GI
ANATOMY

 # 5

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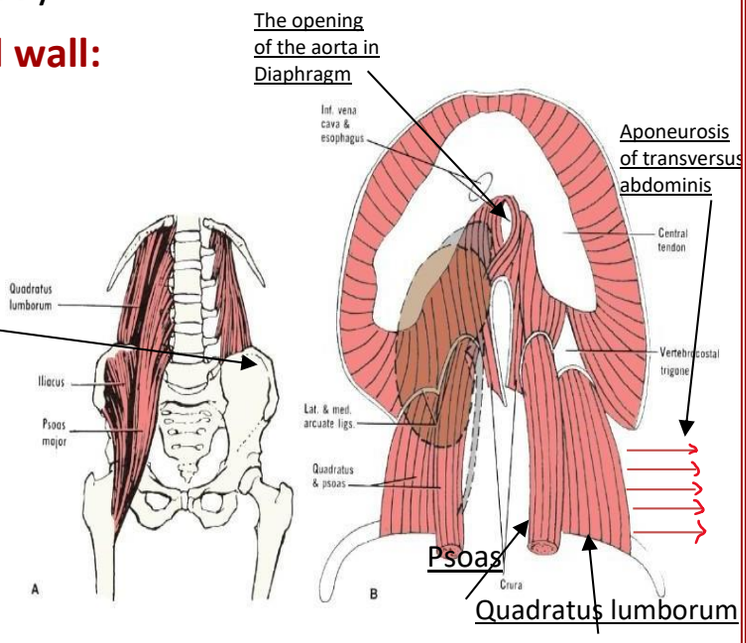
POSTERIOR ABDOMINAL WALL

As we have learnt about the anterior abdominal wall, today we are gonna talk about the posterior one, but our POV will be anteriorly since we are studying the abdominal part of the body.

❖ Structures of posterior Abdominal wall:

- **5 lumbar vertebra & their intervertebral discs**
- **12th rib** (the last one)
- **Upper part of bony pelvis** the iliac crest (the palpable part of the hip that separates the abdomen from the pelvis)
- **Muscles:**
  - **psoas major**
  - **psoas minor** (located in front of the psoas major, may be absent and if it is present, it will be useful for reconstructive surgeries)



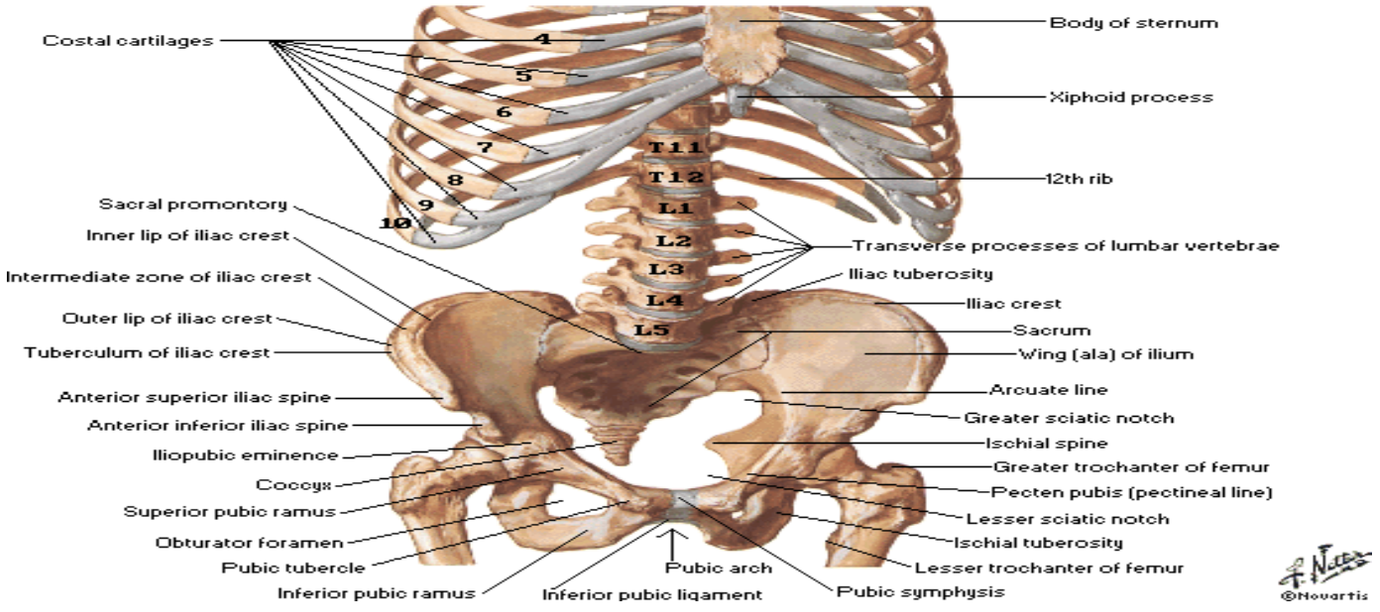
Side note: reconstructive surgery is done to reshape or rebuild a part of the body changed by previous surgery.

- **Quadratus lumborum**

- **Aponeurosis of** (the origin) **transversus abdominis muscles**

The iliacus muscle lies in the iliac fossa.

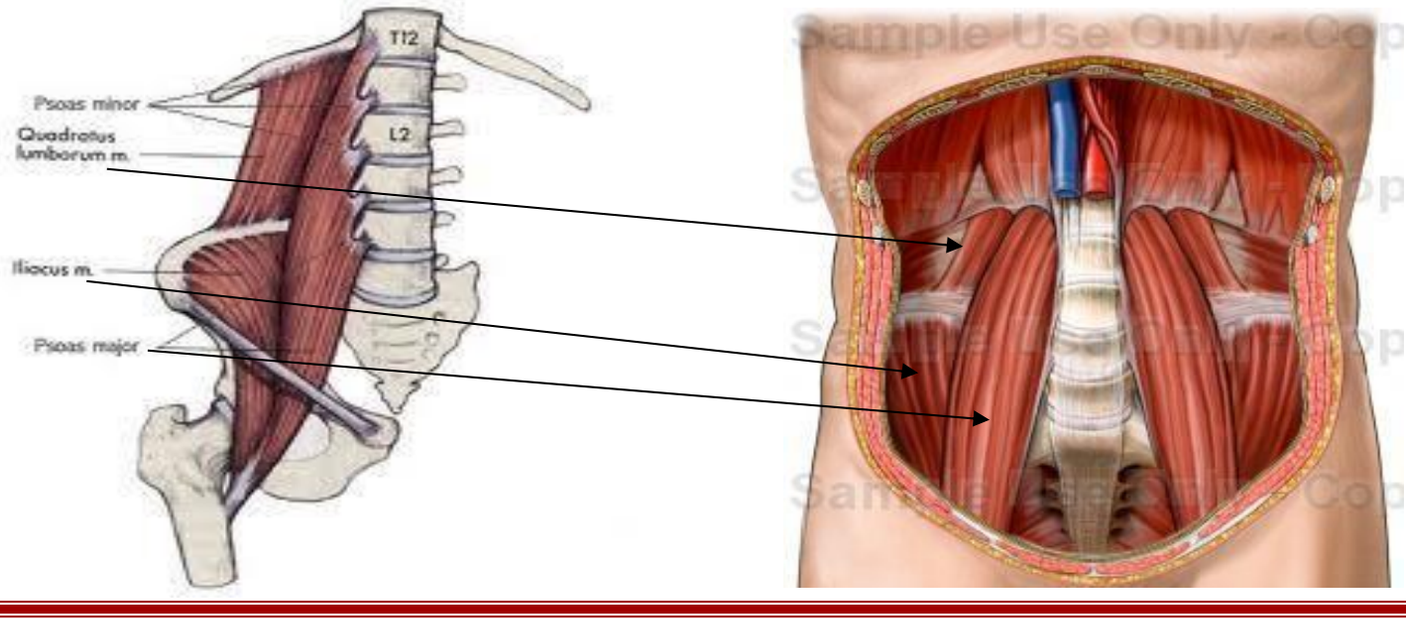
Bony Framework of Abdomen



MUSCLES OF POSTERIOR ABDOMINAL WALL

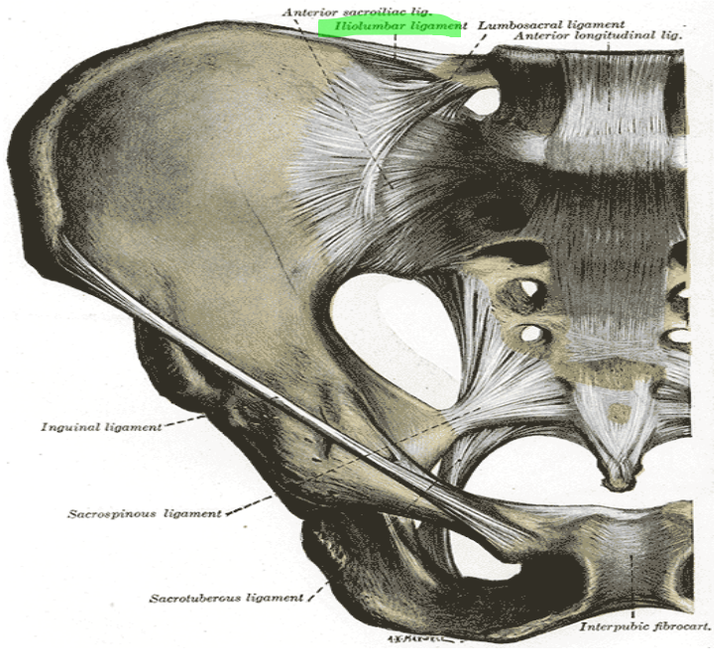
The muscles of the posterior abdominal wall are important, especially the psoas major because if there is any abscess forming infection, the abscess descends downwards and affects the pelvis, due to this peril it is surrounded by fascia (psoas fascia).

- **Psoas Major:**
  - **Origin: body & transverse process of lumbar vertebra & intervertebral disc**
  - **Insertion: Lesser trochanter of femur**
  - **N.S: nerve plexus (T12, L1, L2.L3)**
  - **Action: flexion of hip & thigh** (if the two sides are involved: bending forward (bowing), while if one side is involved: bending to that side)
- **Quadratus lumborum:** its fibers run upwards.
  - **Origin: Iliolumbar ligament & iliac crest** (its origin is downwards)
  - **Insertion: 12th rib**
  - **N.S: nerve plexus (T12, L1, L2.L3)**
  - **Action: fix or depresses 12th rib <u>during respiration</u> & lateral flexion of the trunk**
- **Iliacus muscle**
  - **Origin: iliac fossa**
  - **Insertion: Lesser trochanter of femur**
  - **N.S: femoral nerve**
  - **Action: Lateral flexion of hip & thigh for lying position**

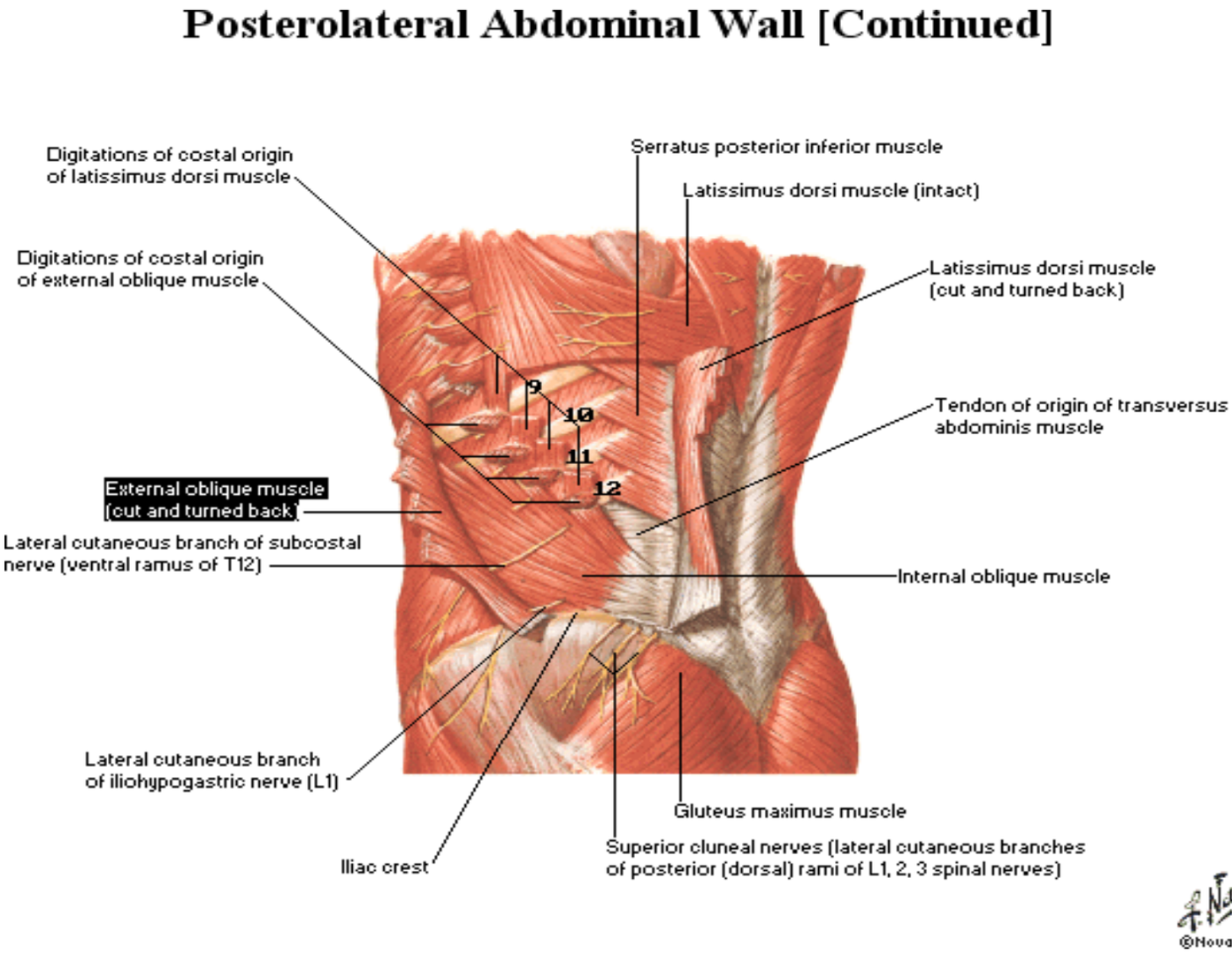


ILIOLUMBAR LIGAMENT

The Iliolumbar ligament is a <u>strong</u> ligament passing from the tip of the transverse process of the fifth lumbar vertebra to the posterior part 1/3 of the inner lip of the iliac crest.



The following picture posterolateral abdominal wall's muscles especially the oblique ones and transversus abdominis.

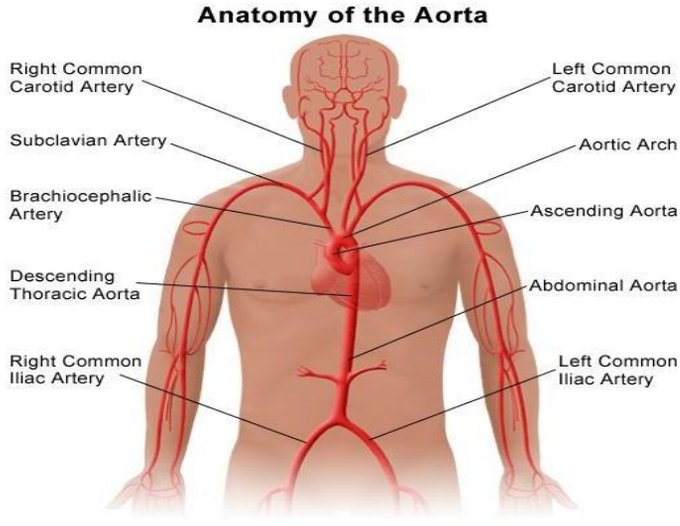


ARTERIES ON THE POSTERIOR ABDOMINAL WALL

The Aorta starts as: ascending aorta, arch of aorta, thoracic aorta then the abdominal aorta, which gives all the branches that we are gonna discuss, then it terminates as two common iliac arteries.

AORTA (RETROPERITONEAL as IVC)

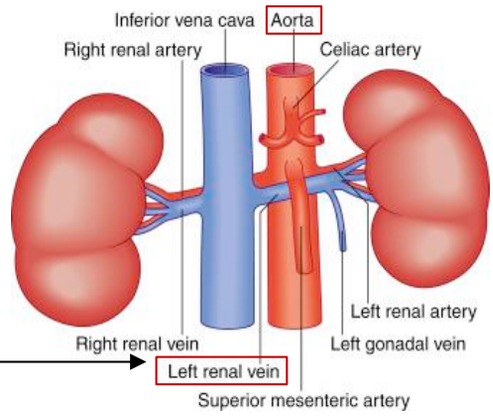
Location and Description:



- **The aorta enters the abdomen through the aortic opening of the diaphragm in front of the 12th thoracic vertebra.**
- **It descends behind the peritoneum on the anterior surface of the bodies of the lumbar vertebrae.**
- **End: At the level of the fourth lumbar vertebra** <u>on the left side</u>**, it divides into two common iliac arteries.**

- The IVC starts at 5th lumbar vertebra <u>on the right side</u> and ends at the right atrium.

RELATIONS



<u>Extra pic</u>

❖ **Anterior:**

- **Pancreas**
- **3rd part of duodenum** (the horizontal part)
- **Coils of small intestine**
- **Crossed by Left renal vein** (why the left one? Because it reaches the IVC on the right side)

❖ **On its right side:**

- **The inferior vena cava**
- **The cisterna chyli** (sac of lymph)
- **The beginning of the azygos vein.** (The most right)
- Thoracic duct (the superior continuation of cisterna chyli)

❖ **On its left side:**

- **The left sympathetic trunk (abdominal sympathetic chain).**

The relations of Aorta are very important in surgeries to avoid bleeding.

BRANCHES OF ABDOMINAL AORTA

❖ **Single branches: 3 front & 1 back**

➢ **Front:**

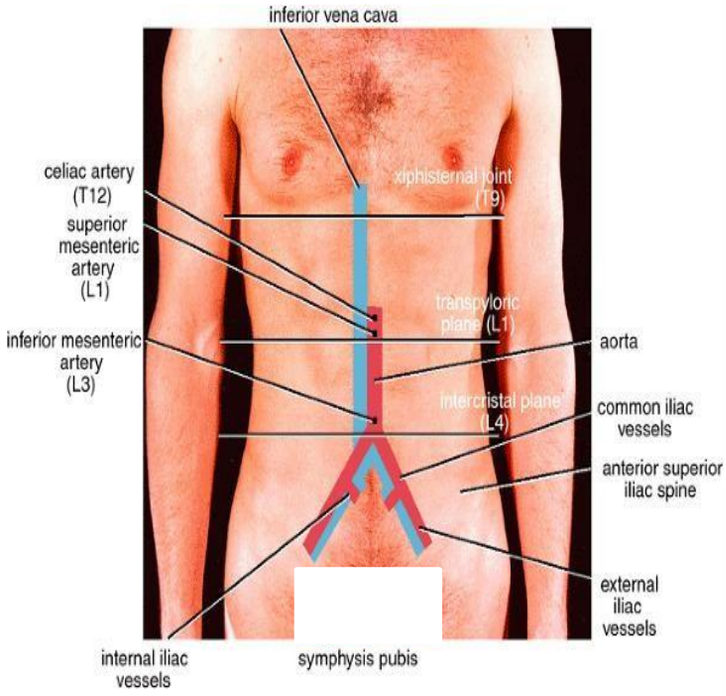
The celiac artery (foregut)

Superior mesenteric artery (midgut)

Inferior mesenteric artery (hindgut)

➢ **Back:**

Median sacral artery (descends downwards at the bifurcation posteriorly)



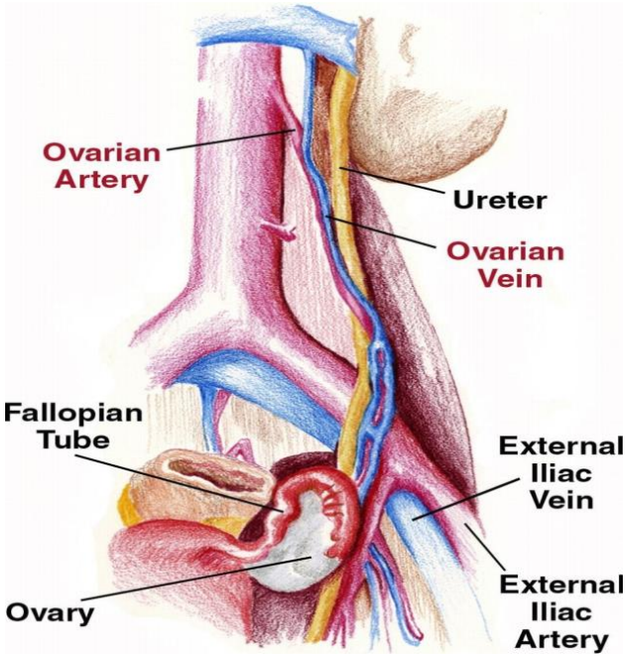
❖ **Pairs branches: 1 front, 4back & 3 side of aorta.**

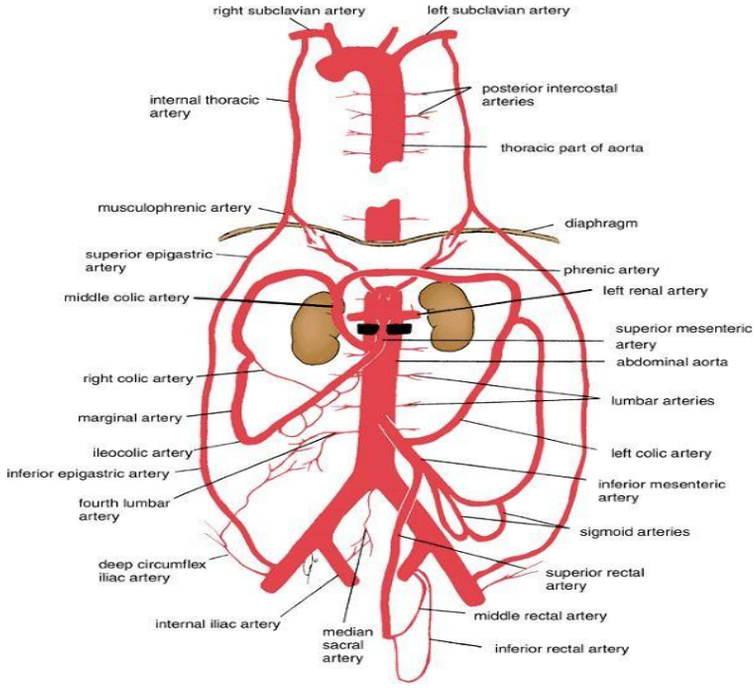
➢ **1 front: a testicular** (M) **or ovarian** (F) **artery at the level of L2**

➢ **4 back: lumbar arteries** (in front of the lumbar vertebrae most posterior)

➢ **3 side of aorta:**

- **Inferior phrenic artery** (below the diaphragm to the diaphragm)
- **Middle suprarenal artey**
- **Renal artery** at the level of L2 (the right is longer than the left one because the aorta is closer to the left kidney





CELIAC ARTERY <u>at the level of L1</u> (at the lower border of T12 ~ same as the upper border of L1)

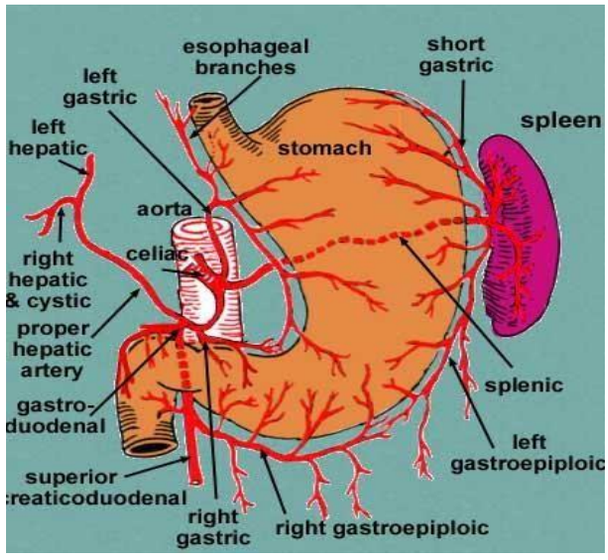
The celiac artery or <u>trunk</u> is very short, about 1cm **and arises from the commencement of the abdominal aorta at the level of the 12th thoracic vertebra. It is surrounded by the celiac plexus and lies behind the lesser sac of peritoneum.**

- **It has three terminal branches:**

1- The left gastric:

- **The small left gastric artery runs to the cardiac end of the stomach, gives off a few esophageal branches, then turns to the right along the lesser curvature of the stomach. It anastomosis with the right gastric artery.**

* The right and left gastric are from the content of lesser omentum.



2- <u>Splenic Artery</u>: a tortuous artery that passes on the upper border of pancreas to reach the hilum of spleen.

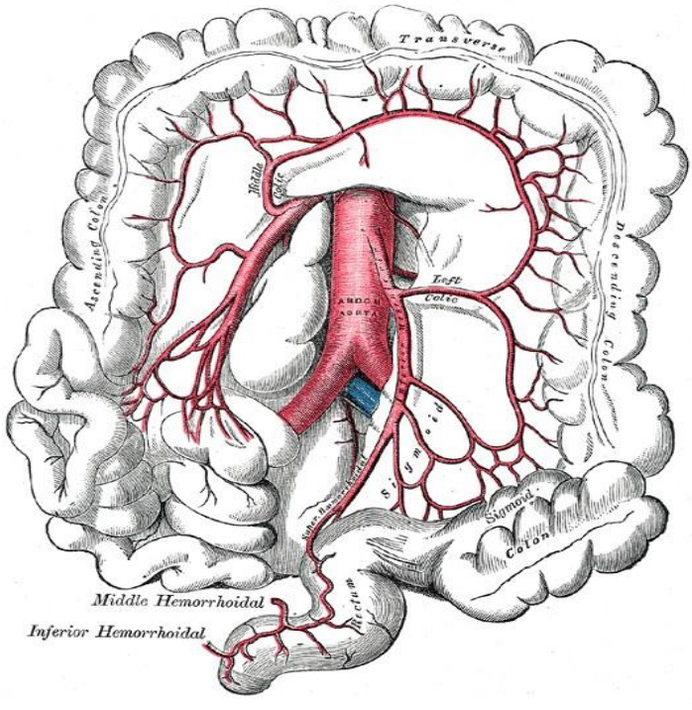
- **Pancreatic branches** anterior and posterior ones
- **The left gastroepiploic artery** across the greater curvature
- **The short gastric arteries → fundus** by gastrosplenic ligament

3- hepatic arteries

- **The right gastric artery arises from the hepatic artery at the upper border of the pylorus and runs to the left in the lesser omentum along the lesser curvature of the stomach. It anastomosis with the left gastric artery.**
- **<u>The gastroduodenal artery</u>: It divides into the <u>right gastroepiploic artery</u> that runs along the greater curvature of the stomach between the layers of the greater omentum and <u>the superior pancreaticoduodenal artery</u> that descends between the second part of the duodenum and the head of the pancreas.**
- **<u>The right and left hepatic arteries</u> enter the porta hepatis. The right hepatic artery usually gives off <u>the cystic artery</u>, which runs to the neck of the gallbladder.**

SUPERIOR MESENTERIC ARTERY at level of L2 (upper border of L2 or lower border of L1)

- **The inferior pancreaticoduodenal artery** to the lower half of duodenum and pancreas
- **The middle colic artery runs forward in the transverse mesocolon to supply the transverse colon and divides into right and left branches** to innervate a part of the ascending colon**.**
- **The right colic artery 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.**
- **The ileocolic artery passes downward and to the right. 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.**
- **The jejunal and ileal branches 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.**



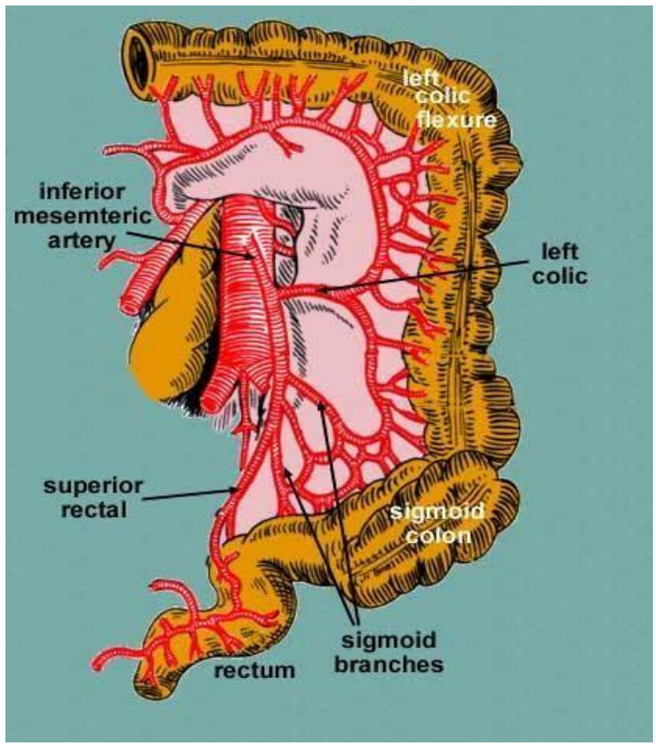
Fewer arcades supply the jejunum than supply the ileum. From the terminal arcades, small straight vessels supply the intestine.

- The veins are located lateral to the arteries (on the right side).

INFERIOR MESENTERIC ARTERY at the level of L3

Branches:

- **The left colic artery runs upward and 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.**
- **The sigmoid arteries are two or three in number and supply the descending and sigmoid colon.**
- **The superior rectal artery is a continuation of the inferior mesenteric artery as it crosses the left common iliac artery. It descends into the pelvis behind the rectum. The artery supplies the rectum and upper half of the anal canal and anastomoses with the middle rectal and inferior rectal arteries.**

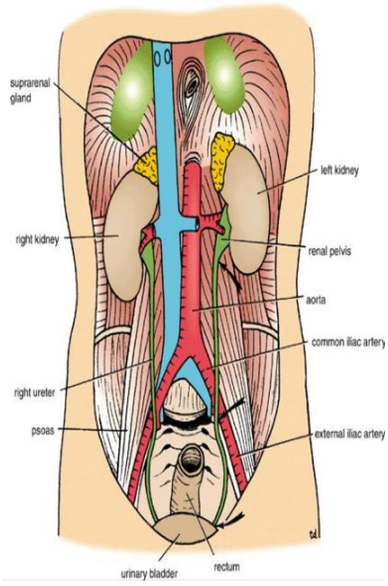


MARGINAL ARTERY

- **The anastomosis of the colic arteries** especially **around the concave margin of the large intestine 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.** Which means if any blockage occurs, there will be a connection between the vessels due to the anastomosis.

COMMON ILIAC ARTERY

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



❖ The external iliac artery goes to the lower limb and gives the femoral artery. Before giving the femoral artery, it gives the inferior epigastric artery (which is an important landmark for differentiating direct inguinal hernia from the indirect type):

- Direct hernia>> medial to the inferior epigastric vessels.
- Indirect hernia >> lateral to the inferior epigastric vessels.

Then the inferior epigastric artery enters the recuts sheath deep to recuts abdominis muscle.

EXTERNAL ILIAC ARTERY

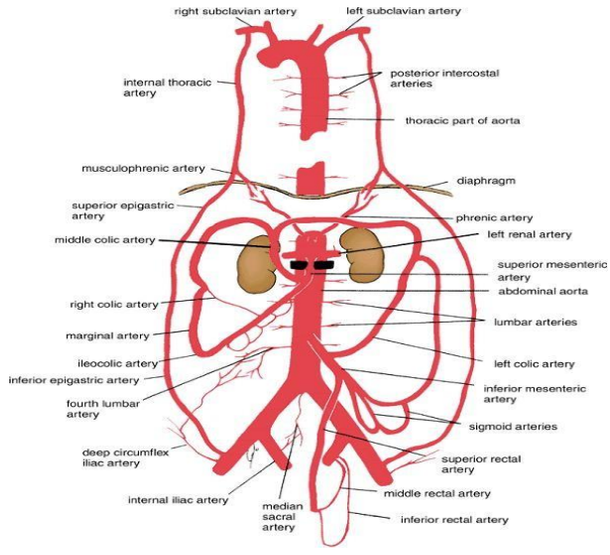
- **runs along the medial border of the psoas muscle.**
- **following the pelvic brim.**
- **It gives off the inferior epigastric and deep circumflex iliac branches.** (Deep circumflex iliac branch goes to the anterior superior iliac spine and supplies muscles of the lower abdomen)
- **The artery enters the thigh by passing under the inguinal ligament to become the femoral artery.**

❖ **Branches of the external iliac artery:** (will be discussed again in urogenital system)

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** (heading to the pelvic viscera)

The doctor said that we only need to be familiar with the names because they will be covered in urogenital system next year, but he added some notes that will be written in black if you are interested.

• **Posterior <u>Iliolumbar artery</u>** (ascends upward to the iliolumbar ligament)

• **Posterior <u>Lateral sacral arteries</u>** (penetrates the sacral foramina and become in posterior relation with the rectum and sigmoid)

• **Posterior <u>Superior gluteal artery</u> - <u>greater sciatic foramen</u>** (above piriformis muscle heading to gluteus Maximus muscle)

• **Anterior <u>Obturator artery</u>** (along with the obturator nerve crossing the pelvis from obturator foramen heading to medial compartment of the thigh) **(occasionally from inferior epigastric artery) - obturator canal**

• **Anterior <u>Inferior gluteal artery</u> - greater sciatic foramen** (below piriformis muscle to muscles of the gluteal region)

• **Anterior Umbilical artery <u>superior vesical artery</u>** gives the upper surface of urinary bladder **(usually, but sometimes it branches directly from anterior trunk) <u>medial umbilical ligament</u>** (distal obliterated part)

- **Anterior Uterine artery (females)** (tortuous for enlargement of the uterus) **deferential artery (males) superior and vaginal branches uterus, vas deferens(male)**
- **Anterior Vaginal artery (females, can also arise from uterine artery) - vagina**
- **Anterior inferior vesical artery - urinary bladder**
- **Anterior Middle rectal artery - rectum**
- **Anterior Internal pudendal artery – inferior rectal**

Terminal branches of internal iliac artery are the middle rectal and internal pudendal and they supply the rectum.

VEINS OF THE POSTERIOR ABDOMINAL WALL

INFERIOR VENA CAVA

❖ **Location and Description**

- **The inferior vena cava conveys most of the blood from the body below the diaphragm to 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 the fifth lumbar vertebra.** (Ascends on the right side)
  - ❖ in the pelvis the common iliac veins are deep to the arteries which is opposite to the rule that arteries are always deep to veins>> because the veins have thinner walls than arteries.

  in pregnancy for example there will be pressure on the wall of the pelvis, the pressure is faced by the superficial arteries which have thicker walls than veins (even with this mechanism varicocele can still occur in pregnancy in the lower limb).
- **It ascends on the right side of the aorta, pierces the central tendon of the diaphragm** (at level of T8)
- **Ascends then separated from the aorta by Rt. crus of the diaphragm.**
- **Ends at the level of the eighth thoracic vertebra, and drains into the right atrium of the heart.**

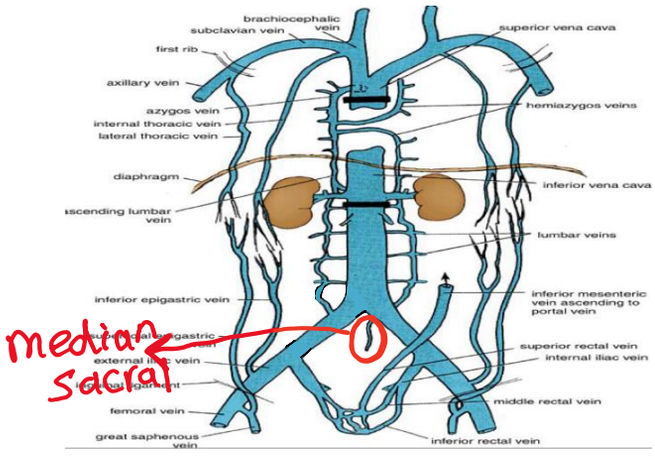
- **The right sympathetic trunk lies behind its right margin and the right ureter lies close to its right border. The entrance into the lesser sac separates the inferior vena cava from the portal vein.**

RELATIONS OF I.V.C

- **Anterior:**
  - **Coils of small intestine**
  - **3rd part & 1st part of d.d**
  - **Head of pancreas & C.B.D**
  - **Related to the foramen of Winslow.**
  - **Portal vein**
  - **Lies in deep groove of liver** (on the posterior surface of the liver)

TRIBUTARIES OF I.V.C

- **The inferior vena cava has the following tributaries:**
  - **Two anterior visceral tributaries: the hepatic veins** (usually two veins (left and right) but clinically we see three openings (caudate and quadrate has central vein)
  - **Three lateral visceral tributaries: the right suprarenal vein (the left vein drains into the left renal vein), renal veins, and right testicular or ovarian vein (the left vein drains into the left renal vein)** because of that varicocele in left testes is more common than the right. (On the left is oblique and on the right its perpendicular). Also because the left testes is lower than the right.
  - **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**



INFERIOR MESENTERIC VEIN

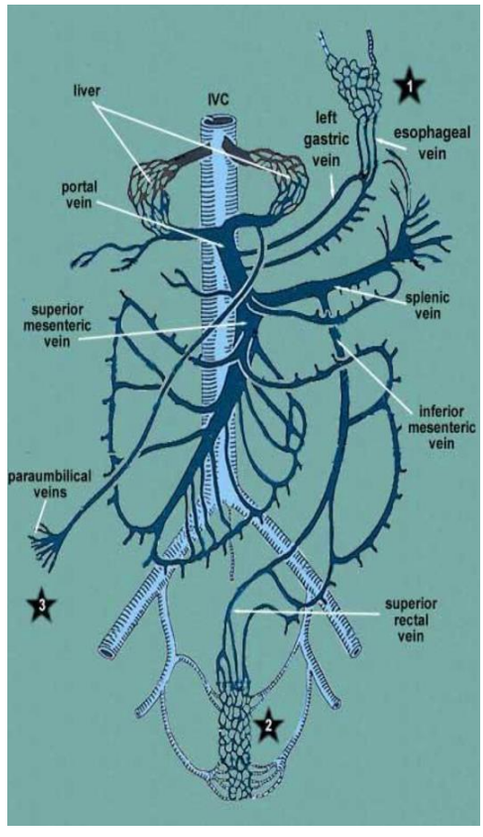
- **The inferior mesenteric vein is a tributary of the portal circulation** (it means it goes to the portal vein so in the end it goes to the liver)**. It begins halfway down the anal canal as the superior rectal vein** (the upper half of anal canal and rectum)**.**
- **It passes up the posterior abdominal wall on the left side of the inferior mesenteric artery and the duodenojejunal flexure and joins the splenic vein behind the pancreas. It receives tributaries that correspond to the branches of the artery.** (Opens to the splenic vein then to the portal vein).

THE SPLENIC VEIN

- **It is a tributary of the portal circulation. 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. 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.**

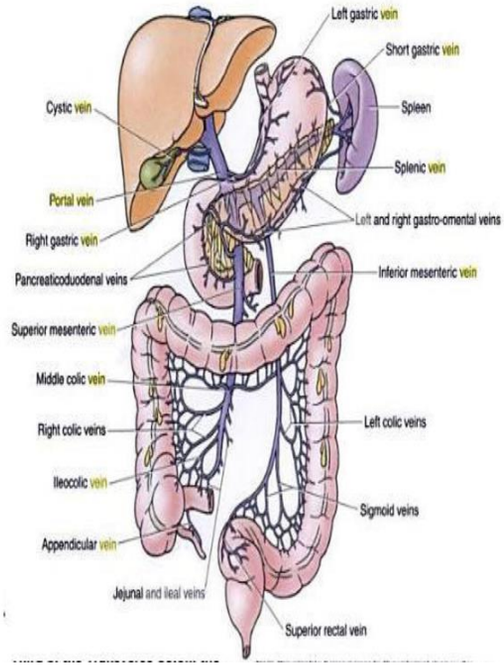
SUPERIOR MESENTERIC VEIN

- **The superior mesenteric vein is a tributary of the portal circulation. 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 and also receives the inferior pancreaticoduodenal vein and the right gastroepiploic vein.** (Superior mesenteric drains the whole midgut and the portal drains a large potion of the foregut).



PORTAL VEIN

- **The portal vein drains blood from the abdominal part of the gastrointestinal tract from the lower third of the esophagus to halfway down the anal canal; it also drains blood from the spleen, pancreas, and gallbladder.**
- **The portal vein enters the liver and breaks up 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**(begins) **behind the neck of the 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.**

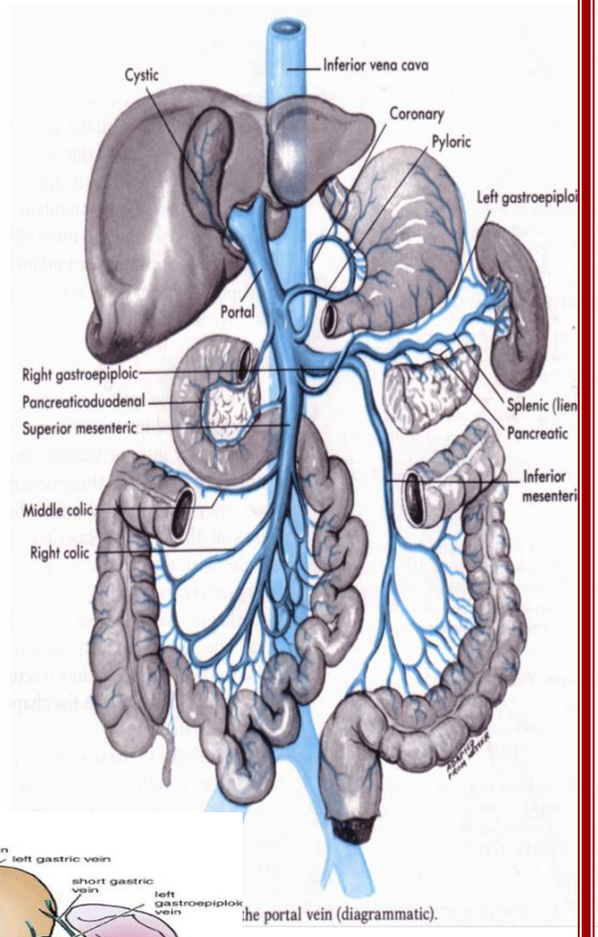


- **It then runs upward in front of the opening into the lesser sac to the porta hepatis** (ends there)**, where it divides into right and left terminal branches.**
- **The portal circulation begins as a capillary plexus in the organs it drains and ends by emptying its blood into sinusoids within the liver.**

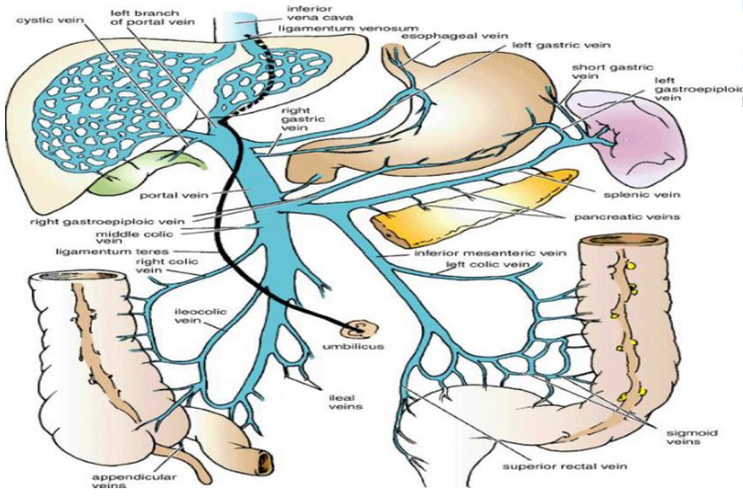
TRIBUTARIES OF PORTAL VEIN

- **The tributaries of the portal vein are the splenic vein, superior mesenteric vein, left gastric vein, right gastric vein, and cystic veins.** +superior pancreaticoduodenal
- **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.**
- **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.**

- **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.**
- **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.**
- **Right gastric vein: This vein drains the right portion of the lesser curvature of the stomach and drains directly into the portal vein.**
- **Cystic veins: These veins either drain the gallbladder directly into the liver or join the** (right) **portal vein.**



he portal vein (diagrammatic).



Keep in mind: obliterated ducts:

1) ductus venosus between IVC and left branch of portal.

2) Umbilical vein when obliterated>> ligamentum teres or round ligament of the liver.

PORTAL SYSTEMIC ANASTOMOSES

- **A porta caval anastomosis (also known as portal systemic anastomosis or portal caval system) is a specific type of anastomosis that occurs between the veins of portal circulation and those of systemic circulation.**
- **The lower end of esophagus is one of the important sites for the portosystemic anastomosis** (blood return by the left gastric vein)**. In portal hypertension as in the case of cirrhosis of liver anastomosis opens and forms venous dilatation called esophageal varices.**
- **Their rupture causes severe and dangerous haematesis (hematemesis).**

❖ In case of liver cirrhosis or fibrosis that leads to obstruction in the face of the portal vein so the blood return back to the tributaries of the portal vein

❖ Most important:

- To the lower third of the esophagus by the left gastric vain
- To the umbilicus by the paraumbilical vein
- To the rectum and anal canal by the superior rectal vein

- Anastomoses occurs between portal and systemic veins around them.

CAUSES OF PORTAL HYPERTENSION

- **Liver diseases>>Cirrhosis, fibrosis (bilharzial)**
- **Valvular diseases of the heart**
- **Congenital patent** (no obliteration of ductus venosum)

Portal systemic anastomosis

Region	Name of clinical condition	Portal circulation	Systemic circulation
Esophageal	Esophageal varices	Esophageal branch of left gastric vein	Esophageal branches of Azygos vein
Rectal	Internal Hemorrhoids	Superior rectal vein	Middle rectal veins and inferior rectal veins
Paraumbilical	Caput medusae Star like shape around the umbilicus	Paraumbilical veins	Superficial epigastric vein
Retroperitoneal Rare	(no clinical name)	Right colic vein, middle colic vein, left colic vein	Renal vein, suprarenal vein, paravertebral vein, and gonadal vein
Intrahepatic	Patent ductus venosus	Left branch of portal vein	Inferior vena cava

The esophageal type:

1) Lower third of the esophagus.

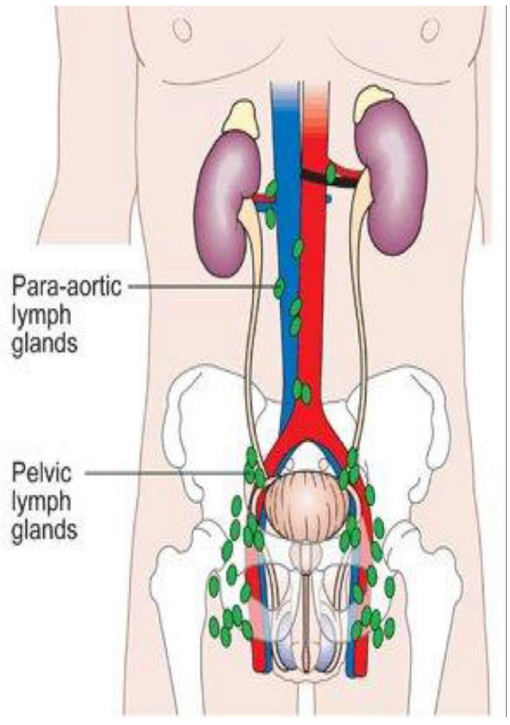
2)Causes hematemesis (vomiting of blood)

3)Used to be lethal but now its easily treatable by gastroscope (reaching the esophageal varices and inject sclerosing material and vasoconstrictor devices.

The rectal type: bleeding with defecation.

LYMPHATICS ON POSTERIOR ABDOMINAL WALL

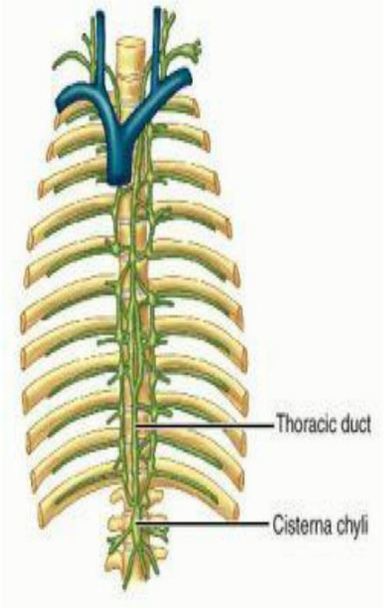
❖ **Lymph Nodes**



- **The lymph nodes are closely related to the aorta and form a preaortic and a right and left lateral aortic (Para-aortic or lumbar) chain.**
- **The preaortic lymph nodes** (in-front of the aorta)
- **lie around the origins of the celiac, superior mesenteric, and inferior mesenteric arteries and are referred to as the celiac, superior mesenteric, and inferior mesenteric lymph nodes, respectively.**
- **They drain the lymph from the gastrointestinal tract, extending from the lower one third of the esophagus to halfway down the anal canal, and from the spleen, pancreas, gallbladder, and greater part of the liver** (upper surface through the right thoracic duct)**.**
- **The efferent lymph vessels form the large intestinal trunk** (connects the inferior mesenteric with the superior mesenteric and celiac nodes and drain to cisterna chyli)**.**
- **The lateral aortic (para-aortic or lumbar) lymph nodes** (on the two sides of aorta and drains from abdominal organs)
- **drain lymph from the kidneys and suprarenals; 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** (from pelvic viscera and lower limb)**.**
- **The efferent lymph vessels form the right and left lumbar trunk** (to cisterna chyli)
- **The thoracic duct commences in the abdomen as an elongated lymph sac, the cisterna chyli. This lies just below the diaphragm in front of the first two lumbar vertebrae and on the right side of the aorta.**

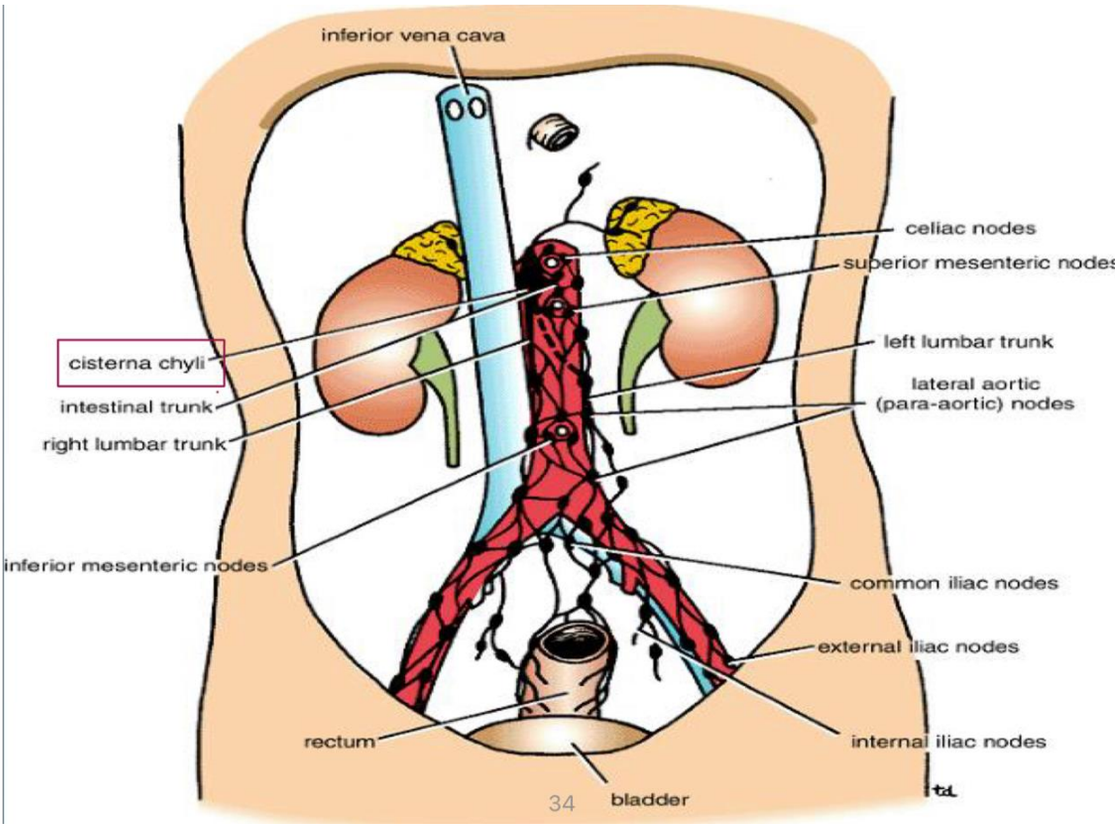
CISTERNA CHYLI

- The right and left lumbar trunks under the diaphragm on the side of the aorta.
- Receives lymph from
  - The intestinal trunk
  - Some small lymph vessels that descend from the lower part of the thorax.
  - Rt & Lt vessels from lower thorax



Sac of aortic orifice on the right side of abdominal aorta.

More right to it >> the beginning of azygos vein



V.2

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The location of the median sacral vein on the image