Digestive System

University of Jordan

Faculty of Medicine

Batch of 2013-2019

Medical Committee
The University of Jordan

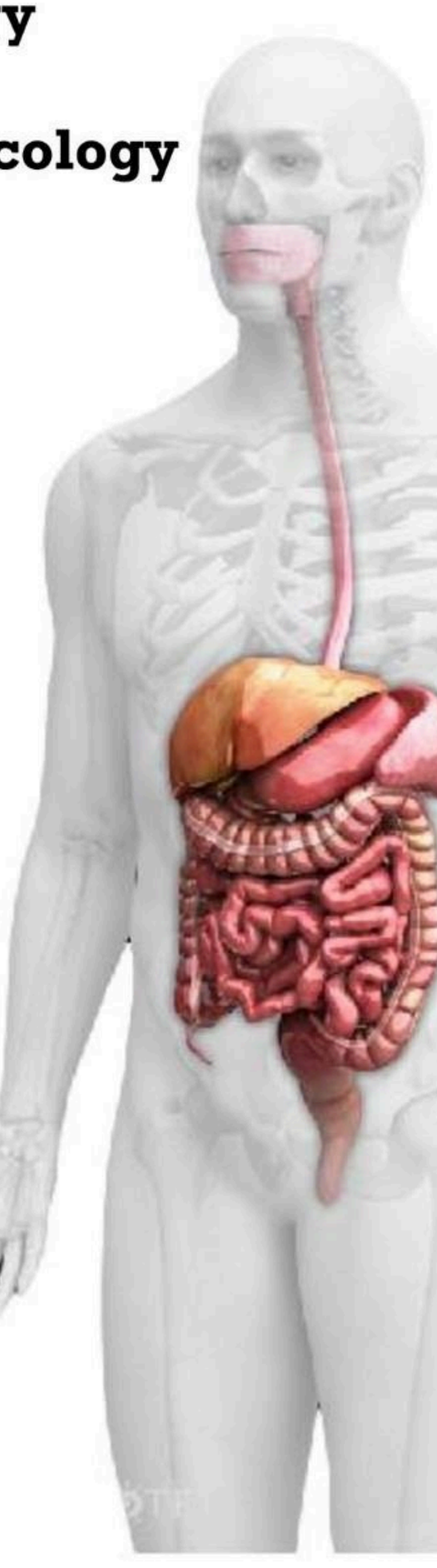
○ Slide ● Sheet ○ Handout ○ Other

☐ Anatomy ☐ Embryology

☐ Physiology ☐ Histology

☐ Pathology ☐ Pharmacology

☐ Microbiology ☐ PBL



Sheet #: 11

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Date: 25-4

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DESIGNED BY: TAMER ALTAMIMI "SMILE"

The Posterior Abdominal Wall

Hi, it's nice to see you - still alive :p - after that sweet exam (يتذكر وما ينعاد)

Today we'll talk about the posterior abdominal wall, its contents, relations & blood supply,... etc ***((Please: Don't forget to go through the slides))***

- Structures of the Posterior Abdominal Wall:

- We'll find the 5 Lumbar vertebras (L1-L5) and their intervertebral discs.

✓ ***Characteristics of these Lumbar vertebra:***

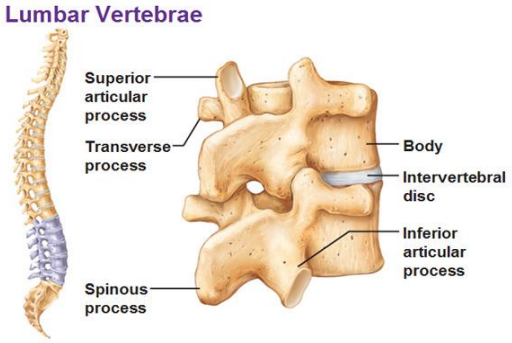
Their transverse processes are thin, short & you'll **NOT** find transverse foramen (or foramen transversarium) **NOR** facets.

While, ***Thoracic vertebra*** ➔ there are facets for ribs.

Cervical Vertebra ➔ There is transverse foramen for vertebral vessels.

Foramen Transversium:

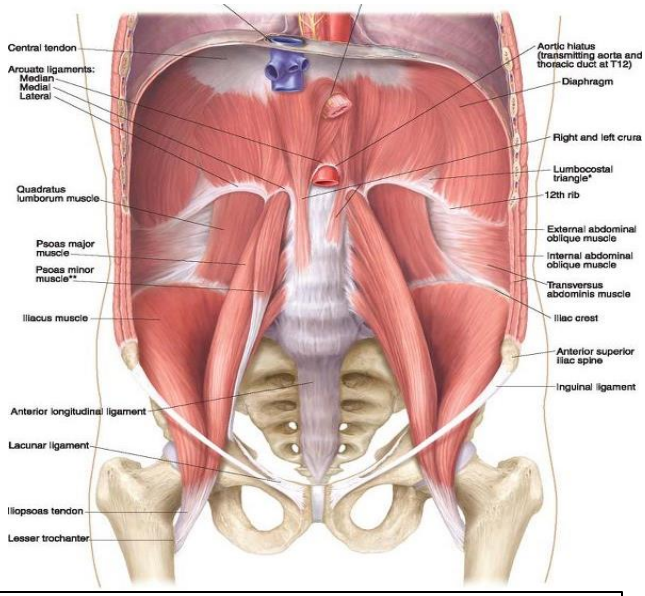
An opening in the transverse process of a cervical vertebra for
the passage of the vertebral artery and vein and sympathetic nerve.



- The 12th rib (which is the last one) makes the upper boundary of the abdomen and is found posterior.
- The upper part of the bony pelvis which is the iliac fossa & iliac crest.

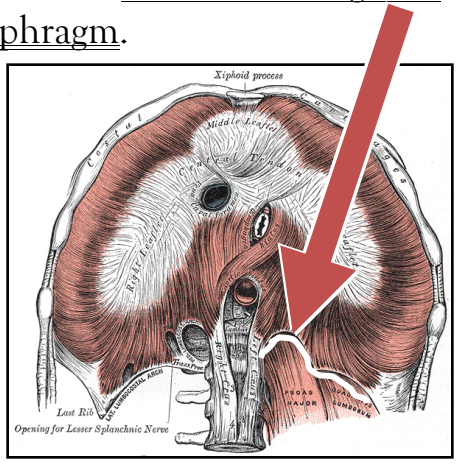
Muscles situated within the Posterior Abdominal Wall (continuous to the structures):

1. Psoas major.
2. Quadratus Lumborum.
3. Iliacus.
4. Psoas minor (sometimes).
5. Origin of transversus abdominis muscle.



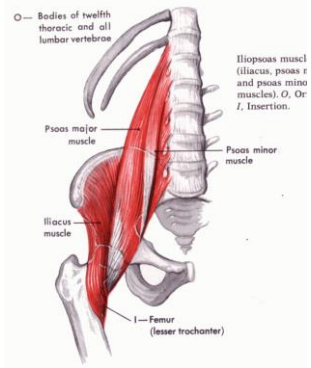
Above the *Psoas major* & *Quadratus Lumborum:*

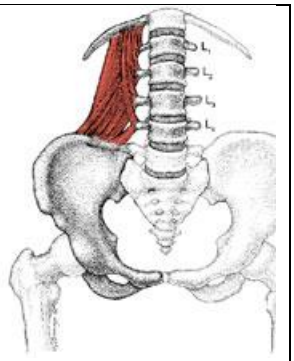
You'll find the arcuate origin of Diaphragm.



In fact, the arcuate origin of Diaphragm consists of *medial arcuate ligament* that arches over the psoas major muscle & *lateral arcuate ligament* that arches over the quadratus lumborum muscle (while they are crossing the diaphragm).

	Psoas		Quadratus Lumborum	
Origin	Body & transverse process of lumbar vertebra & Intervertebral disc		Iliolumbar ligament (between the transverse process of L5 & ilium) and iliac crest	
Insertion	With the iliacus muscle at the lesser trochanter of femur.		The last rib (12th rib)	
Nerve supply	For both it is T12,L1,L2,L3			
Action	Flexion of Hip & Thigh		Depresses the 12th rib during respiration & lateral flexion of the trunk	

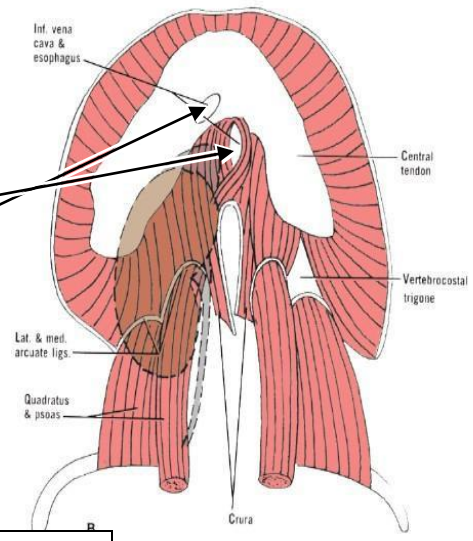


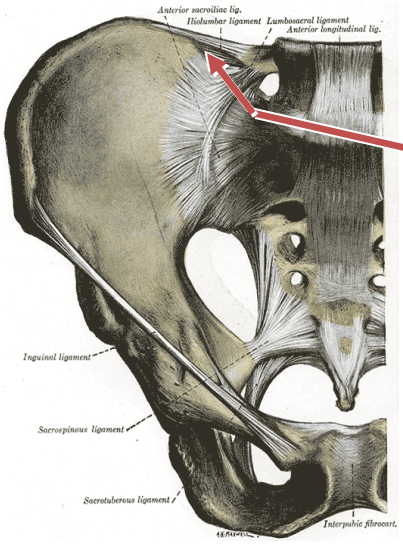


And here you can see ***the opening of the Abdominal Aorta in the diaphragm.***

You can also find some other ***openings*** for the ***esophagus***

& the ***Inferior vena cava.***

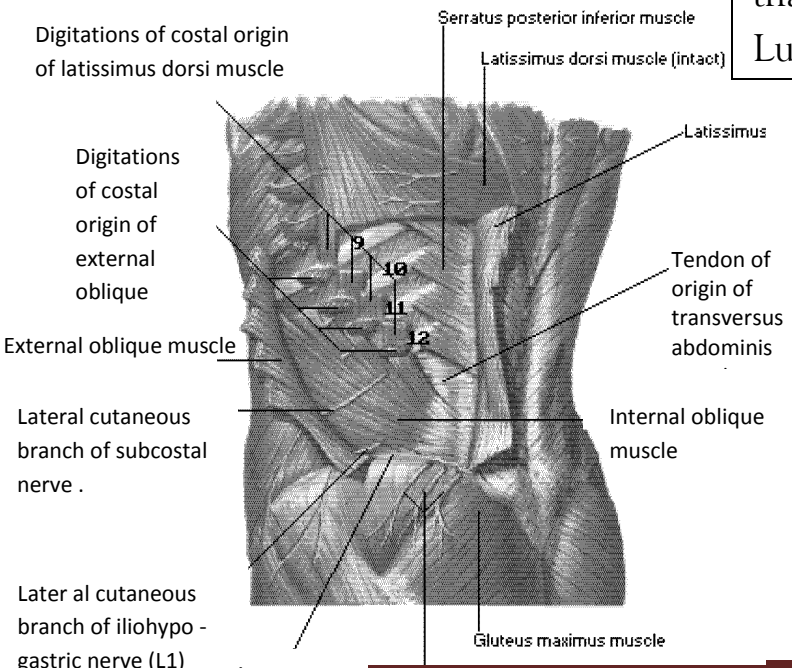




The **Iliolumbar ligament**

It is a strong ligament passing from the tip of the transverse process of the fifth lumbar vertebra to the posterior part of the inner lip of the iliac crest.

What is important about this ligament is that it gives an origin for the Quadratus Lumborum muscle.



Here you can see the origin of some of these muscles, and the Lumbar fascia which gives an origin for the Internal Oblique muscle, you'll also see the digitations of costal origin of the External Oblique muscle, and it is also interdigitated with the origin of Serratus posterior inferior muscle.

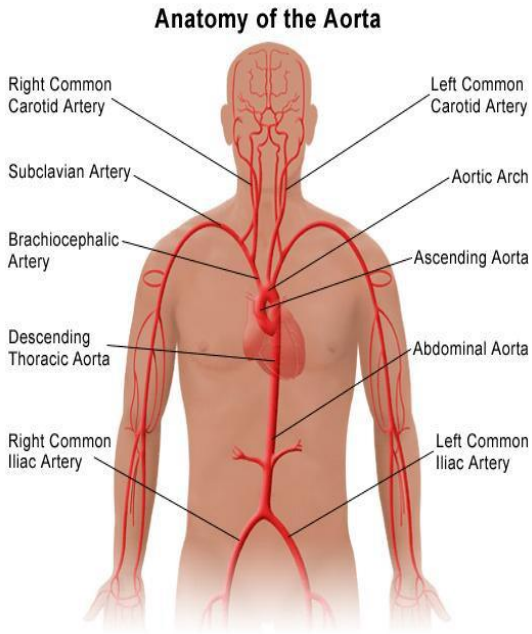
Blood Vessels In The Posterior Abdominal Wall:

The most important ones are:

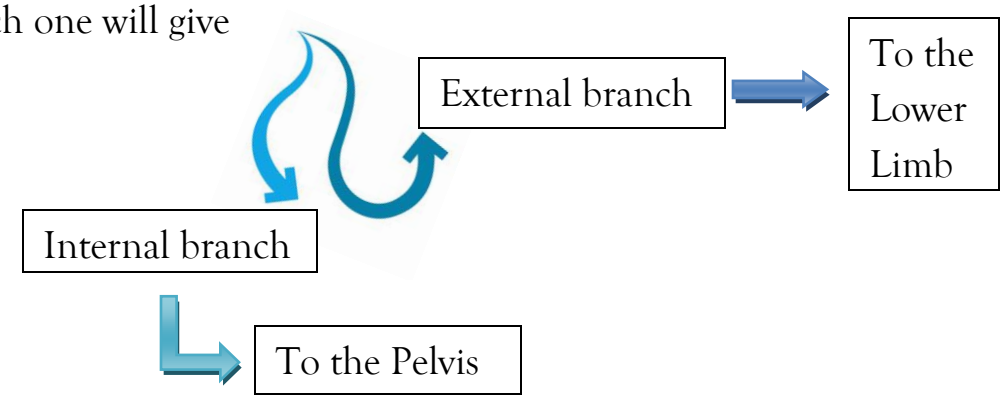
1. Abdominal Aorta.
2. Inferior Vena Cava.

Here we'll repeat the whole blood supply of the abdomen, so it's your (last) chance :P to study them.

➢ Arteries:



Let's start from the heart where the Ascending Aorta emerges from the left ventricle through the aortic orifice (we'll take this in the Cardiovascular System -lamma nekbar :p Insha'Allah -), then we have the Arch Of Aorta which will curve and descend downward giving the descending thoracic aorta that enters the diaphragm at the level of T12 on the midline posterior, and it will continue as the Abdominal Aorta. The abdominal aorta ends at the level of 4th lumbar vertebra **deviated to the left** & giving 2 terminal branches which are the right and left common iliac arteries. And each one will give



- Relations Of The Abdominal Aorta

The abdominal aorta is retroperitoneal, found in the posterior abdominal wall, and on its right side you'll see the I.V.C (Inferior Vena Cava).

Anterior:

- ✓ Pancreas (the abdominal aorta is found posterior to the pancreas- on the posterior surface of the pancreas)
- ✓ 3rd part of the duodenum (the horizontal part)
- ✓ Coils of the small intestine.
- ✓ Crossed by the left renal vein, WHY???? (Important)

> Because the left renal vein goes to the I.V.C which is found on the right side, so it must move in front of the Abdominal Aorta.

On the Right side:

- ✓ I.V.C .
- ✓ CISTERNA CHYLI ➔ it is a lymphatic sac found below the diaphragm in front of L1 & L2
  - ❖ All lymph of the Lower Limb & the Abdomen converge in the CISTERNA CHYLI where the thoracic duct emerges and goes to the chest and empties in the left innominate vein. (AKA brachiocephalic).
- ✓ Beginning of the Azygos vein.

On the Left side:

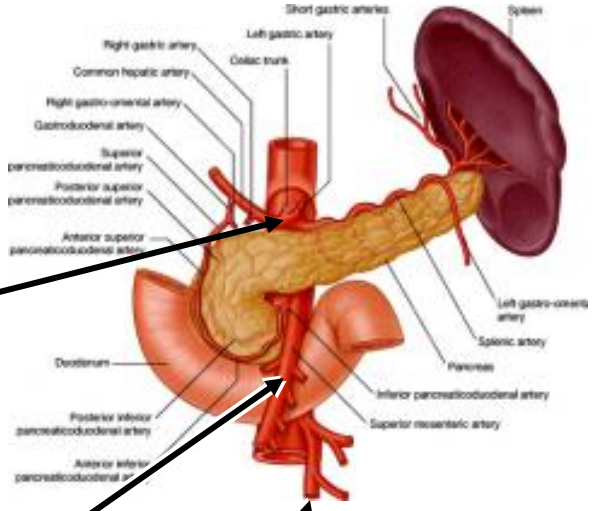
- ✓ The left sympathetic trunk (chain).

- Branches Of The Abdominal Aorta:

They are either single or paired (one on the right & the other is on the left).

Single Branches:

- The single branches are usually from the anterior surface (3 branches), & 1 branch from the posterior surface.



From the Anterior surface:

1. Celiac Trunk
   (Above the body of pancreas at the level of lower border of T12, or upper border of L1).

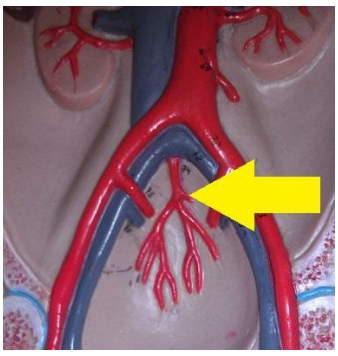
To the Foregut

To the Midgut

2. Superior mesenteric artery.

To the Hindgut

3. Inferior mesenteric artery.



From the Posterior surface:

We have only the **Median Sacral Artery**, it goes to the posterior wall of the rectum.

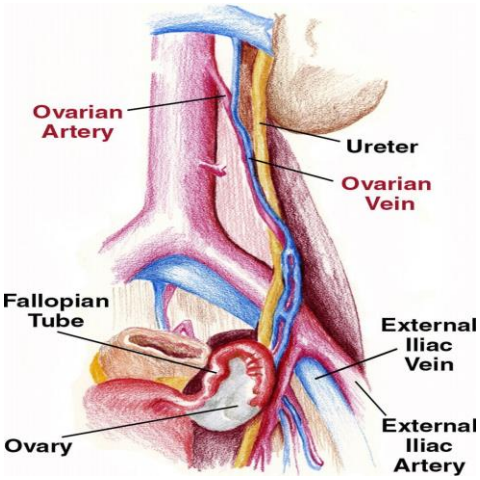
Paired Branches: (For each pair: One on the right & the other is on the left)

Some are from the front of the abdominal aorta➔ like the Testicular or ovarian arteries at the level of L2 lumbar vertebra.

But remember,
When we talk about the testicular VEINS, they are different:
- Right testicular vein ➔ goes to the I.V.C.
- Left testicular vein ➔ goes to the Left Renal vein

So From the Anterior surface:

We have the testicular or ovarian arteries at level of L2.



From the Posterior surface:

We have four Lumbar arteries, they are from the back and go to the posterior abdominal wall.

From the sides:

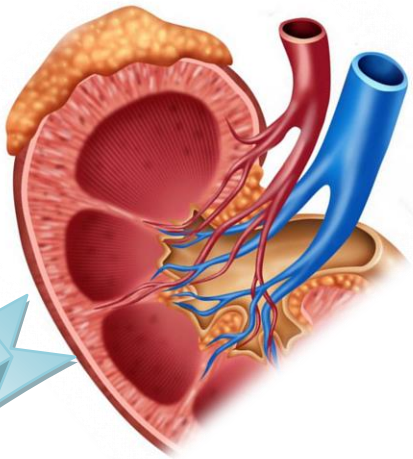
1. Inferior phrenic Arteries ➔ they supply the undersurface of Diaphragm.

However, it's nice to know that the Superior Phrenic arteries which supply the upper surface of the diaphragm are branches from THORACIC AORTA.

2. Middle Suprarenal Arteries.
3. Renal Arteries(to the right and left kidneys).

Suprarenal glands are found at the upper border of the kidneys ➔ they are rich in blood vessels because they are endocrine ➔ for that they are supplied by 3 branches: (Remember these are paired arteries)

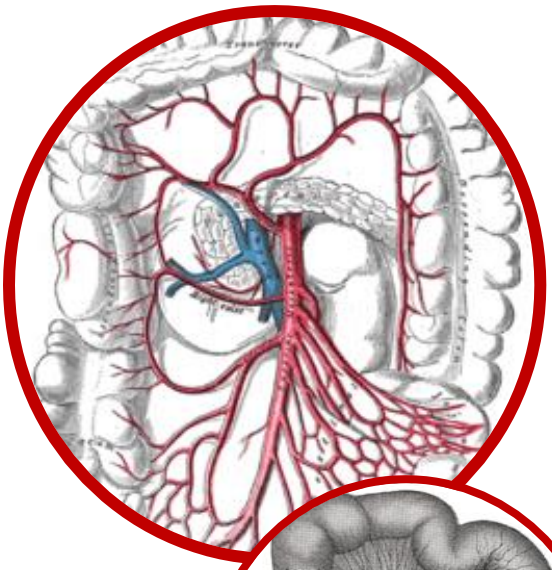
- Superior suprarenal from the Inferior Phrenic.
- Middle suprarenal from the Abdominal Aorta (directly from the abdominal aorta).
- Inferior suprarenal from the Renal Artery.

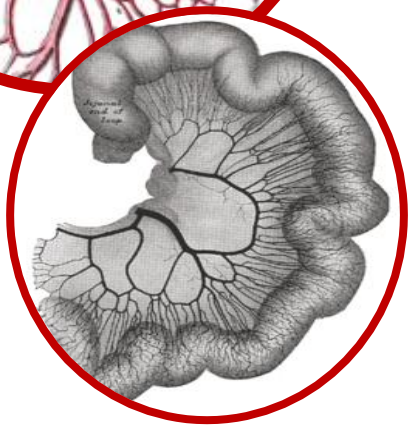


Revise the slide about branches of celiac artery because the doctor mentioned them again.

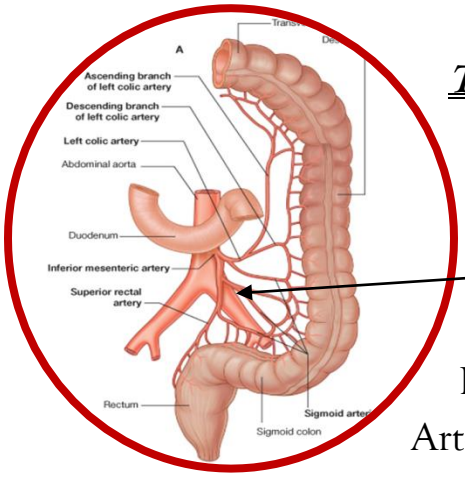
Now, we'll start talking about ***The Superior Mesenteric Artery*** –allah wakeelkom tool elyom w ne7na nesta3'eeb, msh m5lyeen 7ada mn sharna :P- it emerges at the level of L2 lumbar vertebra, behind the body of pancreas.

Branches of superior mesenteric A.:





1. **The inferior pancreaticoduodenal artery.**
2. The middle colic artery.
3. The right colic artery.
4. The ileocolic artery.
   ➔It gives rise to a superior branch that anastomoses with the right colic artery and an 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** is a branch of the posterior cecal artery .
5. The jejunal & ileal branches. (They form the arcades & vasa recta in the mesentery)



The Inferior Mesenteric Artery appears at the level of L3.

Origin :

Behind the horizontal part of the duodenum.

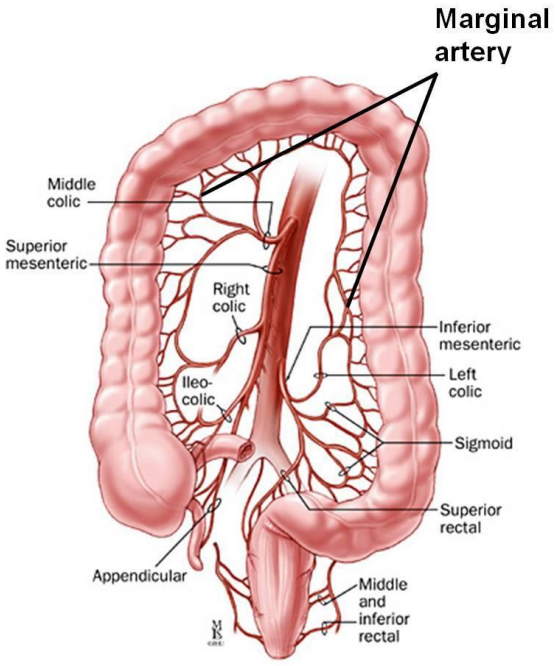
It continues as the terminal branch; Superior Rectal Artery that supplies the rectum & anal canal.

Branches:

1) **Left Colic Artery.**
2) **Sigmoid Arteries.**
3) **Superior Rectal Artery as a continuation.**

- Marginal Artery:

The anastomosis of the **colic arteries** around the concave margin of the large intestine (ascending, transverse & descending colon) forms a single arterial trunk called the marginal artery. This 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.



We have like this anastomosis in the small intestine (in the mesentery of Jejunum & Ilium as Vasa Recta).

- Common Iliac Arteries:

We mentioned them before, and we said that at the level of 4th lumbar vertebra, the abdominal aorta will terminate by giving 2 branches;2 common iliac arteries. At the bifurcation, the common iliac artery on each side is crossed anteriorly by the ureter. Each one will give external and internal iliac arteries.

- **The External Iliac Artery:**

It will supply the Lower Limb by its 2 branches:

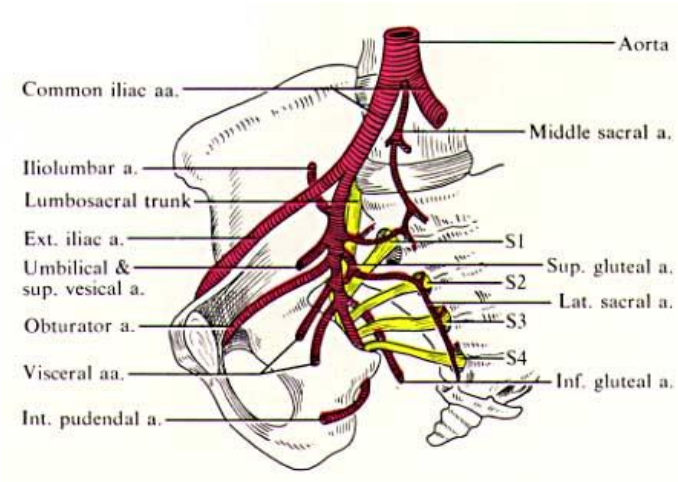
1) **Inferior Epigastric artery:**

(Remember when we talked about it and said that it anastomoses with the superior epigastric branch of the internal thoracic artery in the rectus sheath).

2) **Circumflex Iliac Artery** (deep branch)➔goes toward the ASIS.

➢ The Internal Iliac Artery:

The internal iliac artery passes down into the pelvis in front of the sacroiliac joint.



Branches:

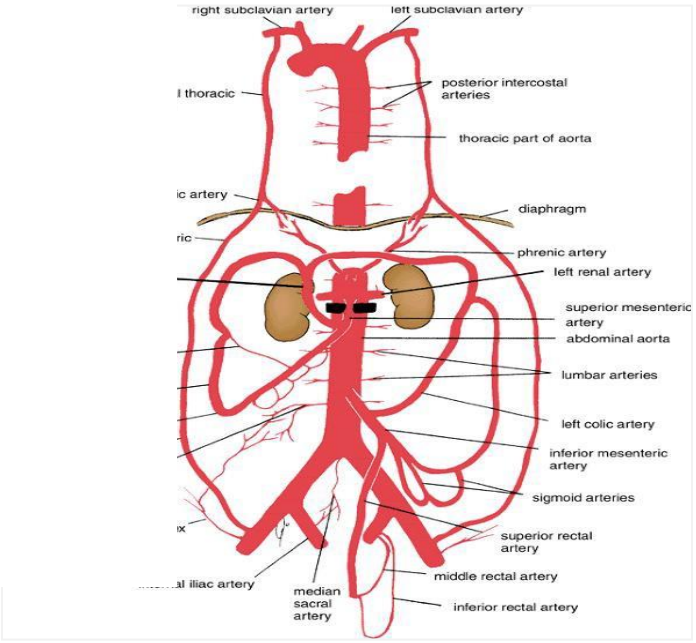
- Posteriorly: Iliolumbar artery .
  Lateral sacral arteries.
  Superior gluteal artery through the greater sciatic foramen

- Anteriorly: Obturator artery (with the obturator nerve) (occasionally from inferior epigastric artery) through the obturator canal.
  Inferior gluteal artery through the greater sciatic foramen.
  Umbilical artery ➔which gives the superior vesical artery to the urinary bladder (usually, but sometimes it branches directly from anterior trunk).
  Uterine artery (females) or deferential artery (males) and they give branches to the vagina and vas deferens.
  Vaginal artery (females, can also arise from uterine artery) - for vagina.
  Inferior vesical artery – for urinary bladder.
  Middle rectal artery – for rectum
  Internal pudendal artery that gives the inferior rectal artery.

Hamzeh you can start now, Ana 5allaset ;D

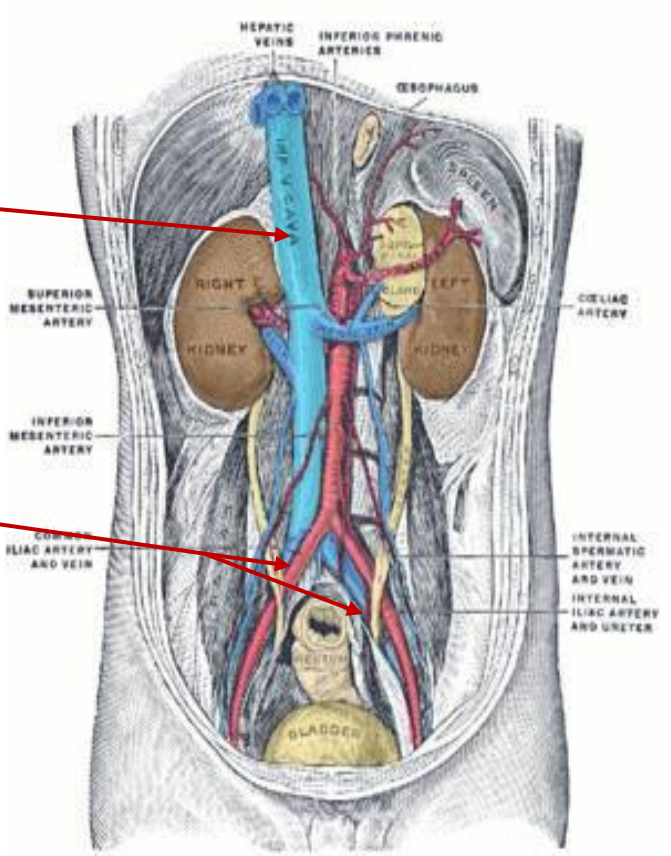
-Blood Supply To The Rectum & Anal Canal: (Important)

- The rectum and the anal canal receive blood supply from the **superior rectal artery**; a continuation to the **inferior mesenteric artery**.
  - **Middle rectal artery** from internal iliac.
  - **Inferior rectal artery** from internal pudendal which is a branch from internal iliac.



- Veins On The Posterior Abdominal Wall:

- The **inferior vena cava** is just the opposite of the abdominal aorta.
- It begins at the level of the fifth lumbar vertebrae **(L5)** from the right side. The aorta ends at the left side of the fourth lumbar vertebrae **(L4)**.
- The I.V.C. is formed from the union of the **right and left common iliac veins**, the union occur behind the right common iliac artery at the level of **(L5)**.
- It is located in the posterior abdominal wall on the right side of the abdominal aorta. It is retroperitoneal.



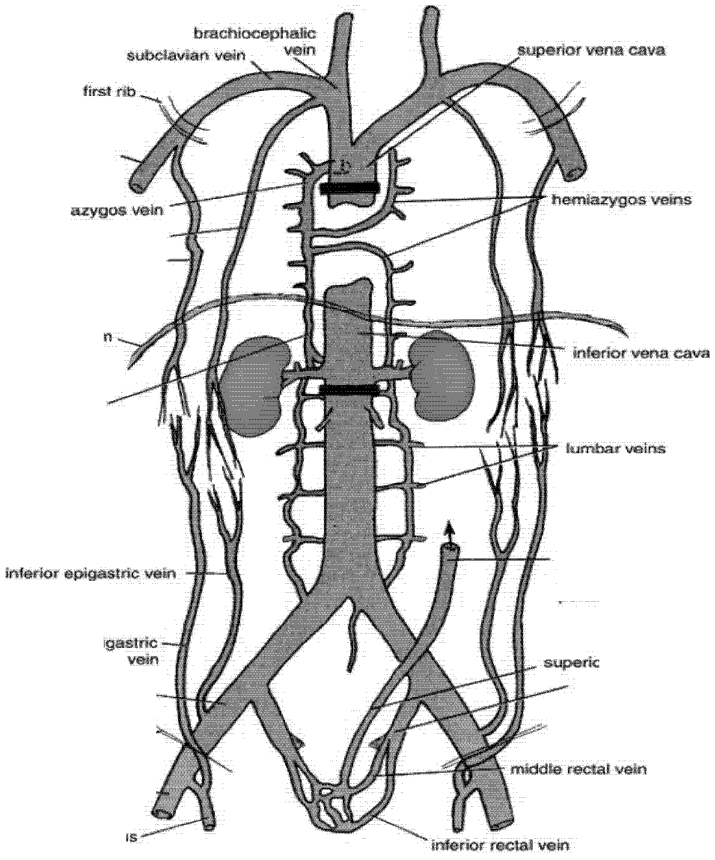
- It has an impression on the posterior surface of the liver (on the right side of the caudate lobe). It pierces the central tendon of the diaphragm on the right cupula at the level of the eighth thoracic vertebrae (**T8**) 1 inch to the **right** from the midline.
- It ends in the right atrium.

- Tributaries Of The I.V.C:

- There is a difference here from the abdominal aorta which is the presence of the portal circulation.
- The portal vein carries the nutritive material from the G.I.T to the liver. And it's formed behind the neck of the pancreas from the joining of the splenic vein and the superior mesenteric vein. And also the **inferior mesenteric vein** drains into the splenic vein.
- So, anything that's related to absorption will go first to the portal vein, directly, not to the I.V.C.

So, what goes to the I.V.C.?

Veins that aren't related to absorption, (tributaries of I.V.C) such as: →



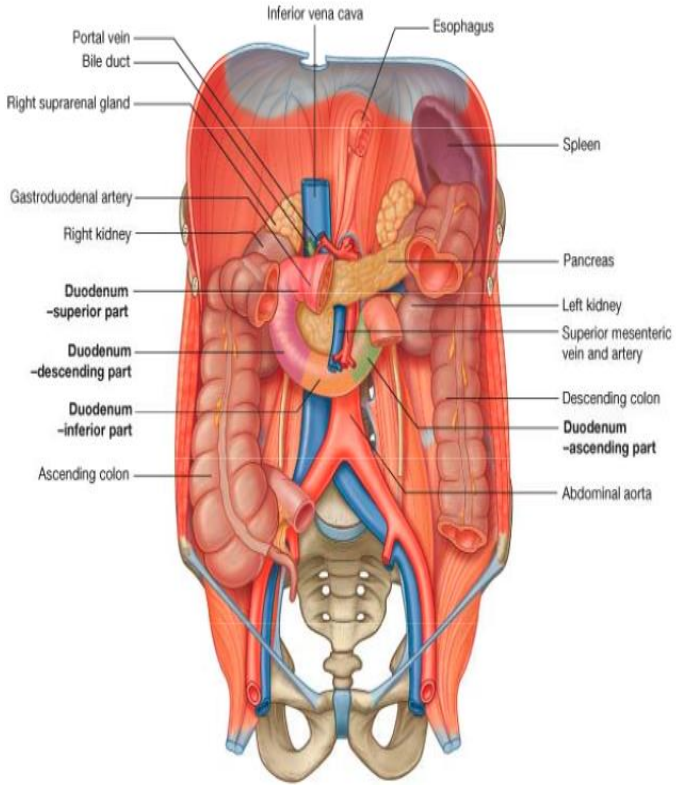
1- Common iliac veins (that join to form the I.V.C.).
2- Four Lumbar veins from the posterior abdominal wall.
3- Right Testicular/ Ovarian vein.
4- Renal veins from kidney.
5- Right suprarenal veins from the suprarenal gland.
6- Inferior phrenic vein from the diaphragm.
7- Hepatic veins (venous drainage for liver) open directly into the I.V.C.

Note: Left gonadal vein and left suprarenal vein drain into the left renal vein.

Relations of the I.V.C.:

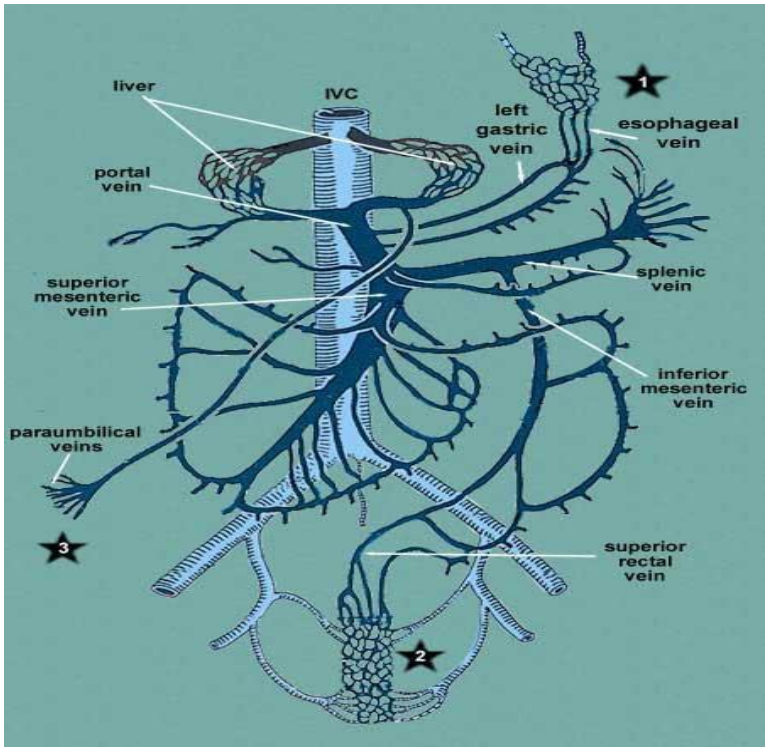
Anteriorly:

1- Coils of the small intestine (jejunum and ilium).
2- Third and first parts of duodenum.
3- Head of pancreas and common bile duct.
4- The foramen of Winslow.
5- Portal vein (which is anterior to the foramen of Winslow).
6- Has a groove behind the liver.

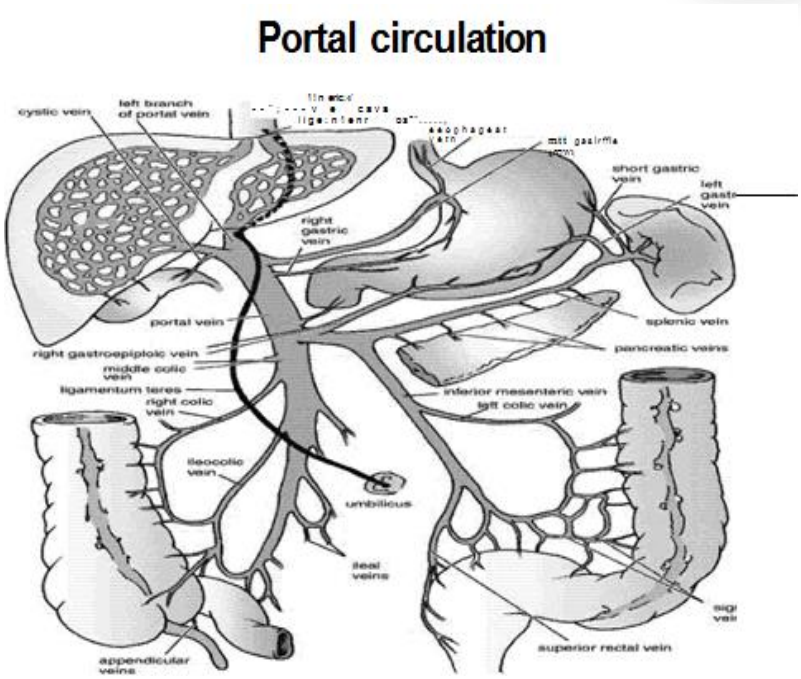


Portal vein: (Important)

- Measures about 2 inches / 5 cm long.
- It is formed behind the neck of the pancreas (from the union of the splenic vein and the superior mesenteric vein).
- It ends in the porta hepatis of the liver by dividing into right and left terminal portal branches.
  - ✓ **Note**: the **right** branch receives the **cystic vein** from the gallbladder.



- Tributaries: splenic vein, inferior mesenteric vein, superior mesenteric vein, right & left gastric and the cystic vein.
- The portal vein ends in sinusoids between hepatocytes in the liver.



- Porto-systemic Anastomosis:

There are locations where the **portal vein** and other **systemic veins** meet and we call this the Porto – systemic anastomosis.

What is the importance of this anastomosis?

It is actually an indicator of portal hypertension that could be caused by:

- **Liver cirrhosis**: due to alcoholism.
- **Liver fibrosis**: occurs in Bilharziasis (this disease is very common in Egypt).

Both - liver fibrosis & cirrhosis - cause obstruction in the liver and increase portal pressure.

- Valvular disease of the heart.
- Congenital; patent ductus venosum.

So, in these conditions, the blood will not be able to pass to the central and hepatic veins and instead returns back to the portal vein and its tributaries and portosystemic anastomosis will develop.

Examples on the Porto – systemic anastomosis:

1) Around the lower third of the **esophagus**; where **branches from the left gastric tributaries of** the left gastric vein (portal) are located and meet with branches of the **azygos vein** (systemic). **Note**: the azygos vein goes directly to the arch of the azygos and drains into the superior vena cava.

During congestion (portal hypertension), this anastomosis occurs and **esophageal varices** develop. Congested and tortuous veins in the esophageal varices cause hematemesis (vomiting of blood). **Note**: if you remember esophageal varices from pathology, you would know that there is a high mortality rate from the first episode of hematemesis.

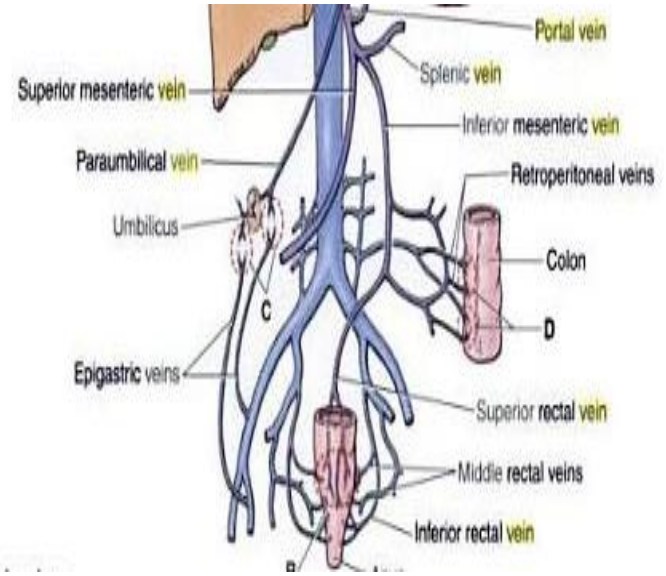
The artist AbulhaleemHafeth (Betloomonee Leh :p) lost his life to Bilharziasis; specifically from esophageal varices. Back then it was difficult to treat so he suffered from recurrent hematemesis with anemia.

Nowadays, using an endoscope doctors can perform sclerosing to these varices. Sometimes they introduce a very cold material to stop the bleeding. It has become easier to treat.

2) Around the rectal and anal canal; between the superior rectal vein that drains into the inferior mesenteric which ultimately ends in the portal vein through the splenic vein and the middle and inferior rectal veins which are systemic and drain into the inferior vena cava. Because they are located in the lower part of the abdomen and pelvis, the congestion is high and hemorrhoids (piles) will develop as a result.

3) Around the umbilicus; the **paraumbilical veins** (portal) meet the **superficial epigastric vein** that goes to subclavian vein to superior vena cava (systemic) (said by the doctor).

When this anastomosis occurs it causes a clinical case known as **caput medusa**; characterized by radiating veins forming a niche (shallow recess) around the umbilical region.

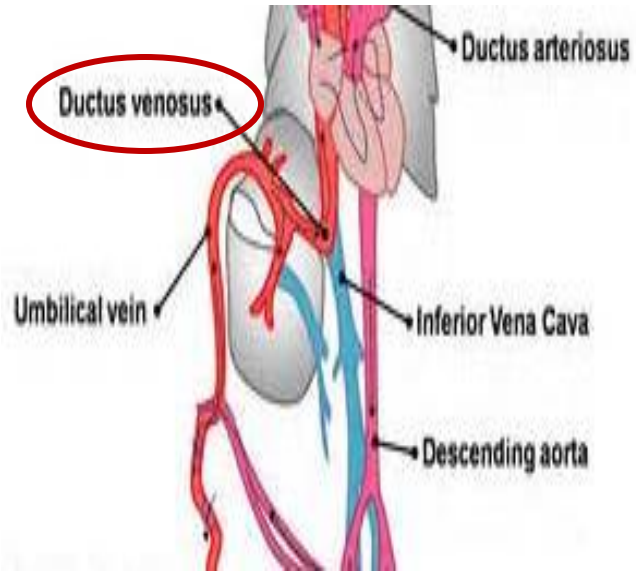


4) Retroperitoneal; you can find anastomosis in the peritoneum on the posterior abdominal wall between the systemic and portal veins such as that between the **right colic vein**, the **middle colic vein** and the **left colic vein** (all portal) and the **renal veins** (going to I.V.C.), **suprarenal veins**, **lumbar veins**, **gonadal veins** or **paravertebral veins (all systemic)**.

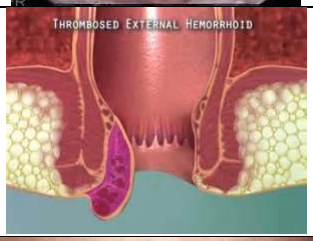
5) Intrahepatic: where the left branch of the **portal vein** (portal) meets the **I.V.C.**(systemic).

When this anastomosis occurs it forms the **ductus venosum.** The clinical condition is termed **patent ductus venosus.**

- Porto – systemic anastomosis can also occur in the **bare area** (portal) of the liver and the **diaphragm** (systemic).



Remember me!

Region	Name of clinical condition	Portal circulation	Systemic circulation	Picture
Esophageal	Esophageal varices	Esophageal branch of left gastric vein	Esophageal branches of azygos vein	
Rectal	Hemorrhoids	Superior rectal veins	Middle & inferior rectal veins	
Paraumbilical	Caput medusa	Paraumbilical veins	Superficial epigastric vein	
Retroperitoneal	--------	Right, middle and left colic veins	Renal, suprarenal, paravertebral and gonadal veins	----------
Intrahepatic	Patent ductus venosus	Left branch of portal vein	I.V.C.	----------

*The first three regions are very important clinically.

- Lymphatics On The Posterior Abdominal Wall:

Lymph nodes are found around the arteries.

Divided into:

1- Pre – aortic lymph nodes.
2- Para – aortic or lumbar lymph nodes.

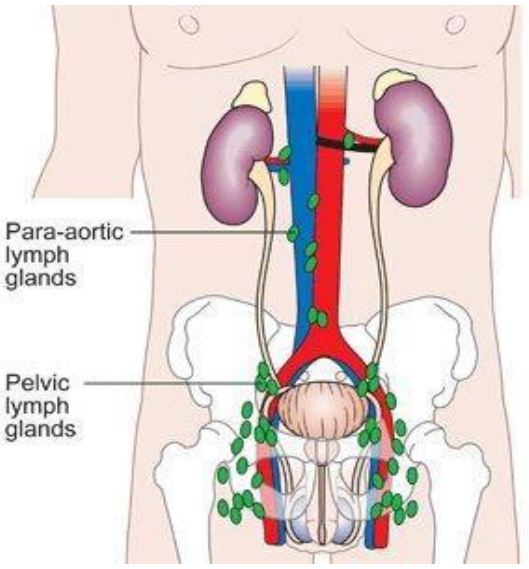
The **pre – aortic lymph nodes** are located on the anterior surface of the aorta; around the origins of the **celiac trunk** (celiac lymph nodes), **superior mesenteric artery** (superior mesenteric lymph nodes) and around the **inferior mesenteric artery** (inferior mesenteric lymph nodes). Notice that they can also be termed: Foregut, Midgut & Hindgut lymph nodes.

- They receive lymphatic drainage from the G.I.T. from the lower third of the esophagus until the anal canal. The spleen, pancreas, gallbladder and the greater part of the liver are included.
- What about the bare area of the liver?

It has its own lymphatic drainage to the **right thoracic duct**.

- Why did we include the spleen and the pancreas?

Because, the splenic artery travels along the lymphatic drainage to the superior mesenteric and celiac lymph nodes.



The **para– aortic (lateral aortic or lumbar) lymph nodes** are located on the lateral sides of the aorta.

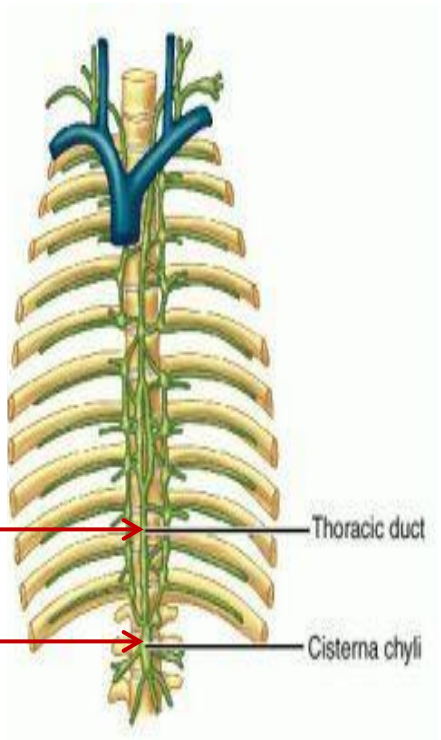
- They receive lymphatic drainage from:
  - ✓ Kidneys.
  - ✓ Suprarenal glands.
  - ✓ Testes in males.
  - ✓ Ovaries & uterus (fundus specifically) in females.
  - ✓ The abdominal wall: from the common iliac nodes, and the efferent vessels go to the **lumbar trunk** around the ascending aorta and then sometimes to the intestinal trunk.

✓ **Note**: the lumbar & intestinal trunks are located on the lateral sides of the aorta and both end in the **thoracic duct**.

The thoracic duct:

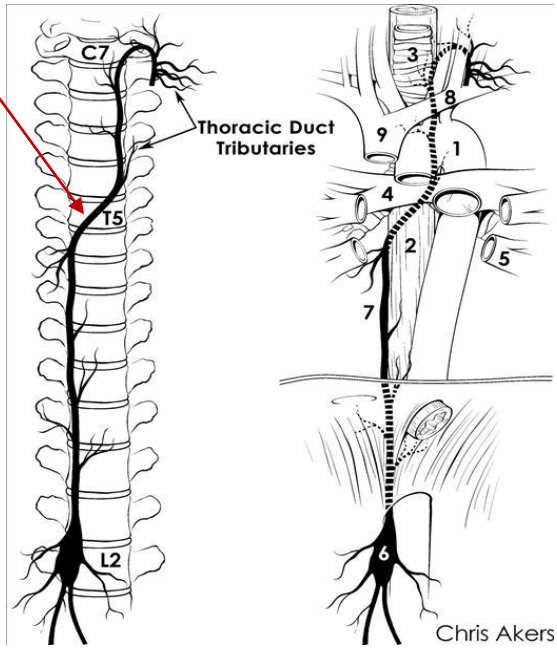
- Begins as **cisterna chyli**.

The cisterna chyli is located below the diaphragm in front of the first two lumbar vertebrae on the right side of the aorta. It collects all lymph from the abdomen and the lower limbs.



- It passes from the abdomen to the thorax through the aortic orifice on the right side of the aorta. Then it ascends in the thorax on the right side of the esophagus until it reaches the fifth thoracic vertebrae (**T5**) where it deviates to the left.
- It then ends at the beginning of the brachiocephalic vein on the left side (the junction between the internal jugular vein and subclavian vein).
- Since it emerges in the chest on the left side then the entire left chest along with the left upper limb will drain there. The left side of the head and neck too.
  - What about the right side?

  It drains into the right lymphatic duct which comes from the bare area of the liver, and drains the right side of thorax, upper limb and head and neck.



This is dedicated to:

The best of the bests ...
Our other half (Ahmad Abu Al3ez) & Tamer Salhab (Tammoora El 2mmora)

Mohammad Fawa3eeeeeeeeeeeeeer
Zakareyah Shkokaney, w Ma7fazteee

2 Qusais
Eiad Barqawey
Rashid Dahabreh (bas lessa bnestanna el bee9')
Mo2men Rbee7at
Ma2moun Kajon
Mohannad Momanei
3laa'
Abdullah Jroud
Abdullah Yameen
Abdullah Joodeh
And our amazing groups 7D & 2D

Thank you so much!

Done by:

Hamzeh Salameh & Tariq Bushnaq

"This too, shall pass" H.S

"In this Faculty, everyday is a new chance for you to SURVIVE, so do it" T.B