Anatomy (GI)

Blood supply of the GIT and portal circulation

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Sheet 13

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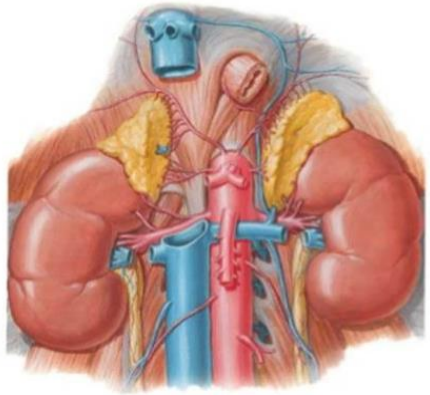
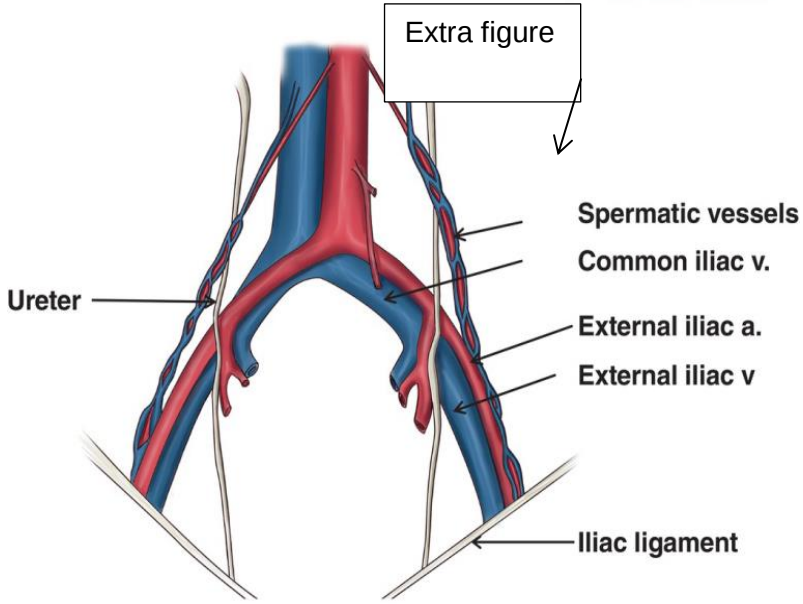
Abdominal Aorta

- It begins at the aortic hiatus of the diaphragm, anterior to the lower border of vertebra **T12**
- It descends to the level of vertebra L4 it is slightly to the left of midline.
- The terminal branches of the abdominal aorta are the two **common iliac arteries**.



Aorta arises from the heart as : ascending aorta → arch of the aorta → descending aorta → thoracic aorta → abdominal aorta .

- Abdominal aorta starts : at level of T 12
- Abdominal aorta ends : at level of L4 (at this level it divides into → 2 common iliac arteries that accompanied with the 2 common iliac veins
- Abdominal aorta runs down (in front of the vertebral column) slightly to the left side



There is two methods to divide aorta branches

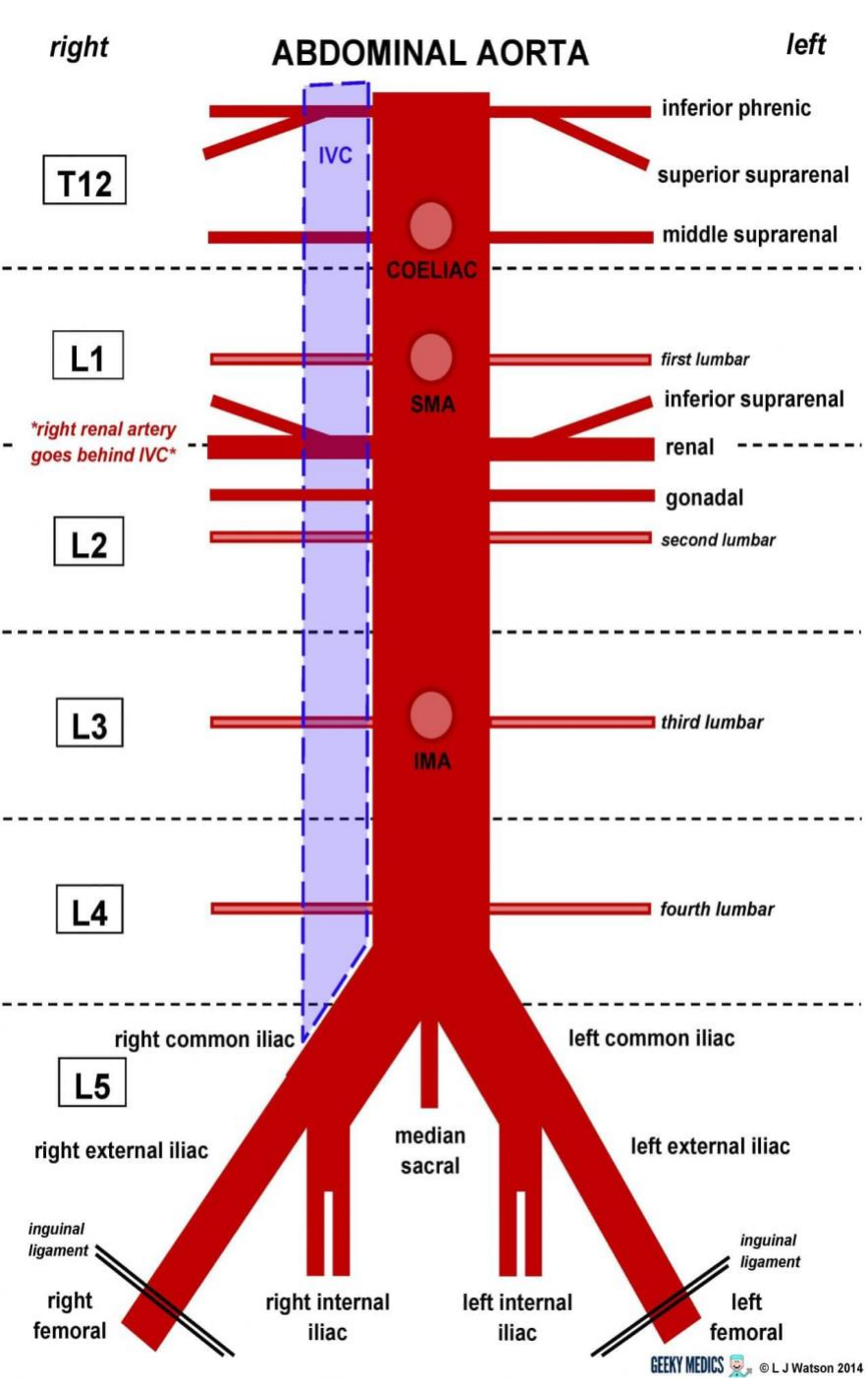
1. Branches of aorta (based on Anatomical Directional)

Anterior branches : celiac artery , superior mesenteric artery , inferior mesenteric artery

Lateral branches : inferior phrenic arteries, middle suprarenal arteries, renal arteries, gonadal arteries

Posterior branches : lumbar arteries

Terminal branches : medial sacral artery , common iliac arteries



2. Branches of aorta → 2 types :

Visceral : celiac artery , superior mesenteric artery , inferior mesenteric artery ,middle suprarenal arteries , renal arteries , gonadal arteries

parietal : inferior phrenic arteries(supply the diaphragm) , lumbar arteries(supply the posterior abdominal wall) , medial sacral artery (note : this artery is short in human but long in animal to supply the tail)

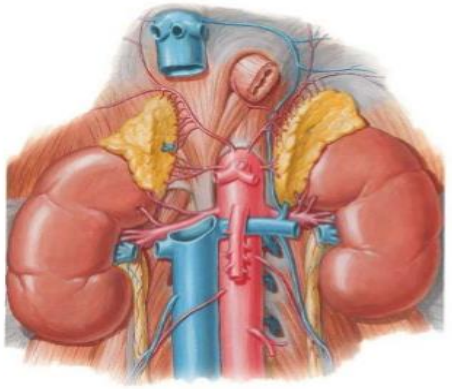
Terminal: common iliac arteries

Anterior branches of the abdominal aorta that supply the gastro-intestinal viscera

- Celiac a. → fore gut
- superior mesenteric a. → mid gut
- inferior mesenteric a. → hind gut

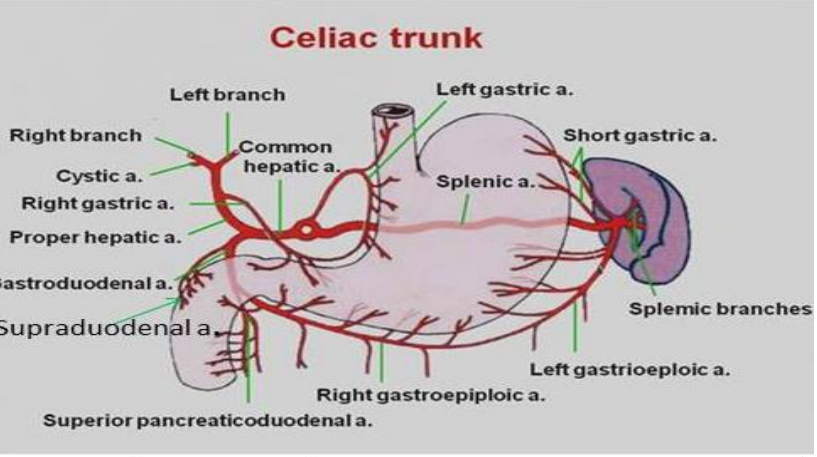
Anterior Branches of The Abdominal Aorta

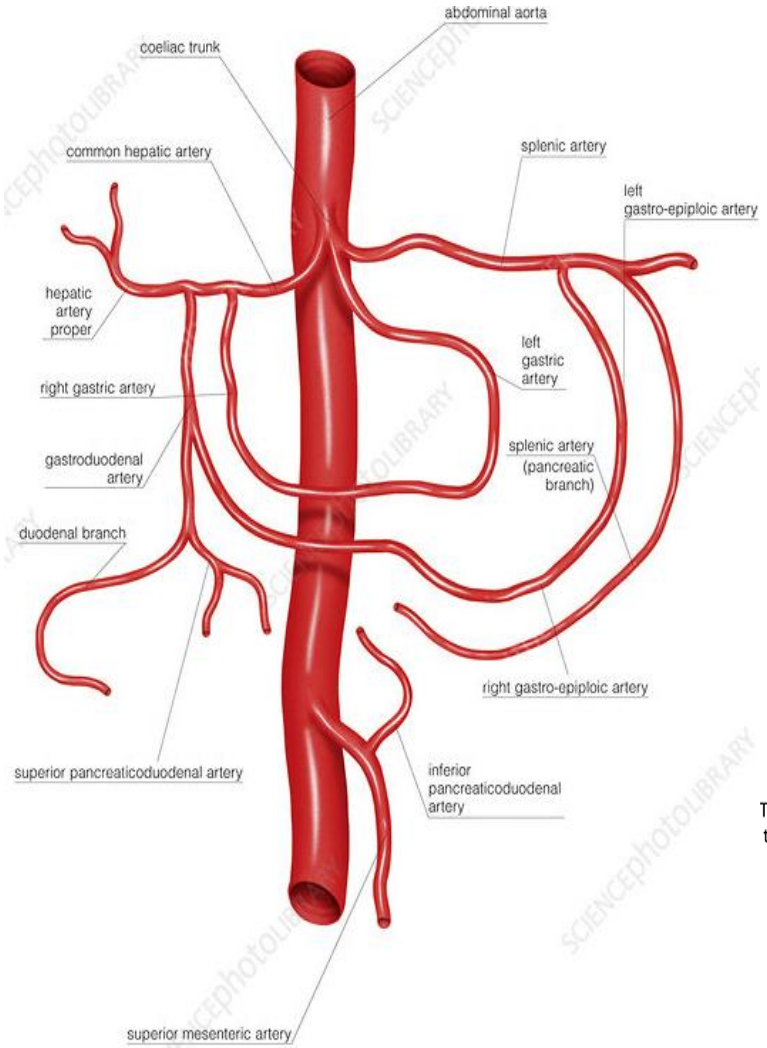
- Celiac Artery.
- Superior Mesenteric Artery.
- Inferior Mesenteric Artery.



- The three anterior branches supply the gastrointestinal viscera.

Blood supply of fore gut : celiac trunk





It arises from the abdominal aorta immediately below the aortic hiatus of the diaphragm anterior to the upper part of vertebra Ll. It divides into the: — left gastric artery, — splenic artery — common hepatic artery.

- it is 2 cm long , runs anteriorly , toward the anterior abdominal wall (<u>note : its direction is toward the abdominal wall , it doesn't reach it b/c it just 2 cm long</u>) , after these 2 cm it divides into 3 main branches :

1- left gastric artery :

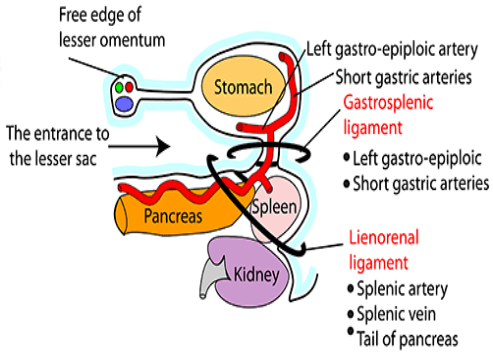
- Runs <u>behind the peritonium</u> on the posterior abdominal wall
- Supplies :

➔ Abdominal esophagus (Abdominal esophagus length = 1 inch , anterior to it : anterior vagus nerve & posterior to it : posterior vegus nerve)

➔ Left side of the lesser curvature

2- splenic artery : It is a tortuous (coiled) artery that runs behind & above the pancreas (so it also runs behind the peritonium and lesser sac) , before it enters the spleen ; it passes in front of : left psoas muscle , left kidney & left suprarenal gland. After it enters the spleen ; it divides into 2 branches :

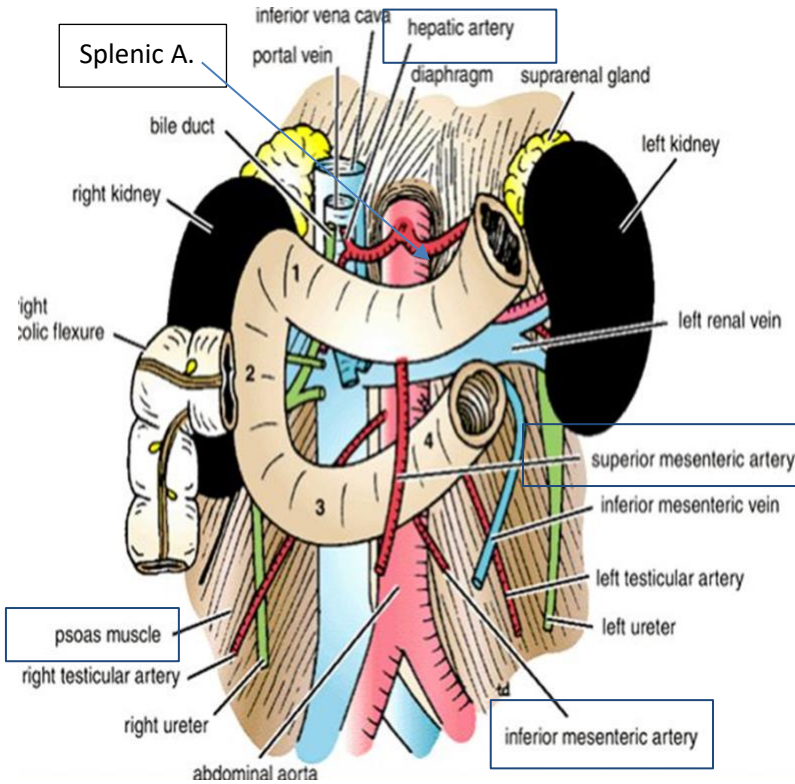
➔ short gastric artery : runs through gastrosplenic ligament and supply the fundus of stomach



Extra information :

the gastrosplenic ligament contains : the short gastric a. & left gastroepiploic vessels

the lienorenal ligament contains : the tail of pancreas & splenic vessels



➔ left gastroepiploic artery (or left gastro-omental artery) : it is within the greater omentum and supplies the left side of greater curvature

3- common hepatic artery (or hepatic artery) : runs in the free margin of lesser omentum.

(note :* lesser omentum extends from the liver to the lesser curvature of stomach and the first part of the duodenum \\ ** 3 things run in the free margin of lesser omentum : right → common bile duct , left → hepatic artery , behind these structures → portal vein \\ these three then go to the Porta hepatis)

Branches of hepatic artery :

➔right gastric artery : runs in the lesser omentum & supplies the right side of lesser curvature

➔ gastroduodenal artery : passing behind the first part of the duodenum

سؤال : لو كان فيه duodenal ulcer in the first part of duodenum وصار posterior perforation شو الجزء يلي رح يضرر؟ gastroduodenal artery

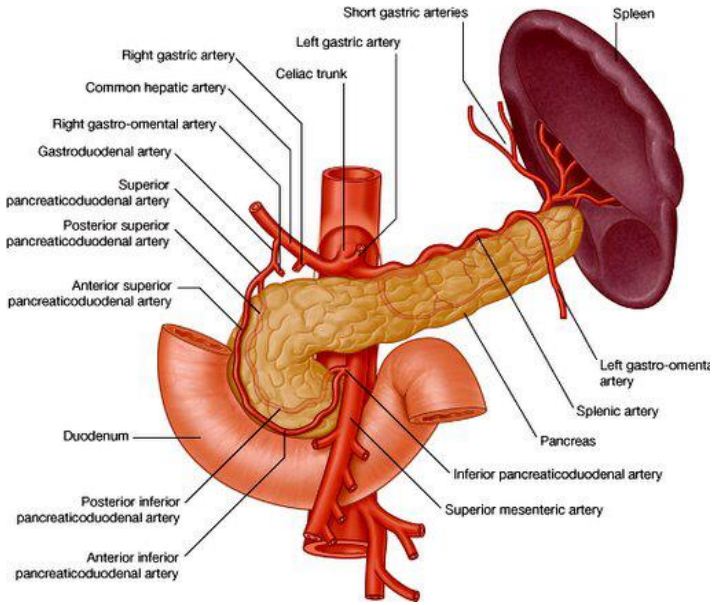
Branches of gastroduodenal artery :

→supraduodenal artery

→right gastroepiploic artery : supplies the right side of greater curvature

there is an anastomosis between right and left gastroepiploic arteries

→ superior pancreaticoduodenal artery : runs between the head of pancreas and duodenum , supplies the duodenum until the entrance of common bile duct (note : in the middle of the descending duodenum is the entrance of common bile duct ; it enters from the posterior medial part)



Relations of arteries :

Splenic artery runs in front of→:

Psoas muscle , left kidney , left suprarenal gland

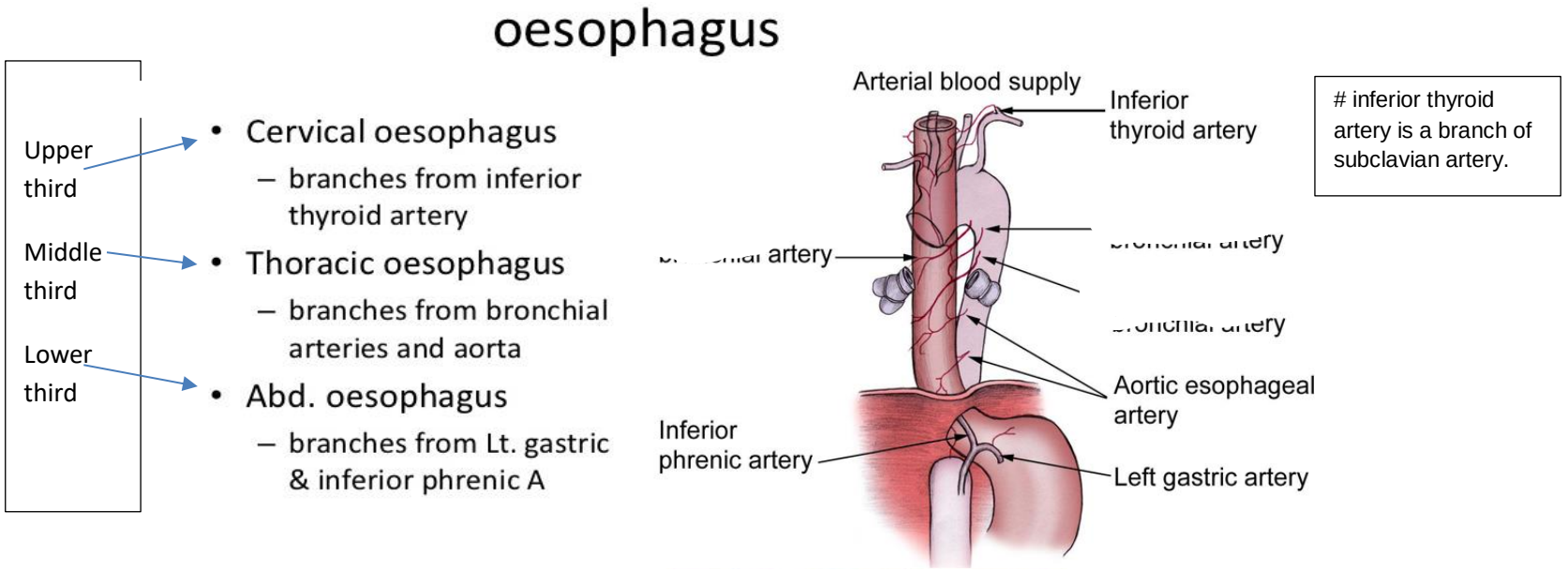
Hepatic artery →

Right : common bile duct

Posterior : portal vein

(common bile duct ,portal vein, Hepatic artery : run in the free margin of lesser omentum)

Blood supply of esophagus



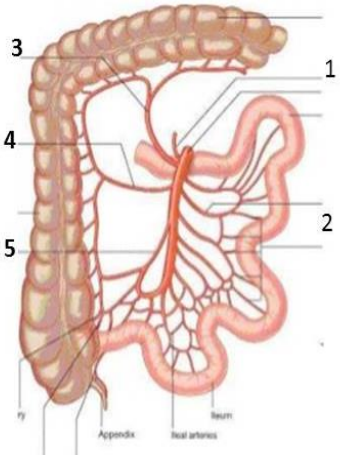
inferior thyroid artery is a branch of subclavian artery.

Blood supply of mid gut : superior mesenteric artery

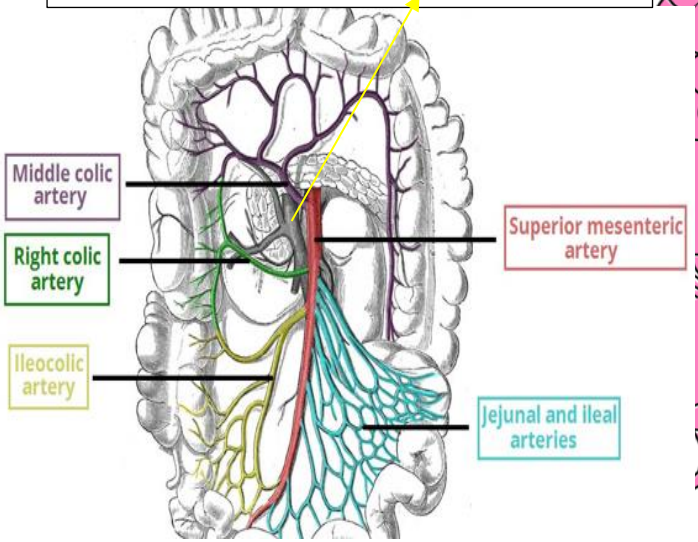
- It arises from the abdominal aorta immediately below the celiac trunk (note : celiac trunk is **anterior to the upper part of vertebra L1**) **anterior to the lower part of vertebra L1** and arises **behind the body of pancreas & splenic vein** , after that it passes **in front of left renal vein** & **uncinate process** (note : uncinate process arises from the ventral part of pancreas) & then it passes **in front of the horizontal part (3rd part or inferior part) of the duodenum**.
- And then it **passes in the mesentery of small intestine** (mesentery of small intestine is directed obliquely from the duodenojejunal flexure to the ileocaecal junction) .
- At the ileocaecal junction , it divides into 2 branches : iliocolic artery & right colic artery

Branches of Superior Mesenteric Artery

- 1 Inferior pancreaticoduodenal artery
- 2 Jejunal and ileal arteries
- 3 Middle colic artery
- 4 Right colic artery
- 5 Ileocolic artery



right to Superior Mesenteric A.→ superior mesenteric vein



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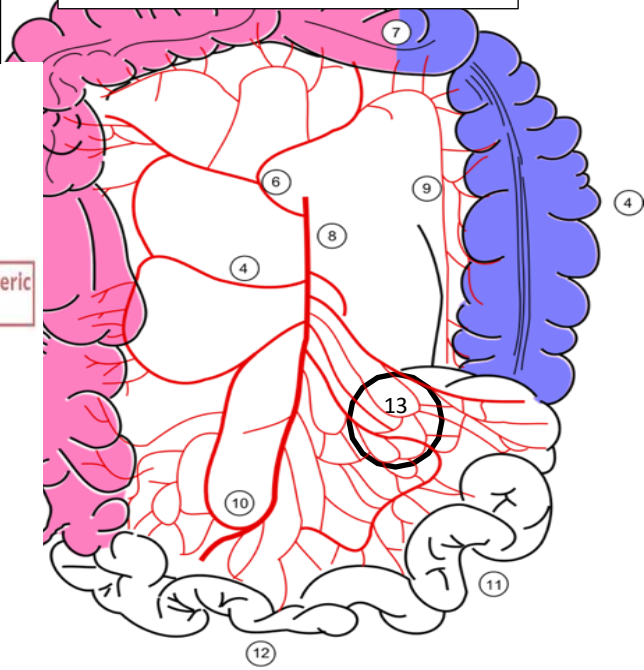
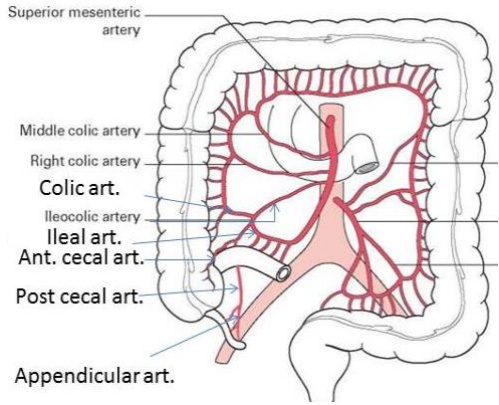
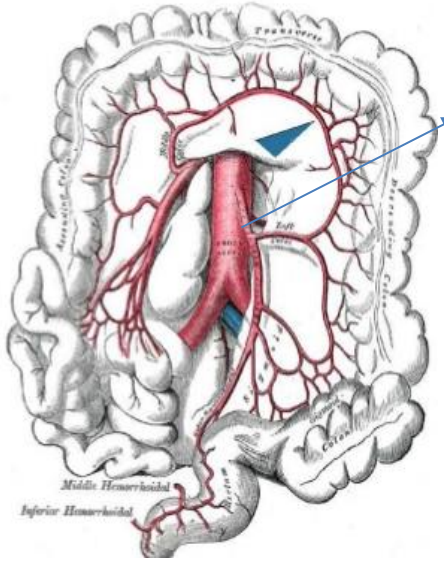


Branches of superior Mesntric artery (8):

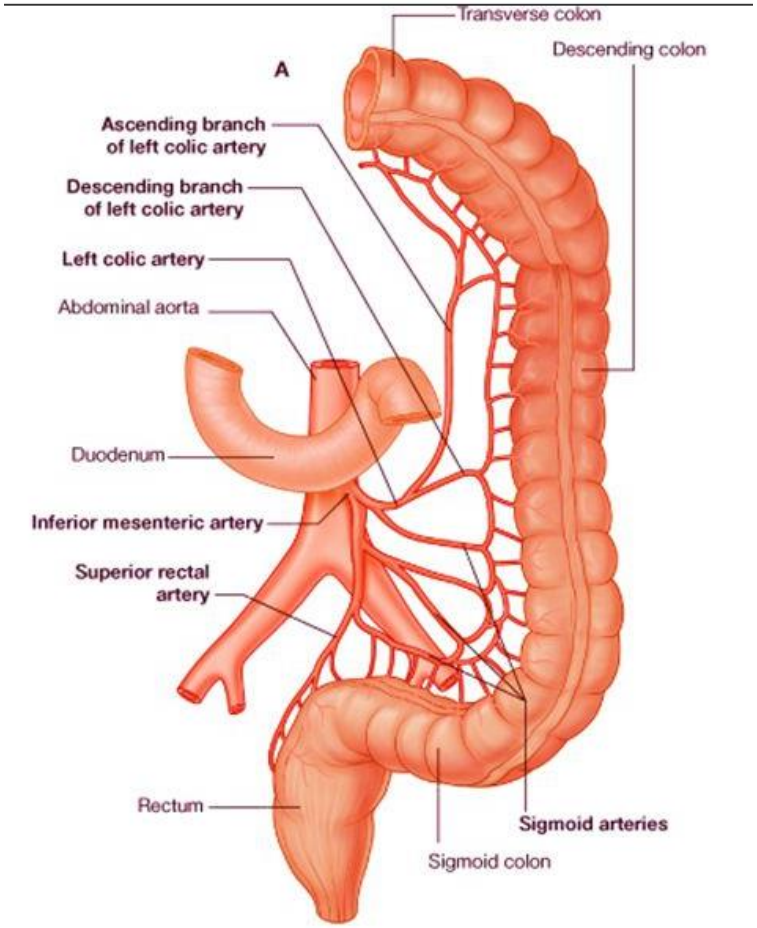
1. **Inferior pancreaticoduodenal Artery:** located Between the head of the pancreas and the duodenum (in front of the common bile duct there will be an **anastomoses** between **Inferior pancreaticoduodenal Artery** and **superior pancreaticoduodenal Artery**. So it means that we can say that **Celiac artery** and **superior mesentric artery** connected with each other at this **anastomoses** which is located at the entrance of the **common bile duct**). Both arteries (inferior and superior pancreaticoduodenal A.) have their veins (inferior and superior pancreaticoduodenal V.) that move with them.
2. **Meddile colic Artery (6)**: it arises just below the pancreas, it moves superiorly until it reaches the mesentry of the transverse colon, them it divided into right and left branches which supply the the right 2/3 of the transverse colon (at this point (7) the, the **midgut ends and the hindgut starts**. the last 1/3 is supplied by the inferior mesentric A. So the superior mesentric artery ends at this point also)
3. **Right collic Artery(4)**: it moves behind the peritoneum, it reaches the **ascending colon** where it devides into ascending branch and descending branch.
4. **Jejunal & ileal Arteries (13)**: they are **15-20 branches** arise from the left side of Superior Mesentric A. . They move in the mesentry of the small intestine supplying jejunum & the ileum.
5. **Ileocolic artery (10):** it supply the ileum and the colon. It devides into two branches: **the descending branch called the ileal branch and the ascending one called the colic branch**. From the descending branch, other arteries arise in front and behind the cecum called **anterior cecal A**. And **posterior cecal A.** respectively. From the **posterior cecal artery, another artery rises toward the appendix and supply it called Appendicular artery**.





Inferior mesenteric artery

It arises behind the **3rd part of the duodenum**. It is the smallest of the three anterior branches of the abdominal aorta and arises anterior to the body of vertebra L3. Initially, the inferior mesenteric artery descends anteriorly to the **aorta** and then passes to the left as it continues inferiorly. It passes in front of **psoas muscle, left common iliac artery and left common iliac vein**. Behind the rectum it becomes **the superior rectal artery** which supply the rectum and the upper half of the anal canal.



Branches of the inferior mesenteric artery

1. **Left colic artery:** it passes in front of left psoas muscle and the ureter. It moves toward the splenic flexure and devides into ascending branch and descending branch. The ascending branch supplies the upper part of the descending colon and the left 1/3 of the transverse colon. So the transverse colon get its blood supply from the right colic A. (First 2/3) and the left colic artery (last 1/3) and they have anastomosis and the point where midgut ends and the hindgut starts, and it will be **the point where the inferior mesenteric A. And the superior one** connected with each other.
   #some books mention that there is two left colic A. : one superior and on inferior.
2. **Sigmoid arteries:** sever branches run in the mesentery of the sigmoid colon and supply the sigmoid colon (pelvic colon)
3. **Superior rectal artery:** the **left colic artery** completes its way behind the rectum and become the superior rectal artery.

##Marginal artery (9): it is an continuous arcade along the mesenteric side of the small and large intestine formed by the dividing and reuniting of branches of the mesenteric arteries (superior and inferior). It provides a collateral flow for the bowel, so if the blood supply interrupted in the main artery that supply a part of bowel for any reason (occlusion, stenosis or cut the artery in a surgery), this part will keep getting blood from the marginal artery. Also we can cut a part of colon and reconnect each end with each other's without interrupting the blood supply to the other parts because of the marginal artery.

Venous drainage of GIT

There two venous systems in the GIT: **1) portal venous system.** 2) **systemic veins:** inferior vena cava and veins that drain into it like hepatic vein

Portal venous system

The blood that came from the intestine is full of nutrients (eg: fructose & lactose) and toxins that must be first **modified** (glucose) and **detoxified** before it goes to the whole body. So it must be first go the filter of the body (the liver) and this system called the portal venous system. Not only the blood from intestine but also GIT derivatives (GIT accessory organs: spleen, pancreas, live and gallbladder) drain finally to the **portal vein**. At this point we had studied several function of the liver like:

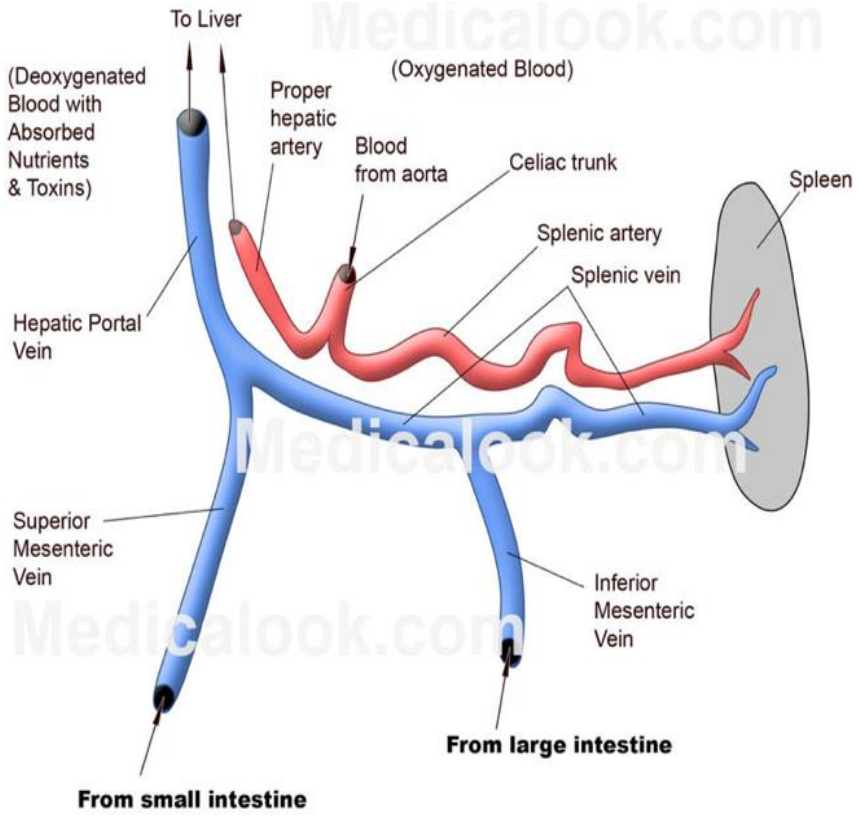
1) **detoxification** for toxins. 2) **storage** of glycogen.
3) **formation** of bile acids, enzymes and proteins. 4) **resisting infections**
5) **excretion** of antibiotics and chemicals like aspirin.

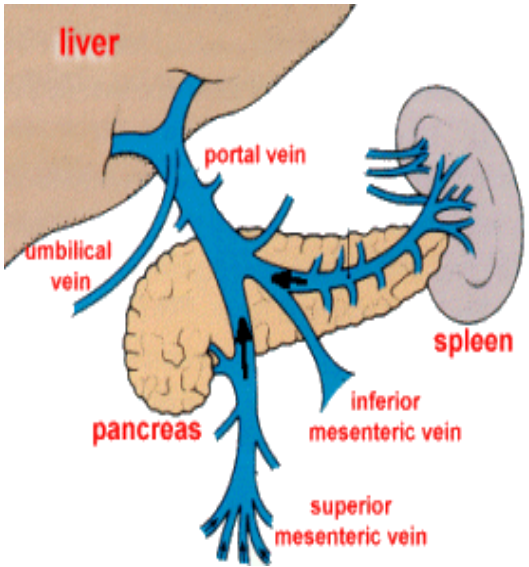
And this is why the liver is the **largest** organ in the body **(1.5 kg).**

Veins of the portal system:

The splenic vein runs behind the pancreas. behind the body of the pancreas, **the inferior mesenteric vein** drains into it. Behind the neck of the pancreas and in front of the Superior Mesenteric artery (superiorly mesenteric vein located at the right side of it), the splenic vein and the Superior Mesenteric vein union to make **the portal vein** at the level of L2. The portal vein runs superiorly in front of inferior vena cava in the free margin of the lesser omentum behind the bile duct and the hepatic artery. At the Porta hepatis, it divides into right and left branches which then they inter into the loops of the liver.

Then the hepatic veins exit the liver and drain into the inferior vena cava (systemic not portal).

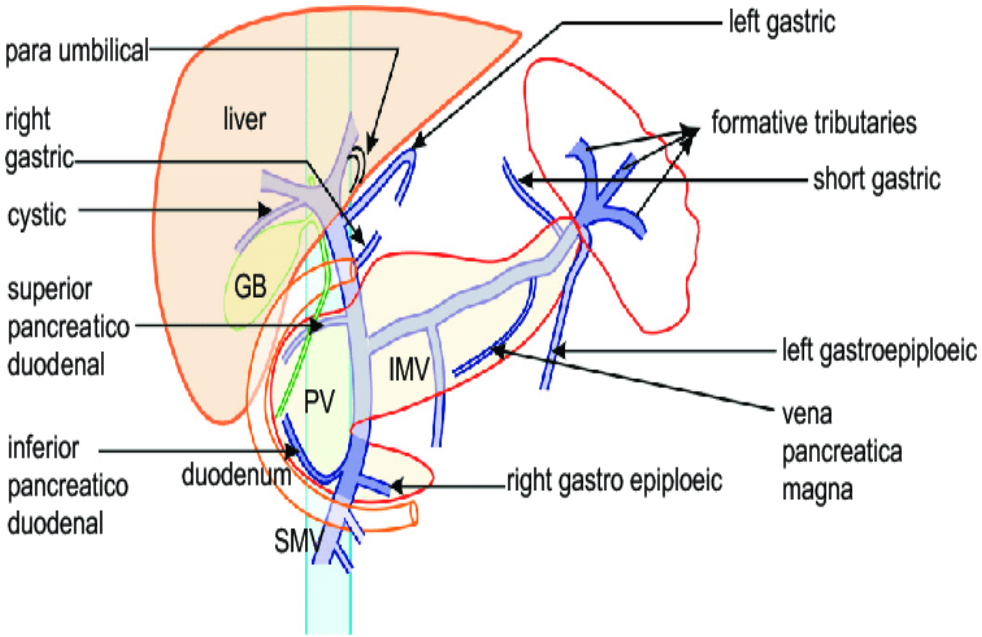


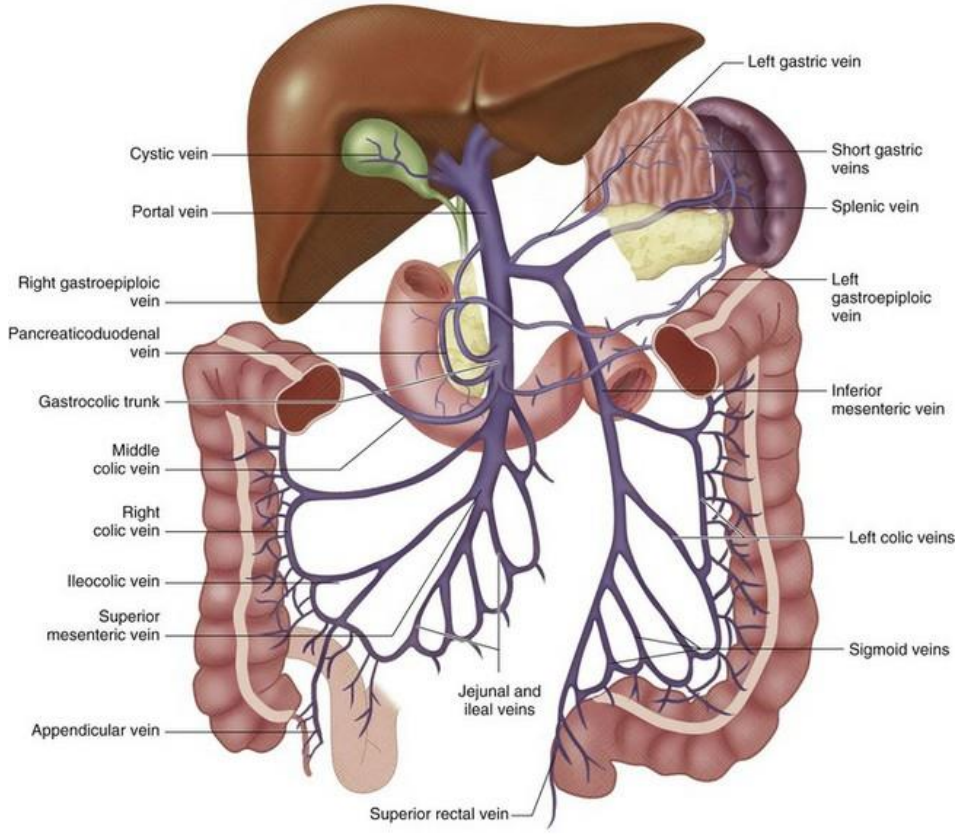


Tributaries to:

1. Portal vein	2. The Splenic Vein	3. Superior Mesenteric vien
Right and left gastric veins **	Short gastric veins**	Right gastro-omental (gastroepiiploic) vein**
Cystic veins from the gallbladder	Left gastro-omental vien	inferior pancreaticoduodenal vein
The para-umbilical veins****	Pancreatic veins****	Jejunal and ileal veins
Superior Pancreaticoduodenal vein	Inferior mesenteric vein	Right colic vein & middle colic vein
** they draining the lesser curvature of the stomach and abdominal esophagus. ****they are associated with the obliterated umbilical vein and connect to veins on the anterior abdominal wall.	**drain from the fundus & left part of the greater curvature of the stomach ****draining the body & tail of pancreas	** draining the right part of the greater curvature of the stomach #Anterior superior pancreaticoduodenal vein usually drain into the right gastro-omental vein, and the posterior superior pancreaticoduodenal vein usually empties directly into the portal vein.

The inferior mesenteric vein does not move with its artery, it runs away from it on the left side of the artery and the medial side of the ureter. It drains blood from the rectum, sigmoid colon, descending colon and splenic flexure. It begins as the **superior rectal vein** and ascends, receiving tributaries from the **sigmoid veins and the left colic veins**. As it ascends further it passes posteriorly to the body of the pancreas and typically joins the splenic vein.

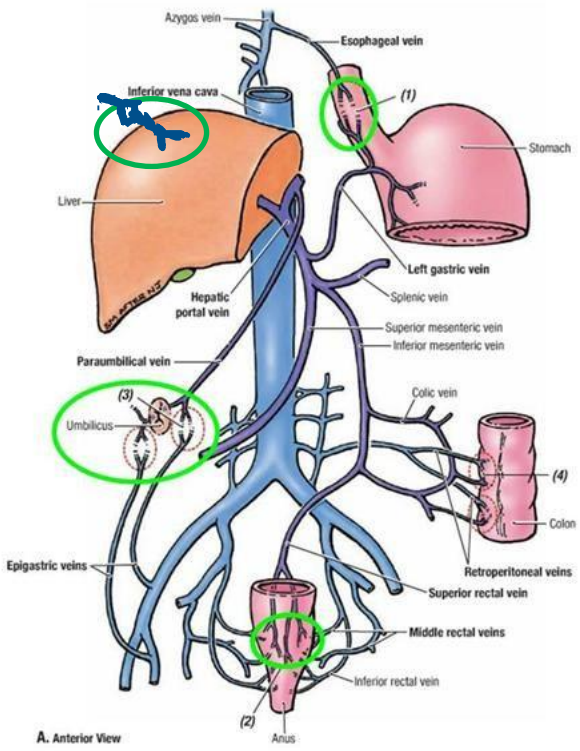




Portosystemic Anastomosis

So what will happen to the blood of the intestine if there is an occlusion in the portal vein (like in the cirrhosis of the liver)?
The blood will move to the systemic circulation by portosystemic anastomosis and they open when there is an occlusion in the portal vein. They are in 4 places:

1) **At Lower end of oesophagus**
2) **At Upper part of anal canal**
3) **Around Umbilicus**
4) **At Retroperitoneal**
5) **Bare area of liver cells**



1) **Lower end of esophagus**: left gastric vein and its tributaries of the portal system anastomosis with esophageal vein into the azygos vein of systemic system.
2) The anus (**the upper part of anal canal)**: the superior rectal vein of the portal system anastomoses with the middle and inferior rectal veins of the systemic system.
3) The anterior abdominal wall **around the umbilicus**: the para-umbilical veins of portal system anastomoses with the superficial veins on the anterior abdominal wall of the systemic system
4) Extra : **retroperitoneal**: the veins of the ascending and descending colon, duodenum, pancreas and liver of the portal system anastomosis with renal, lumbar and phrenic veins of the systemic system
5) **bare area of liver:** portal venous channels in the liver anastomosis with azygous vein of the systemic system.

اعتذر للوقت الطويل الذي استلزمه إنهاء الشيت، العديد من الأمور حدثت خارج إرادتي، آمل ان يستحق ما كتبته كل هذا الوقت، وبالتوفيق جميعا