

أعوذ بالله من الشيطان الرجيم

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

HEPATIC PORTAL SYSTEM

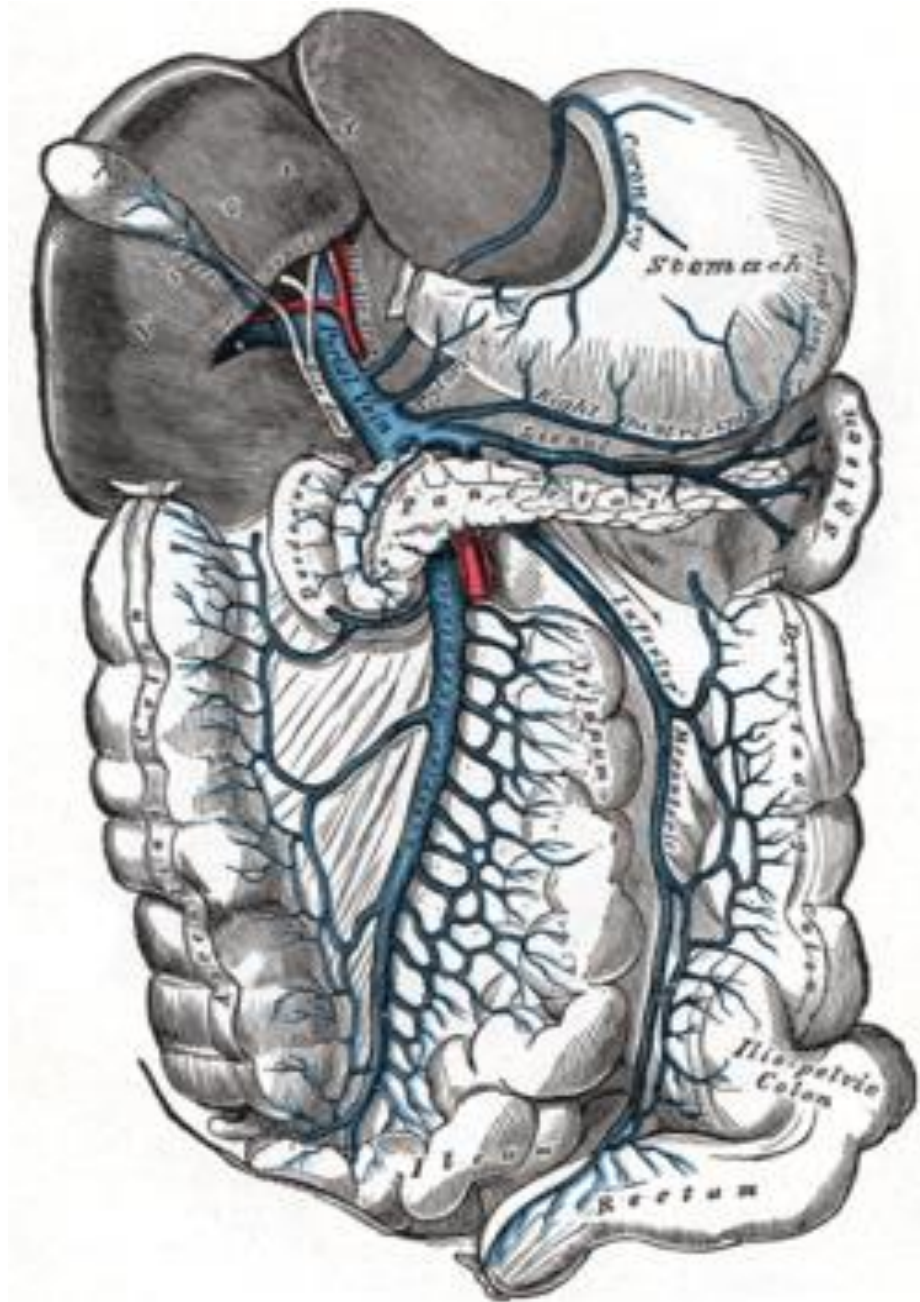
By

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In [human anatomy](#), the **hepatic portal system** is the system of [veins](#) comprising the [hepatic portal vein](#) and its tributaries. It is also called the **portal venous system**.

THE HEPATIC PORTAL VEIN AND ITS TERRITORY



DETAILS

LOCATION

[ABDOMEN](#)

[ANATOMICAL TERMINOLOGY](#)

STRUCTURE

Large veins that are considered part of the *portal venous system* are the:

- [Hepatic portal vein](#)
- [Splenic vein](#)
- [Superior mesenteric vein](#)
- [Inferior mesenteric vein](#)

The [superior mesenteric vein](#) and the [splenic vein](#) come together to form the actual [hepatic portal vein](#). The [inferior mesenteric vein](#) connects in the majority of people on the [splenic vein](#), but in some people, it is known to connect on the [portal vein](#) or the [superior mesenteric vein](#).

Roughly, the portal venous system corresponds to areas supplied by the [celiac trunk](#), the [superior mesenteric artery](#), and the [inferior mesenteric artery](#).

FUNCTION

- The **portal venous system** is responsible for directing blood from parts of the [gastrointestinal tract](#) to the [liver](#). Substances absorbed in the small intestine travel first to the liver for processing before continuing to the heart. Not all of the [gastrointestinal tract](#) is part of this system. The system extends from about the lower portion of the [esophagus](#) to the upper part of the [anal canal](#). It also includes venous drainage from the [spleen](#), [pancreas](#) and [visceral](#) fat.

FUNCTION CONTD...

- The evolutionary benefit of first-pass metabolism, whereby substances absorbed from food in the gut pass through the liver before entering the systemic circulation, is to use the liver as a shield (a first line of defense) between (a) the food, its toxins (whatever they may be), and its metabolic intermediates/[metabolites](#) (such as ammonia) and (b) the rest of the body's tissues, including the brain.
- The necessity of such a system is demonstrated by what happens when the system breaks down, as seen when advanced hepatic fibrosis in [cirrhosis](#) leads to [hepatic encephalopathy](#) in the brain owing to the blood being loaded with ammonia and other substances not conducive to brain function.

FUNCTION CONTD...

- Blood flow to the liver is unique in that it receives both oxygenated and (partially) deoxygenated blood. As a result, the [partial gas pressure](#) of oxygen (pO_2) and perfusion pressure of portal blood are lower than in other organs of the body. Blood passes from branches of the portal vein through cavities between "plates" of [hepatocytes](#) called [sinusoids](#). Blood also flows from branches of the [hepatic artery](#) and mixes in the sinusoids to supply the hepatocytes with oxygen. This mixture [percolates](#) through the sinusoids and collects in a central vein which drains into the [hepatic vein](#). The hepatic vein subsequently drains into the [inferior vena cava](#).

FUNCTION CONTD...

- The [hepatic artery](#) provides 30 to 40% of the oxygen to the liver, while only accounting for 25% of the total liver blood flow. The rest comes from the partially deoxygenated blood from the [portal vein](#). The liver consumes about 20% of the total body oxygen when at rest. That is why the total liver blood flow is quite high, at about 1 litre a minute and up to two litres a minute. That is on average one fourth of the average [cardiac output](#) at rest.

VENOUS DRAINAGE OF THE ABDOMEN

- There are two venous systems that drain abdominal structures – the **portal venous system** and the **systemic venous system**. The portal system transports venous blood to the liver for processing, whilst the systemic venous system returns blood to the right atrium of the heart.

SYSTEMIC VENOUS SYSTEM

The systemic venous system transports deoxygenated blood to the **right atrium** of the heart. The major vessel in this system is the **inferior vena cava**.

• INFERIOR VENA CAVA

The inferior vena cava is the common convergence of venous drainage from all structures below the [diaphragm](#). It is located on the posterior abdominal wall; anteriorly to the vertebral column and to the right of the [abdominal aorta](#).

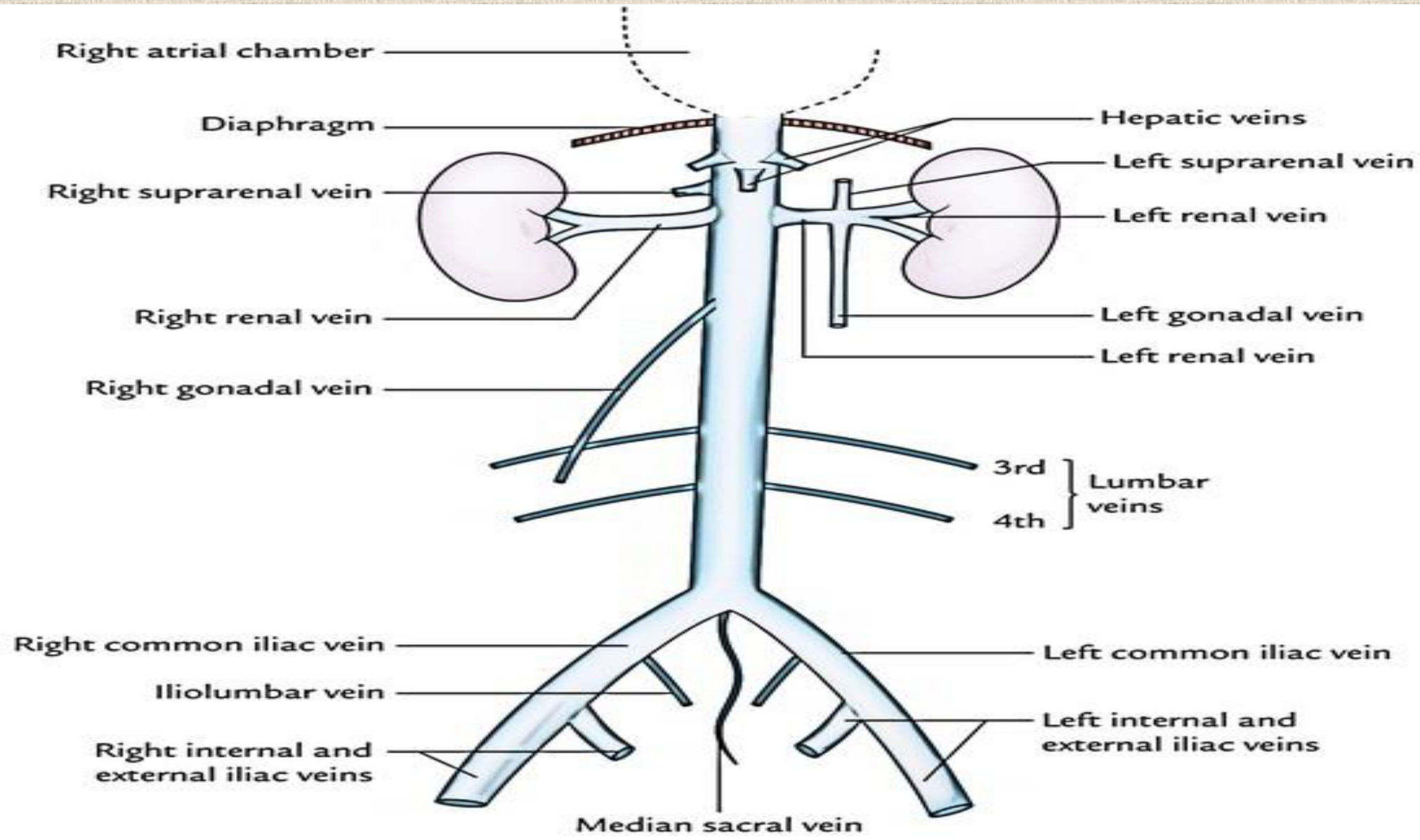
The vessel is formed by the union of the **common iliac veins** at the L5 vertebral level. It ascends superiorly, and leaves the abdomen by piercing the central tendon of the **diaphragm** at the T8 level (the caval hiatus). Within the thorax, the inferior vena cava drains into the **right atrium** of the heart.

During its long course, the inferior vena cava shares an anatomical relationship with numerous abdominal structures – including the right common iliac artery, the root of the mesentery, the head of the pancreas, the bile duct, the portal vein and the liver.

TRIBUTARIES

The inferior vena cava is responsible for the venous drainage of all structures below the diaphragm. It receives tributaries from:

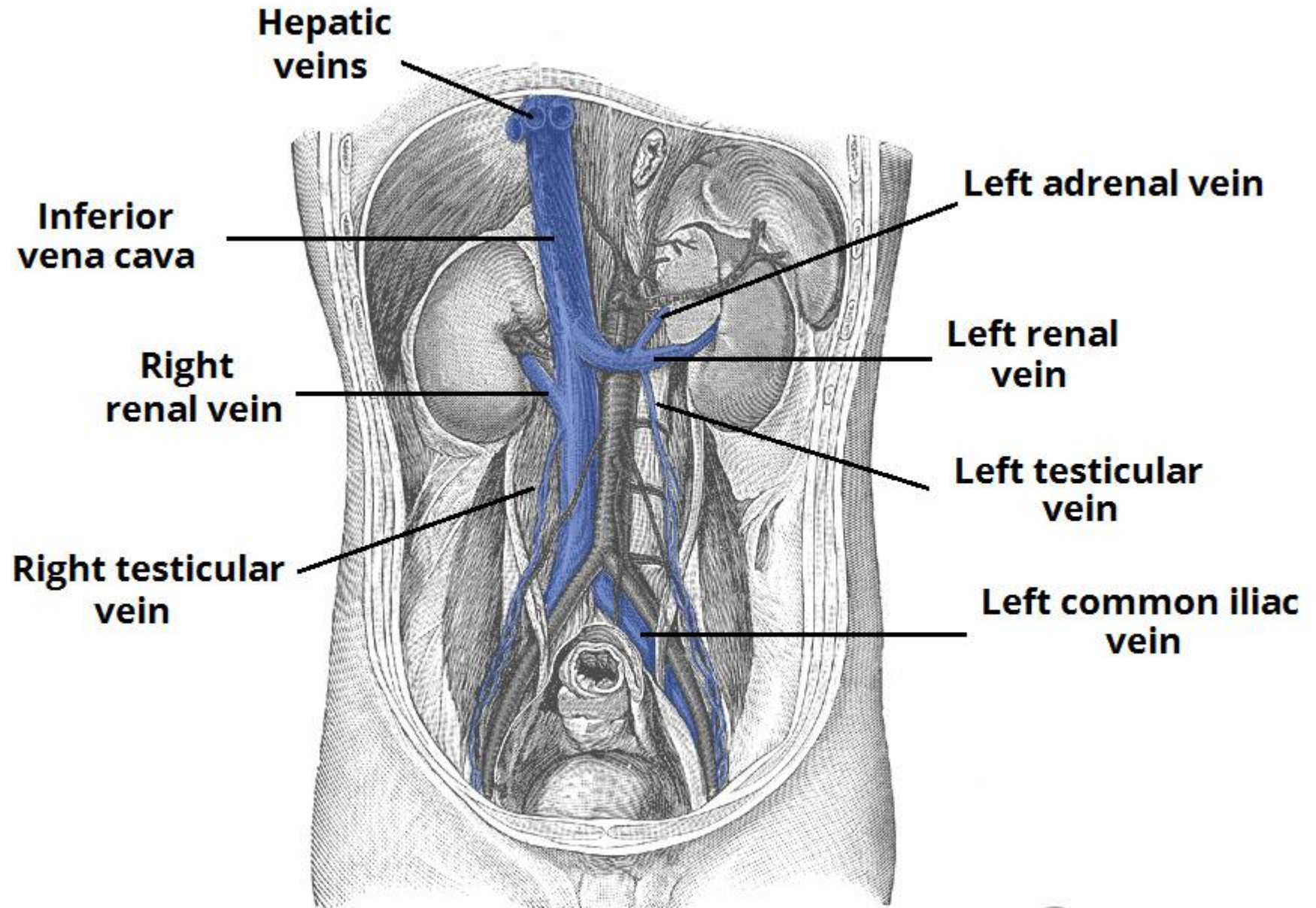
- **Common iliac veins** – formed by the external and internal iliac veins. They drain the lower limbs and gluteal region.
- **Lumbar veins** – drain the posterior abdominal wall.
- **Renal veins** – drain the [kidneys](#), left [adrenal gland](#) and left [testis/ovary](#).
- **Right testicular or ovarian vein** – drains the right testes in males and the right ovary in females (the left testicular or ovarian vein drains into the left renal vein).
- **Right suprarenal vein** – drains the right adrenal gland (the left adrenal vein drains into the left renal vein).
- **Inferior phrenic veins** – drain the [diaphragm](#).
- **Hepatic veins** – drain the [liver](#).



TRIBUTARIES

There are no tributaries from the spleen, pancreas, gallbladder or the abdominal part of the GI tract – as these structures are first drained into the **portal venous system**. However, venous return from these structures ultimately enters the inferior vena cava via the hepatic veins (after being processed by the liver).

The inferior vena cava and major tributaries. Note how the left adrenal vein and left testicular vein empty into the left renal vein.

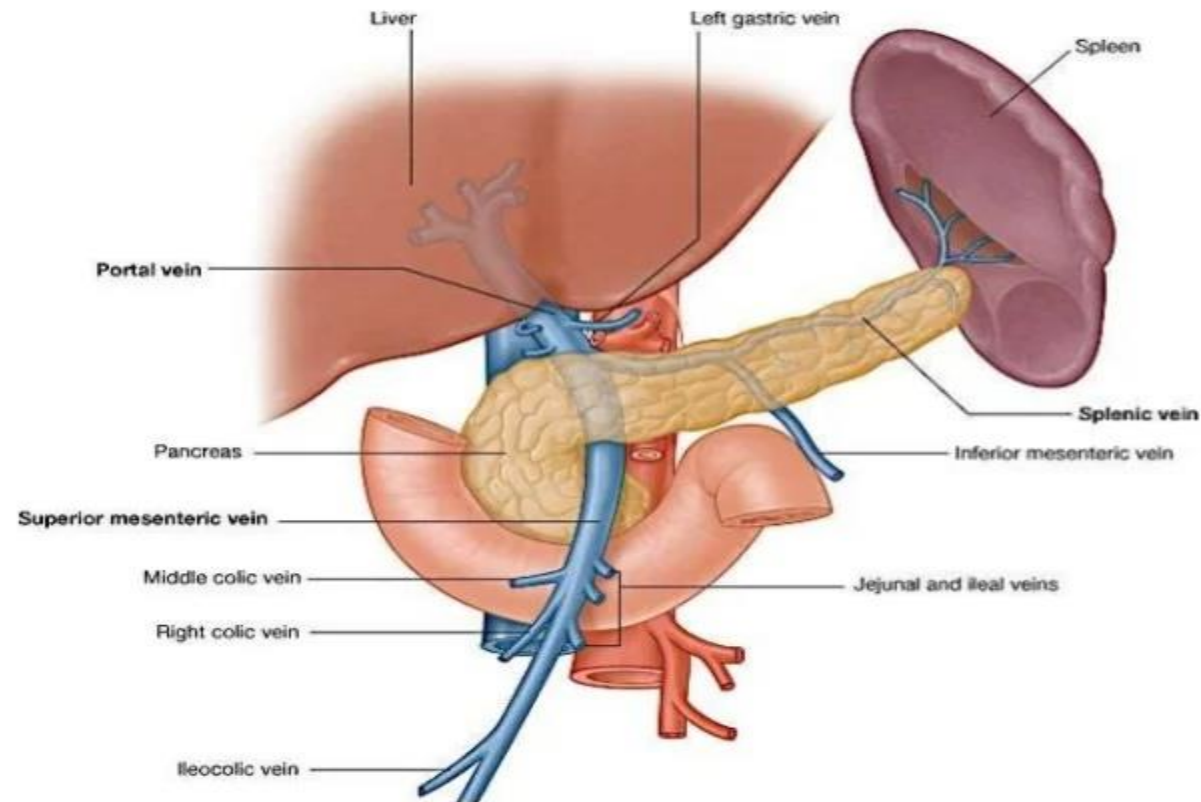


PORTAL VENOUS SYSTEM

- The portal system carries venous blood (rich in nutrients that have been extracted from food) to the liver for **processing**.
- The major vessel of the portal system is the **portal vein**. It is the point of convergence for the venous drainage of the spleen, pancreas, gallbladder and the abdominal part of the gastrointestinal tract. The portal vein is formed by the union of the **splenic vein** and the **superior mesenteric vein**, posterior to the neck of the pancreas, at the level of L2.
- As it ascends towards the liver, the portal vein passes posteriorly to the superior part of the duodenum and the **bile duct**. Immediately before entering the liver, the portal vein divides into right and left branches which then enter the parenchyma of the liver separately.

Formation

- Union of Sup mesenteric & Splenic vein
- Between neck of Pancreas & IVC at level L2

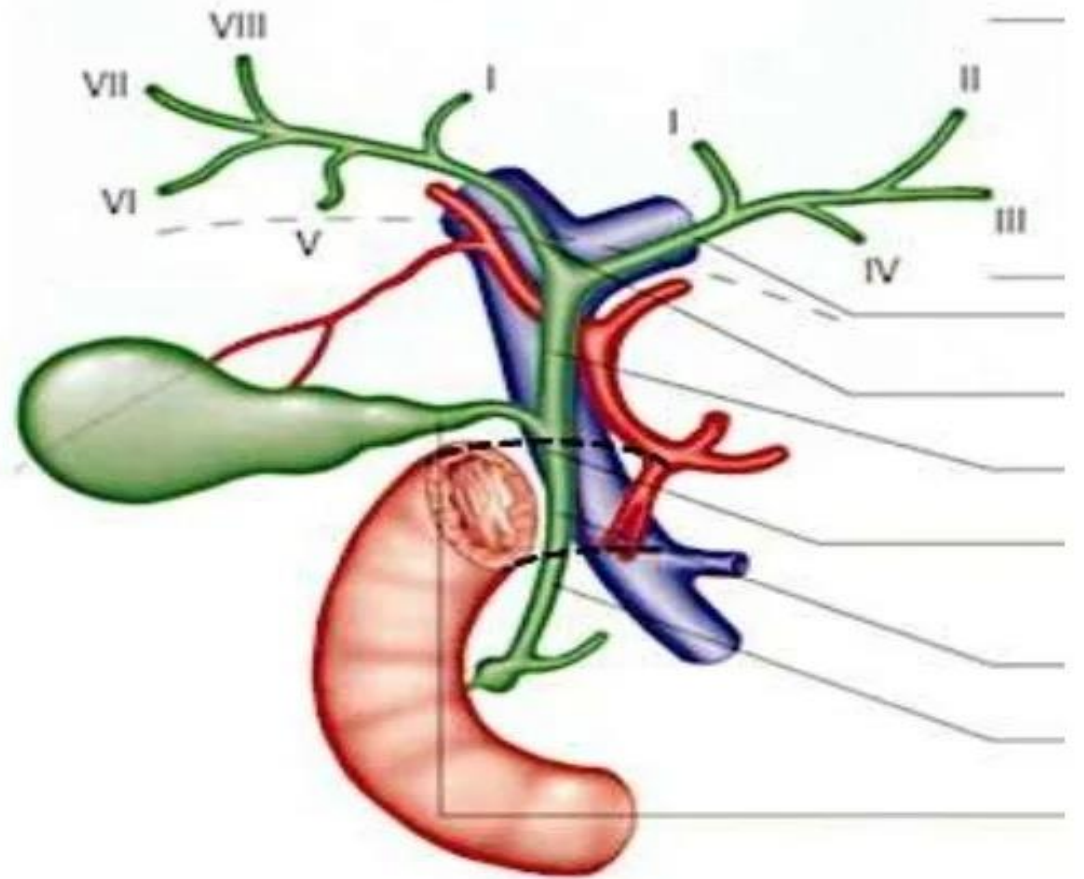


TRIBUTARIES

- The portal vein is formed by the union of the splenic vein and superior mesenteric vein. It receives additional tributaries from:
- **Right and left gastric veins** – drain the [stomach](#).
- **Cystic veins** – drains the [gallbladder](#).
- **Para-umbilical veins** – drain the skin of the umbilical region.

Course: Extrahepatic part

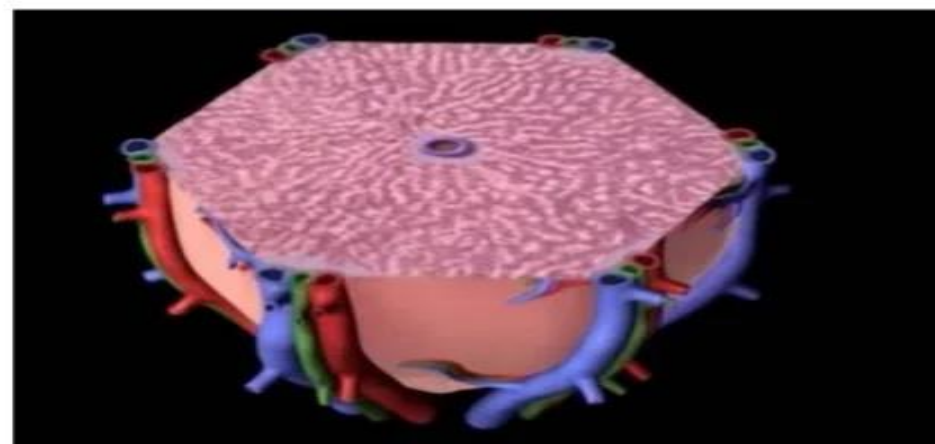
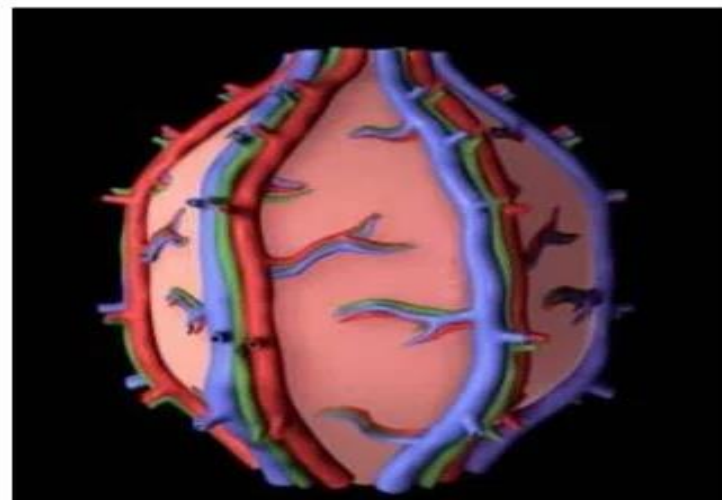
- Passes upwards & Rt, behind neck of pancreas & 1st part of duodenum
- Enters rt free margin of lesser omentum in front of epiploic foramen with BD & HA
- Reaches porta hepatis & divides into rt & Lt branches.



Course: Intrahepatic part

- Branches of portal vein
- Segmental brs
- Brs in Portal canal
- **Hepatic sinusoids**
- Central veins
- Sublobular veins
- Hepatic veins

↓
IVC

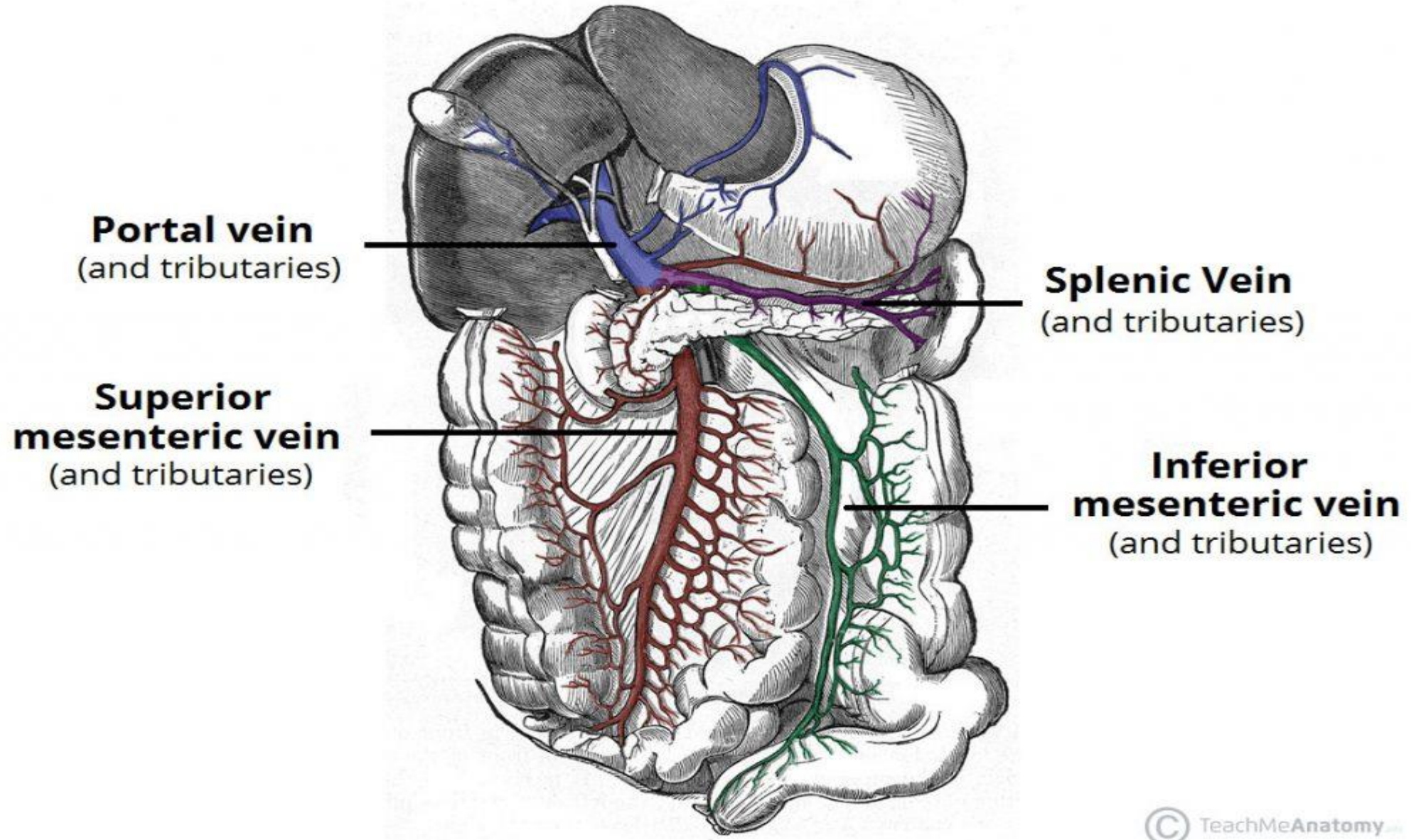


SPLENIC VEIN

- The **splenic vein** is formed from a variety of smaller vessels as they leave the hilum of the [spleen](#).
- Unlike the splenic artery, the splenic vein is straight and it maintains contact with the **body of the pancreas** as it crosses the posterior abdominal wall. As it reaches the neck of the pancreas, the splenic vein joins the superior mesenteric vein to form the portal vein.

TRIBUTARIES

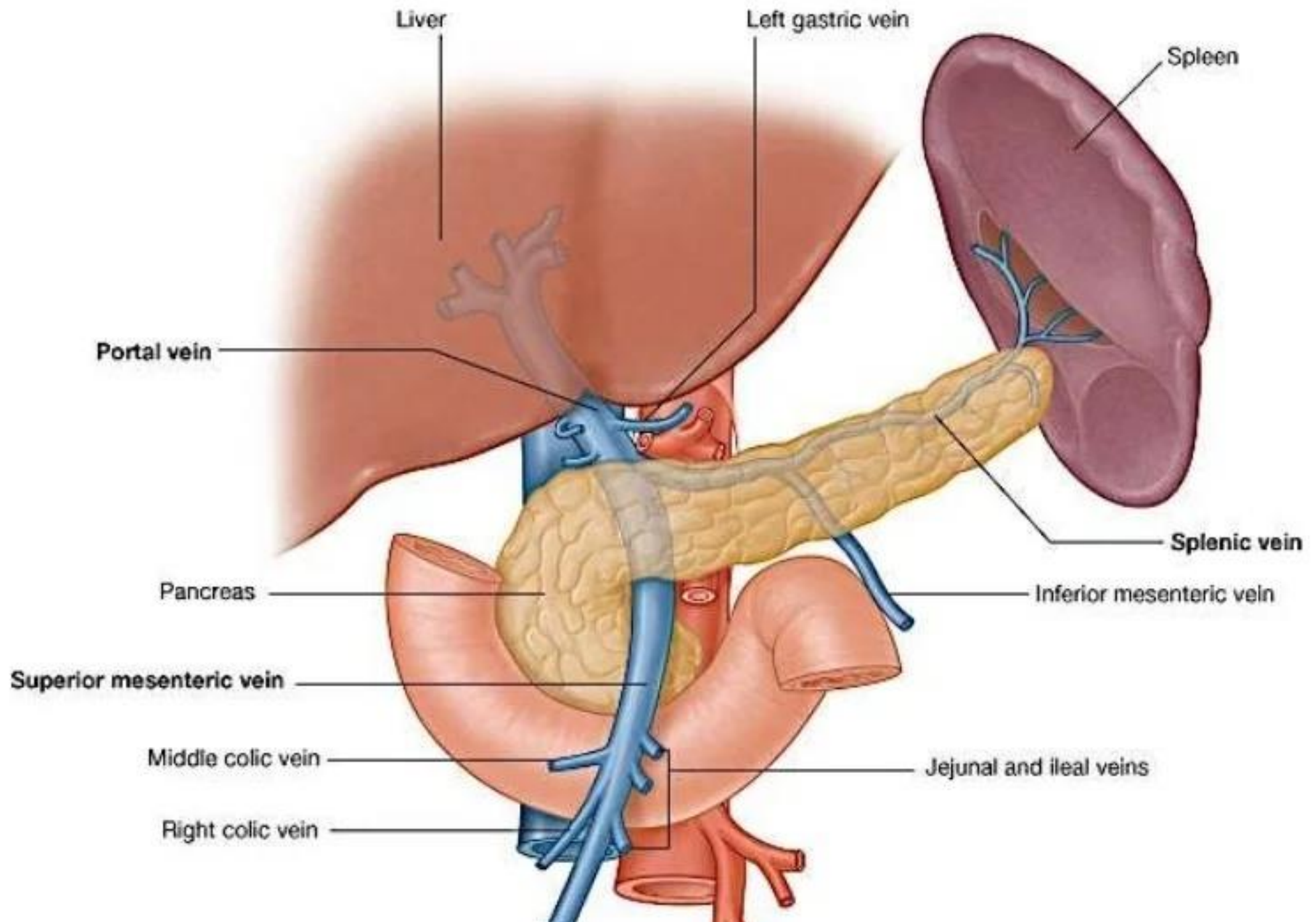
- Tributaries to the splenic vein include:
- **Short gastric veins** – drain the fundus of the stomach.
- **Left gastro-omental vein** – drains the greater curvature of the stomach.
- **Pancreatic veins** – drain the [pancreas](#).
- **Inferior mesenteric vein** – drains the [colon](#).
- The **inferior mesenteric vein** 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.



THE HEPATIC PORTAL VENOUS SYSTEM

SUPERIOR MESENTERIC VEIN

- The superior mesenteric vein drains blood from the small intestine, cecum, ascending colon and transverse colon. It begins in the **right iliac fossa**, as a convergence of the veins draining the terminal ileum, cecum and appendix. It ascends within the mesentery of the small intestine, and then travels posteriorly to the neck of the pancreas to join the splenic vein.



TRIBUTARIES

Tributaries to the superior mesenteric vein include:

- **Right gastro-omental vein** – drains the greater curvature of the stomach.
- **Anterior and posterior inferior pancreaticoduodenal veins** – drain the pancreas and [duodenum](#).
- **Jejunal vein** – drain the [jejunum](#).
- **Ileal vein** – drain the [ileum](#).
- **Ileocolic vein** – drains the ileum, colon and cecum.
- **Right colic vein** – drains the ascending colon.
- **Middle colic vein** – drains the transverse colon.

Many of these tributaries are formed as an accompanying vein for each branch of the superior mesenteric artery.

KEY FACTS

Tributaries

Main: superior mesenteric vein and splenic vein

Additional: posterior superior pancreaticoduodenal vein, left and right gastric veins

Drains blood from: stomach, intestines, pancreas and spleen

Course

superior mesenteric + splenic -> portal vein -> enters the liver -> divides into portal venules -> venules empty into hepatic sinusoids -> sinusoids drain into central veins -> central veins drain into hepatic veins -> hepatic veins drain into inferior vena cava

Function

Claims available nutrients absorbed in the gastrointestinal tract (GIT); transports toxins from GIT to the liver

Clinical relation

Portal hypertension

CLINICAL RELEVANCE

PORTO-SYSTEMIC ANASTOMOSES

- A **porto-systemic anastomosis** is a connection between the veins of the portal venous system, and the veins of the systemic venous system. The major sites of these anastomoses include:
- **Oesophageal** – Between the oesophageal branch of the left gastric vein and the oesophageal tributaries to the azygous system.
- **Rectal** – Between the superior rectal vein and the inferior rectal veins.
- **Retroperitoneal** – Between the portal tributaries of the mesenteric veins and the retroperitoneal veins.
- **Paraumbilical** – Between the portal veins of the liver and the veins of the anterior abdominal wall.

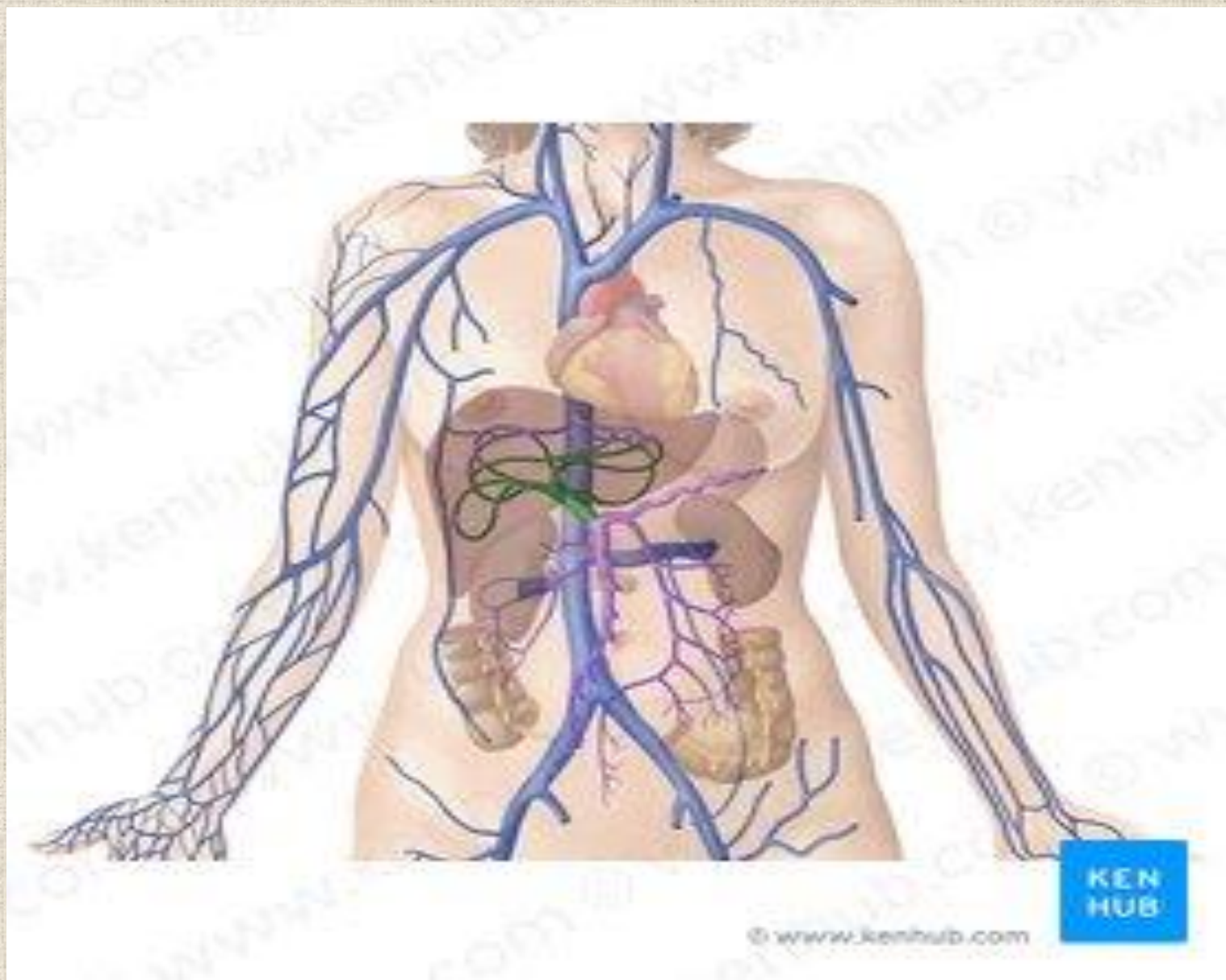


Endoscopic appearance of oesophageal varices. They can undergo rupture, leading to large volumes of blood loss.

CLINICAL RELEVANCE

PORTO-SYSTEMIC ANASTOMOSES

- When blood flow through the portal system is **obstructed** (e.g due to cirrhosis, portal vein thrombosis, or external pressure from a tumour), the pressure within portal system increases. A portal venous pressure in excess of 20mmHg is defined as **portal hypertension**.
- In portal hypertension, blood may be re-directed through the **porto-systemic anastomoses** (as these are now under a lower pressure). If a large volume of blood passes through these anastomoses over a long period of time, the veins around the anastomosis can become abnormally dilated – known as **varices**. Rupture of oesophageal or rectal varices can result in fatal blood loss.



**HEPATIC PORTAL VEIN
VENA PORTAE HEPATIS**

The background is a watercolor-style illustration with various shades of blue and teal, accented with numerous small gold and white speckles. The overall effect is soft and artistic. The text 'THANK YOU!' is centered in a bold, black, sans-serif font.

THANK YOU!