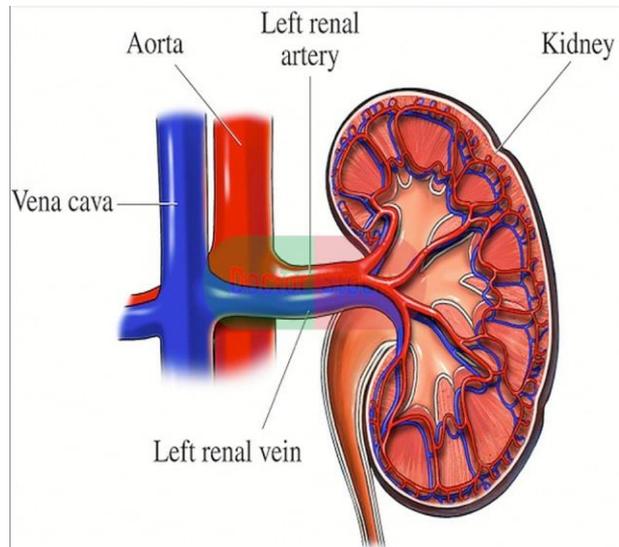
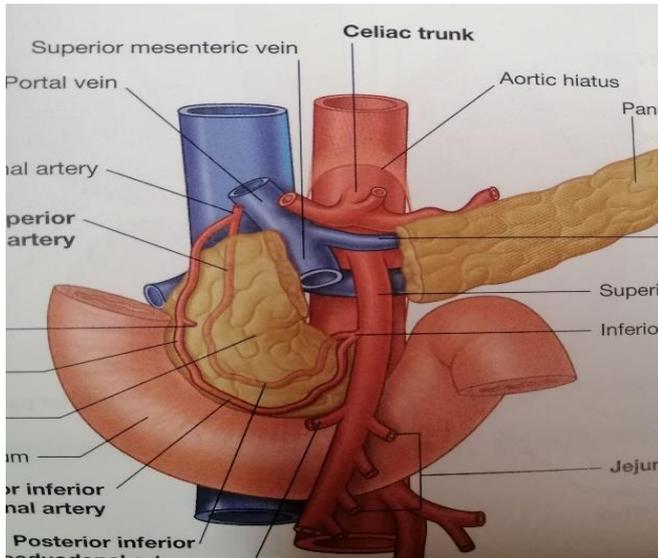


- **Aorta** then descends to form the **descending thoracic aorta** that enters the abdomen through the **aortic opening** at the midline of the diaphragm on the level of **T12** as **abdominal aorta**.
- At the right side of **abdominal aorta** there are **cisterna chyli** & **azygos vein**.
- **Abdominal 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)

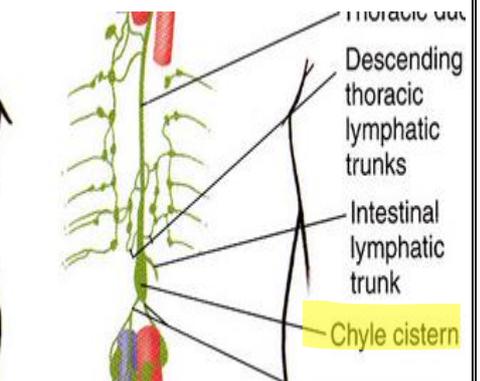
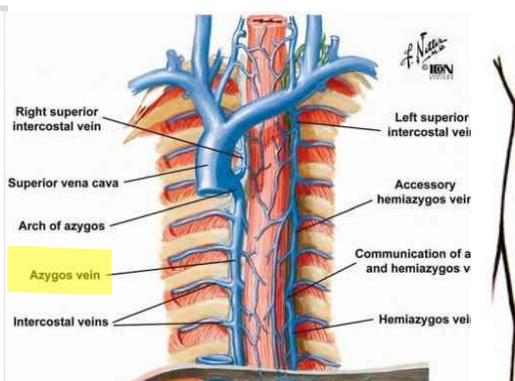
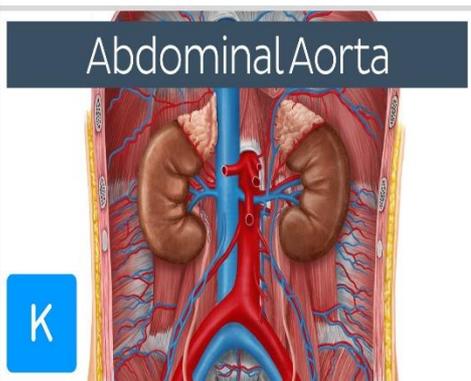
## 1- Anterior relations:

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



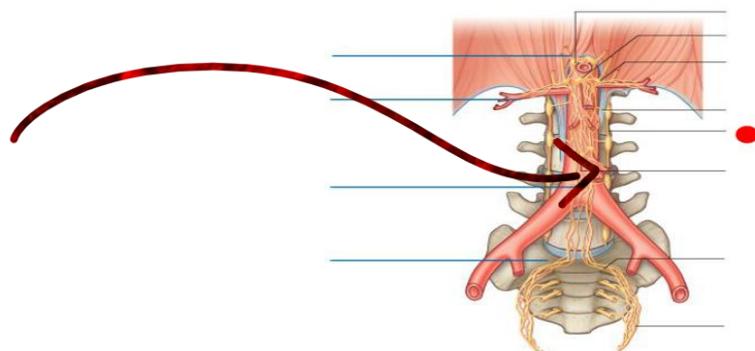
## 2- On the right side:

- The inferior vena cava
- The cisterna chyli
- The beginning of the azygos vein.



## 3- On the left side:

- The left sympathetic trunk.



## ❖ Branches of abdominal aorta

### 1- Anterior

#### a. Single branches:

- 1) Celiac Trunk.
- 2) Superior mesenteric artery.
- 3) Inferior mesenteric artery.

#### 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

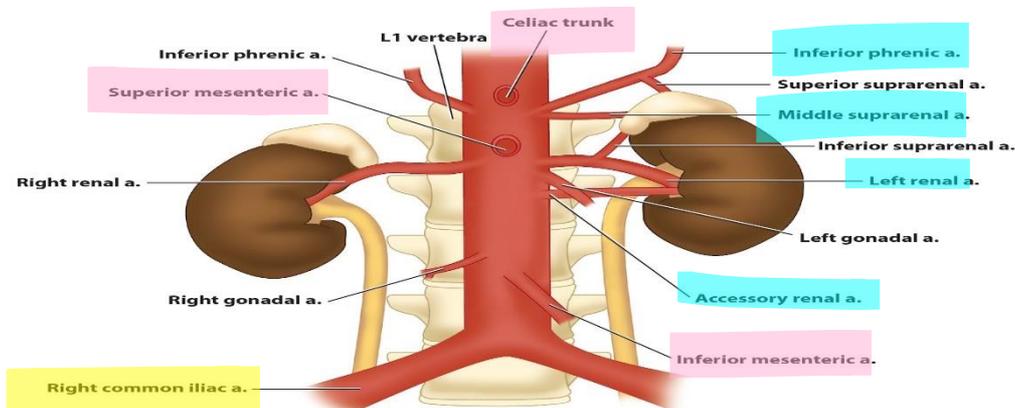
1) Inferior phrenic arteries that supply the diaphragm.

2) Middle suprarenal arteries that supply the suprarenal glands.

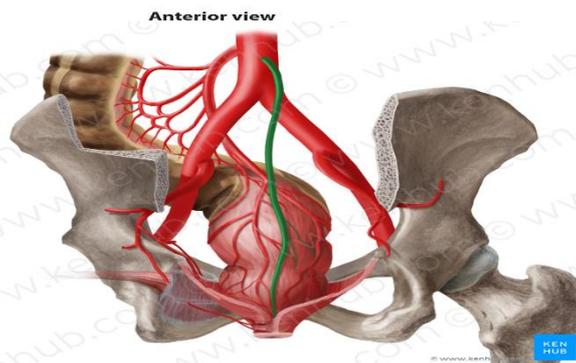
3) Renal arteries at the level of L2 to supply the kidneys.

**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 >>





## ❖ Superior mesenteric artery at the level of L2

»It originates behind the **body of pancreas** at the level between **L1** and **L2**.

- It gives many branches that supply mainly the midgut:

### 1) The inferior pancreaticoduodenal artery.

Gives the lower part of the duodenum, lower part of the head of pancreas, and the uncinate 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.

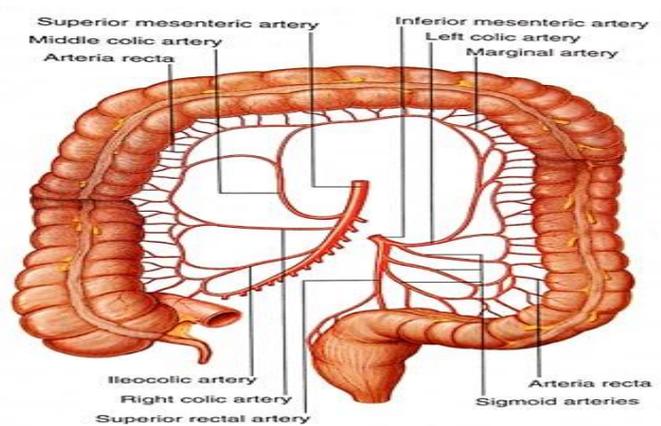
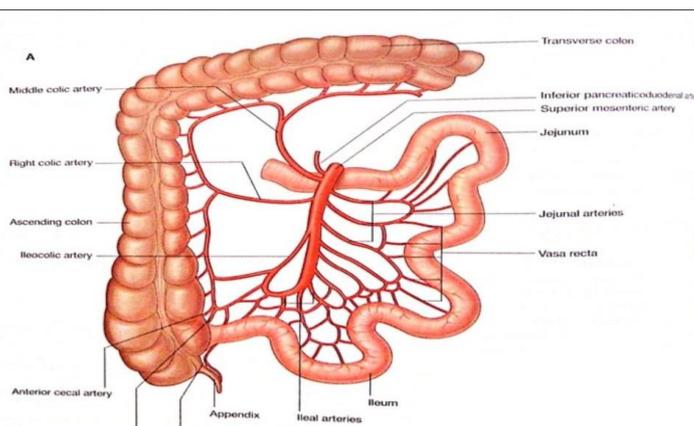
Run through the mesentery, and they are 12 to 15 in number and arise from the left side of the superior mesenteric artery.

» 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 at the level of L3

» It originates behind the **horizontal part of duodenum**.

- 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.

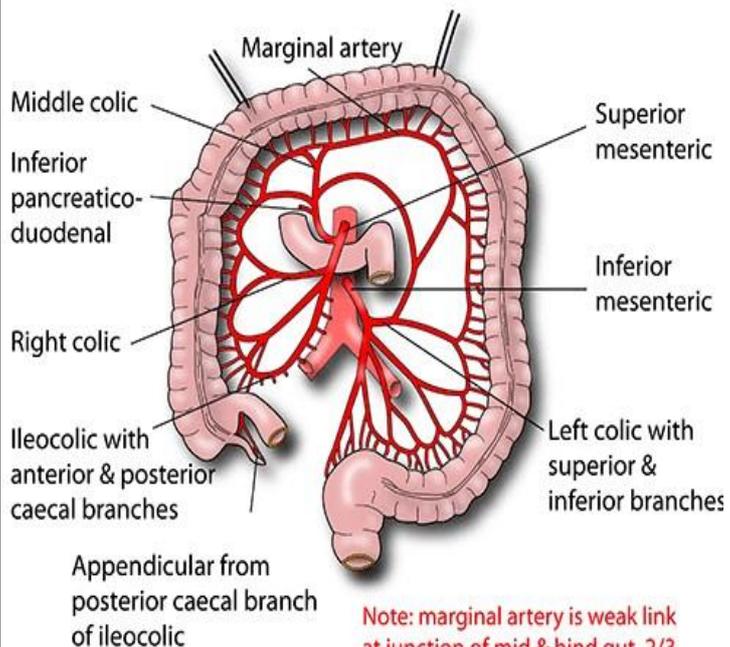
» It descends into the pelvis behind the rectum.

» It supplies the rectum and upper half of the anal canal and **anastomoses** with the **middle** rectal and **inferior** rectal arteries.

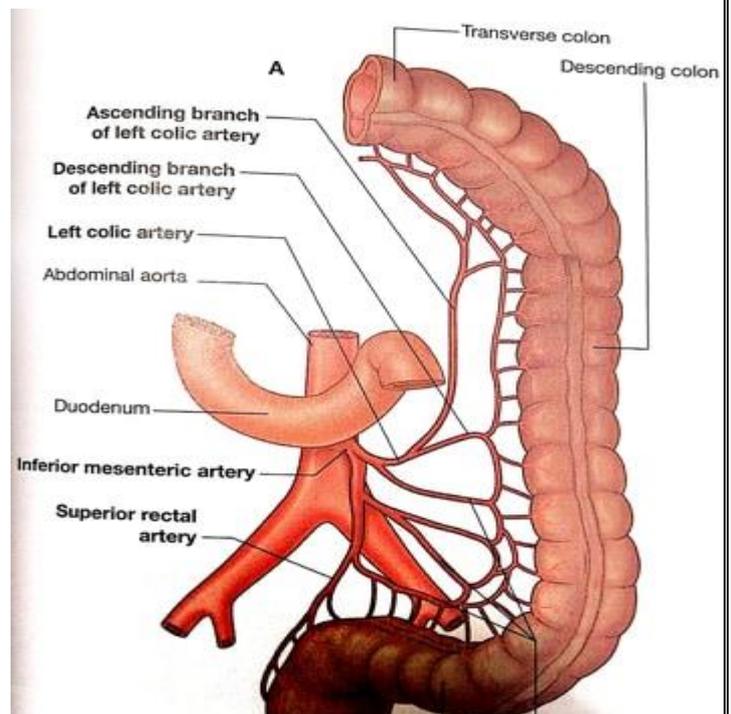
❖ I know that there are a lot of arteries and their branches but I'm sure If you study the pictures below, you will easily memorize them.

∴

### SUPERIOR & INFERIOR MESENTERIC ARTERIES



Note: marginal artery is weak link at junction of mid & hind gut, 2/3 along transverse colon



## ❖ 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.

» The **anastomosis** of the blood supply of the ascending colon and descending colon on the medial side is known as the **marginal artery**.

» 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 superior rectal 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

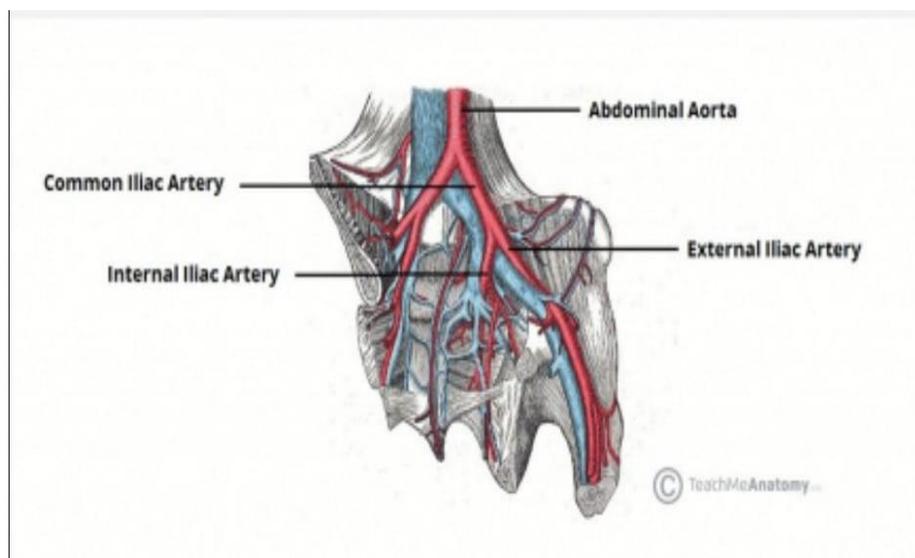
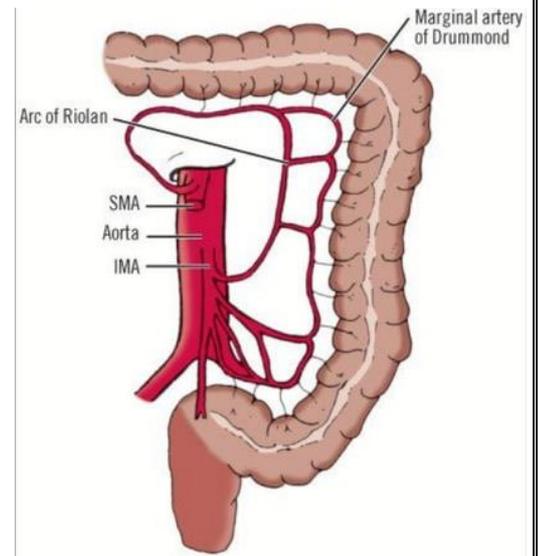
» The **right** and **left** common iliac arteries are the **terminal** branches of the abdominal aorta.

» 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** and **internal** iliac arteries.

» At the bifurcation, the common iliac artery on each side is crossed.



## ❖ External iliac artery

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

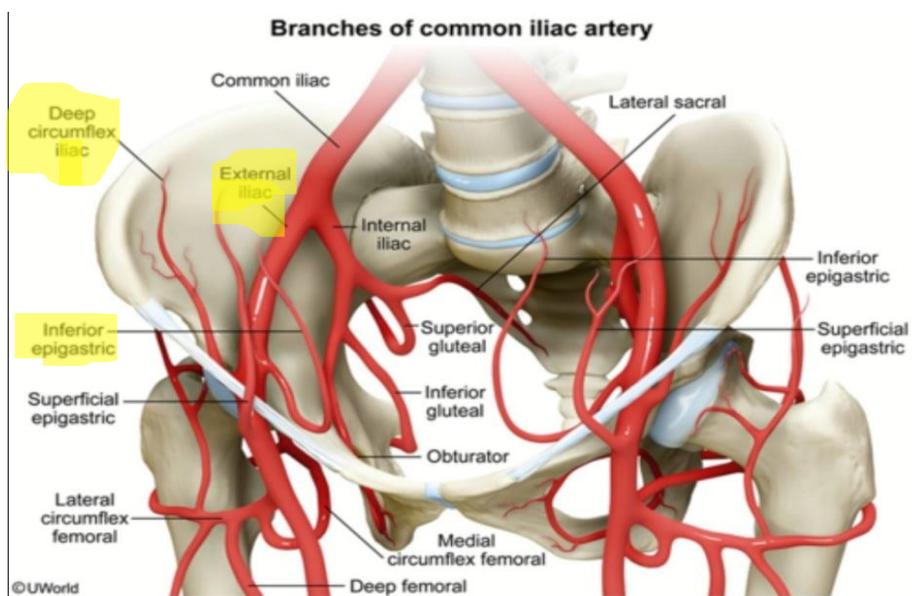
»It is the **main** blood supply to the lower limb.

»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

**NOTE:** you have to memorize only the name of the branches, because we will study about them in detail in urogenital system next year.

»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:** (just memorize the names in blue)

1) **Iliolumbar artery.** It supplies the iliolumbar ligament.

2) **Lateral sacral arteries.** They are 2 in number; each one divides into 4 and enters 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:** (just memorize the names in blue)

- 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** - rectum
- 8) **Internal pudendal artery**, it gives **inferior rectal artery**.

**So 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

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

>>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.

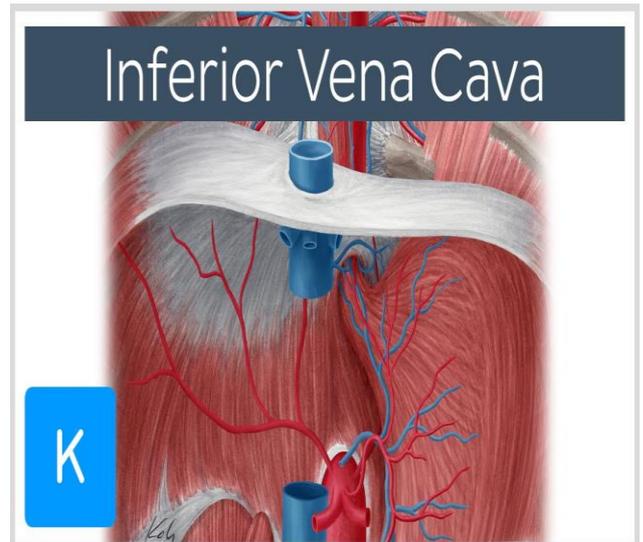
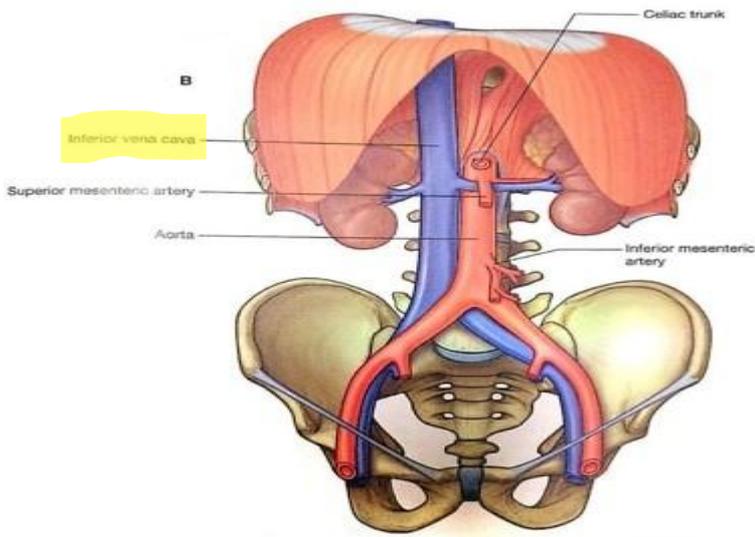
>>Ascends then separated from the aorta by the right crus of the diaphragm.

>>Drains into the **right atrium** of the heart.

>>It is formed by the **union** of the **common iliac veins** behind the right common iliac artery at the level of L5.

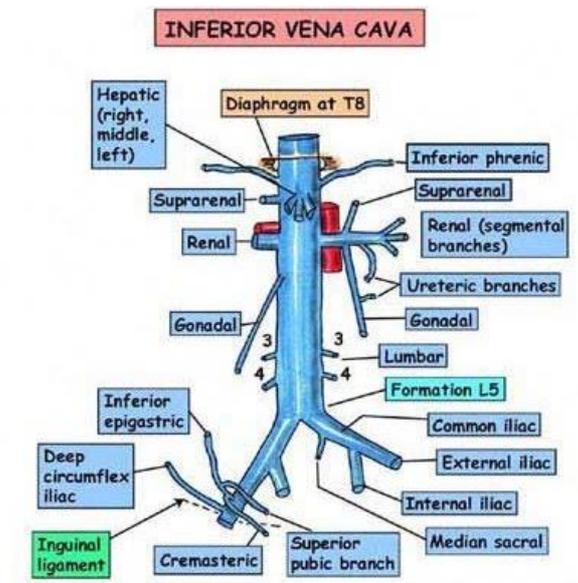
>>The blood that moves in the IVC is called **systemic venous blood**. Systemic **means** that it's going to the **heart**.

>>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:**
  1. The right suprarenal vein (the left vein drains into the left renal vein).
  2. Renal veins.
  3. 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.

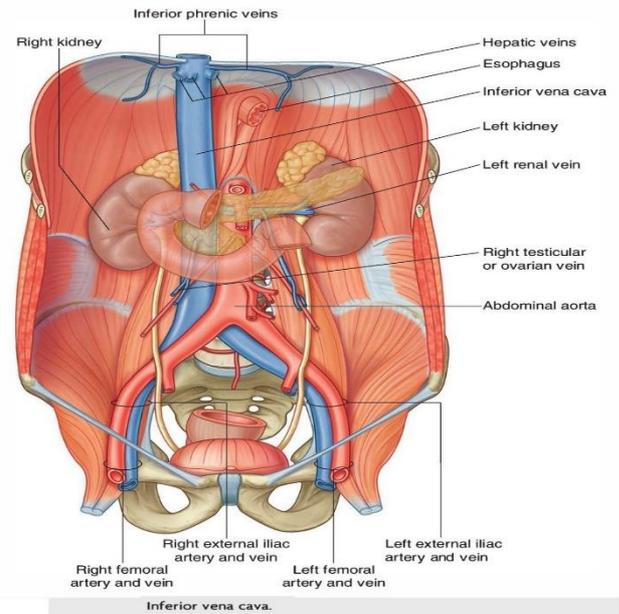
## ❖ The venous drainage of the abdomen is of two types:

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

## ❖ 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).

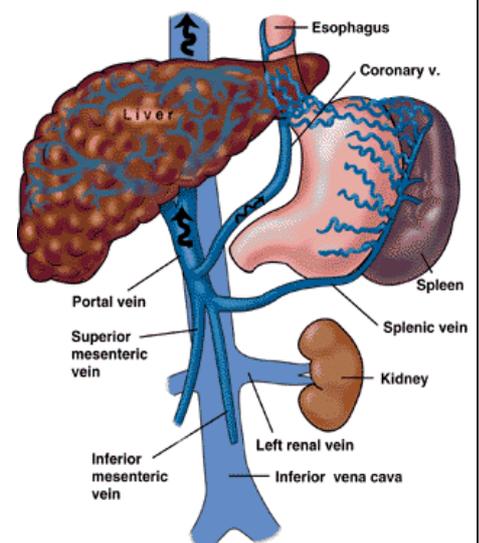


## ❖ Inferior mesenteric vein

- » 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 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**.

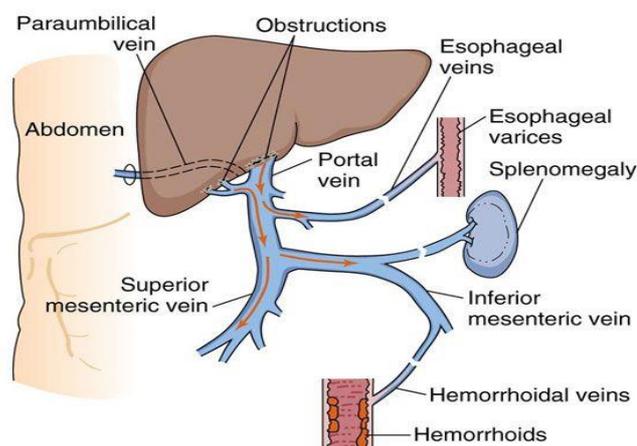
» It is about 2 in. (5 cm) long and is **formed** behind the neck of pancreas by the **union** of the **superior mesenteric** and **splenic veins**.

» 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.

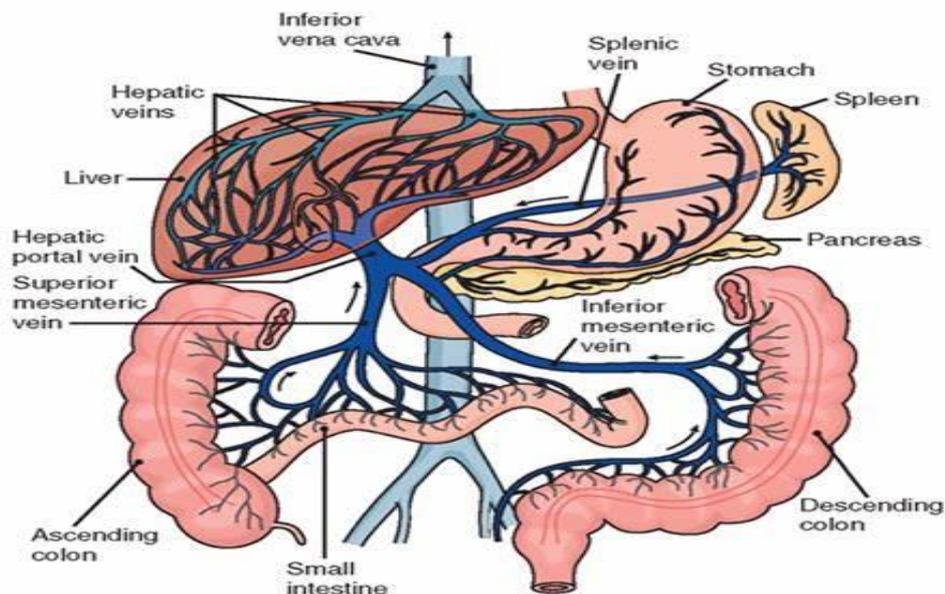
### 5) Right gastric vein:

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).

## Portal Circulation



## 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.

» The lower end of esophagus is one of the important sites for the portosystemic anastomosis.

» In **portal hypertension** as in the case of **cirrhosis** of liver the anastomosis opens and forms venous dilatation called **esophageal varices**.

» Their rupture causes severe and dangerous hematemesis (as we studied in pathology)

» 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, it 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, <b>treated</b> by endoscope using sclerosing material.	Esophageal branch of <b>left gastric vein</b>	Esophageal branches of <b>azygos vein</b>
Rectum and anal canal	<b>Hemorrhoids</b> (Piles), fresh blood after defecation.	<b>Superior rectal vein</b> , continuation of inferior mesenteric	<b>Middle</b> rectal and <b>inferior</b> rectal veins
Paraumbilical	<b>Caput medusae</b> (dilated veins radiating from the umbilicus, star shaped)	<b>Paraumbilical veins</b>	<b>Superficial epigastric vein</b> , 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 drain 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.

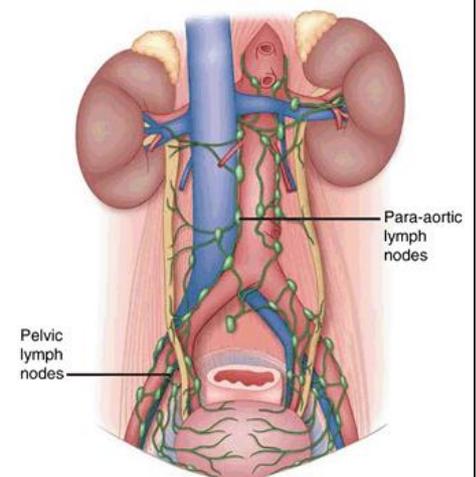
+ spleen, pancreas, gallbladder, and greater part of the liver.

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

» They drain lymph from:

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.

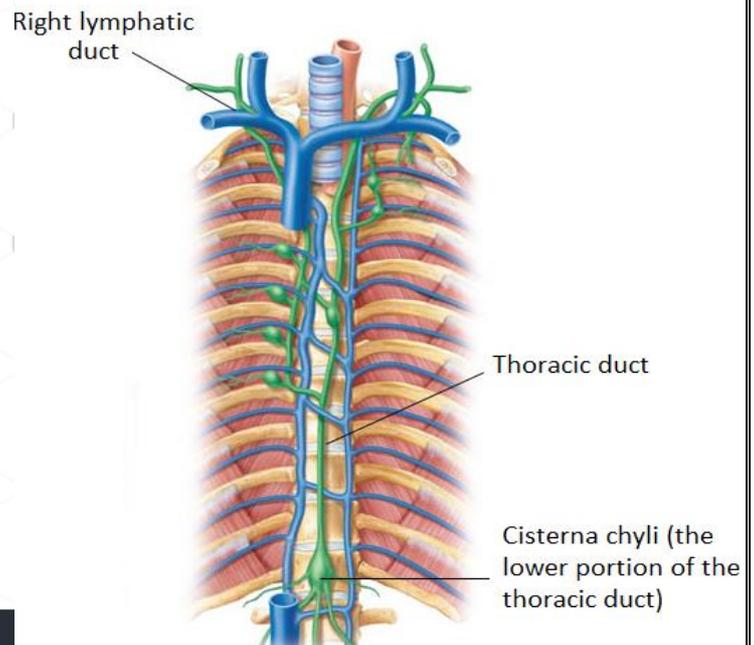
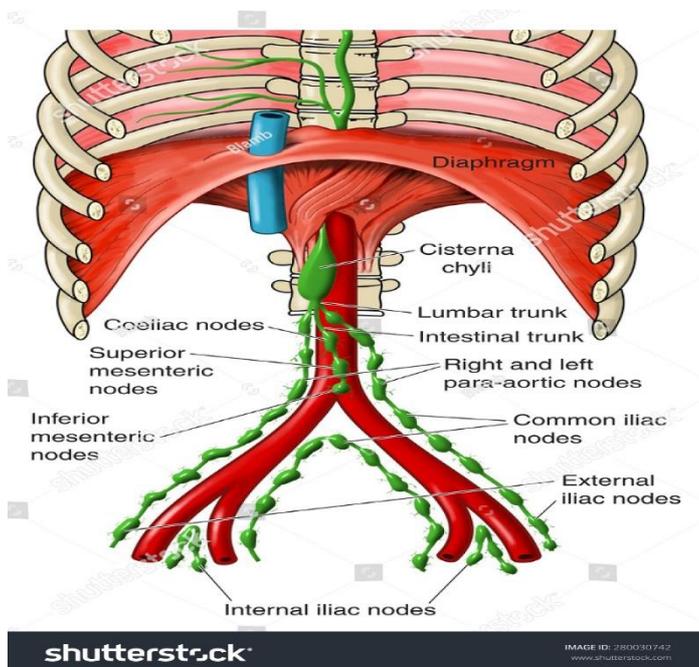
» Found at the right side of the aorta.

» 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

» Receives lymph from: (they aren't mentioned by the doctor, but I think we have to know them).

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.



❖ Don't hesitate to ask anything.

Good Luck