

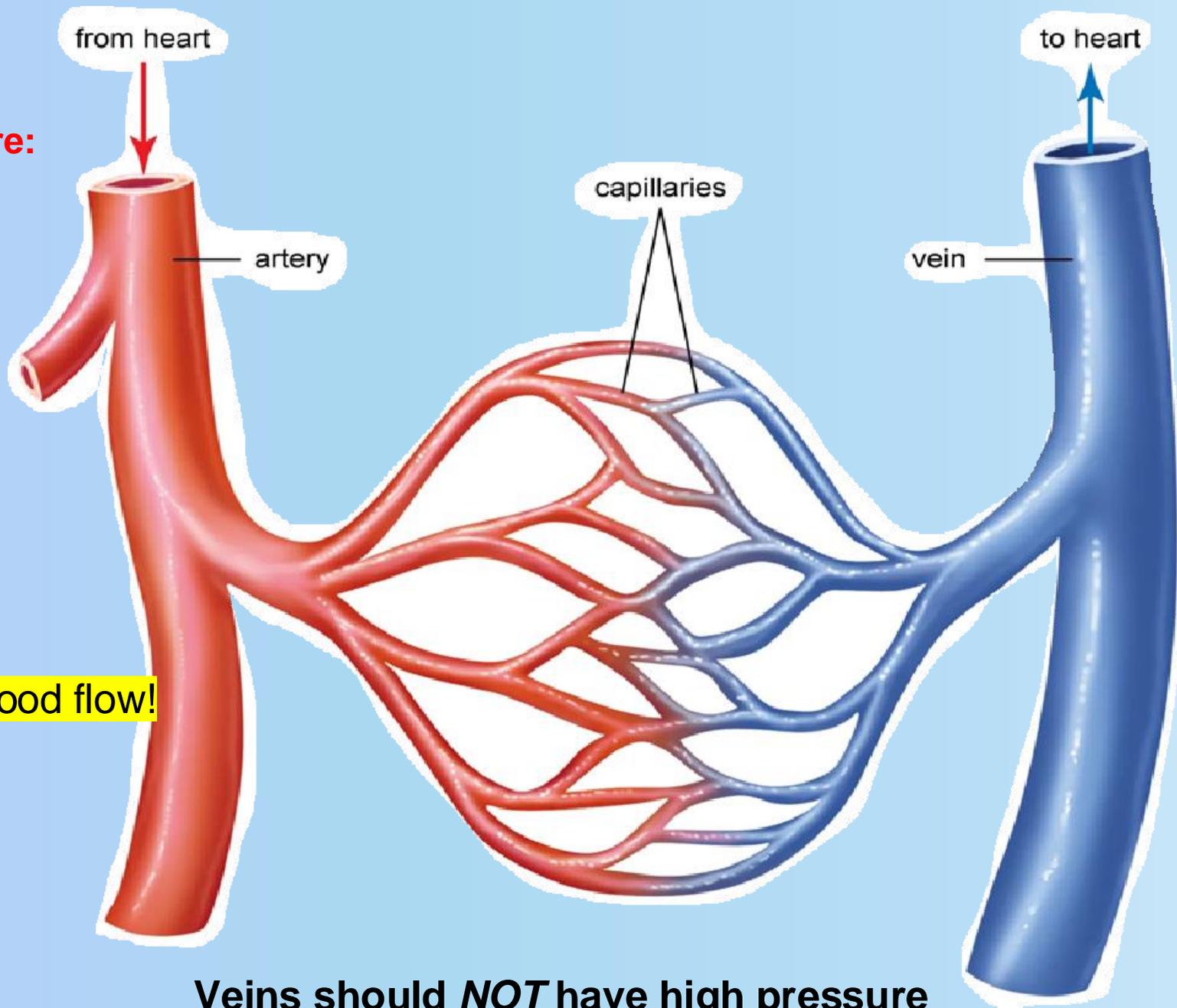
Venous capillary system, Hepatic portal system & Abdominal/pelvic lymphatics

By Glenn André Breivik

Overview

- Venous capillary system with **portosystemic anastomosis system**
- Hepatic portal system
- Lymphatic drainage abdomen/pelvis





Arterial pressure:
80-120 mmHg

Venous pressure:
4-8 mmHg

Artery + Vein:
High + Low = Good flow!

Vein + Vein:
Low + Low = Good flow!

Veins should NOT have high pressure

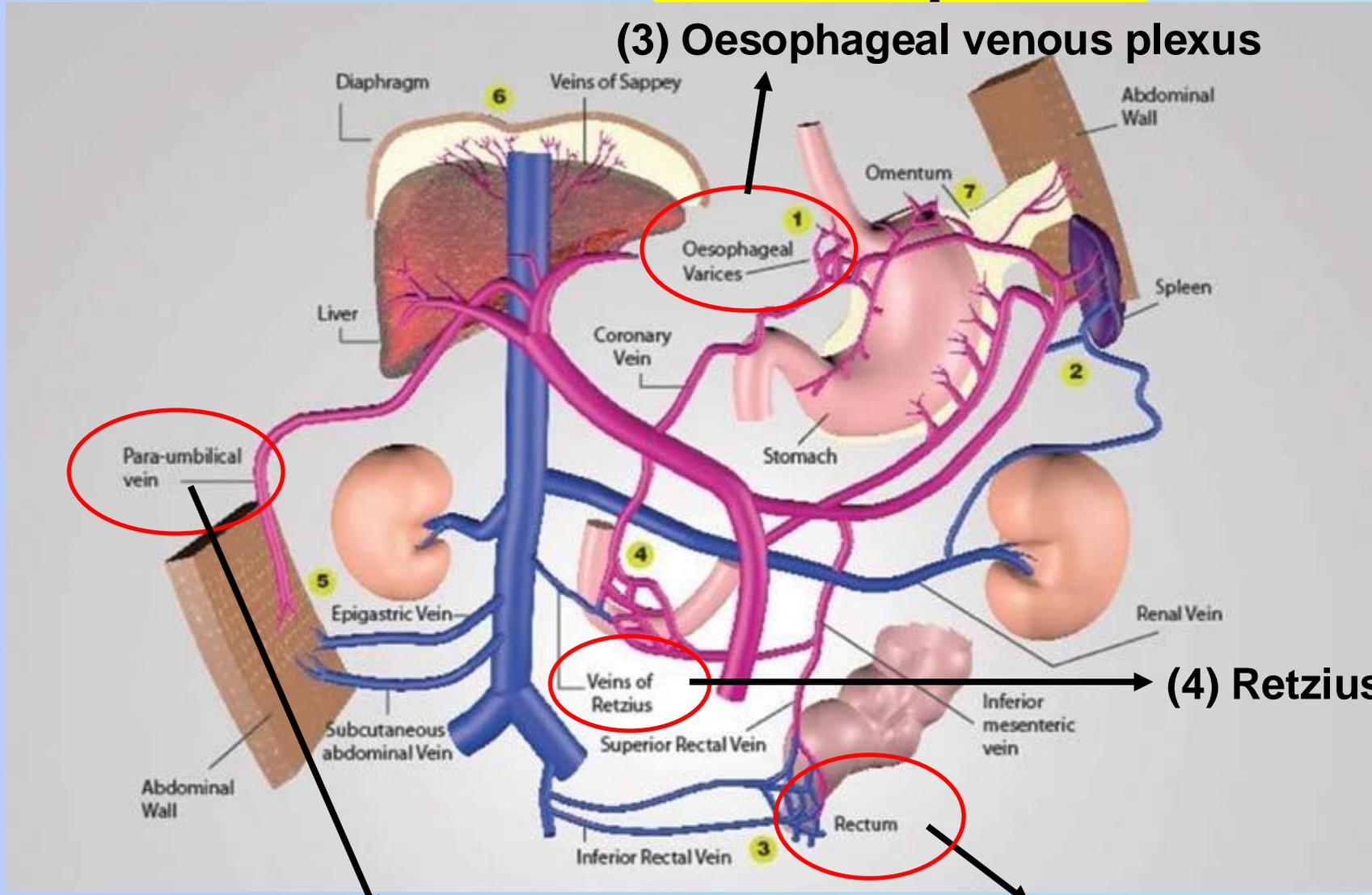
Why does a venous plexus exist?

Anastomoses of *two or more veins* make it possible to access an escape route, and go «the wrong way». Sometimes, the same vein takes the blood flow in reverse.

This is in case the caval/hepatic portal system has some issues, like a blockage.

Venous anastomoses systems (portocaval system)

- Checkpoints



(3) Oesophageal venous plexus

(4) Retzius

(2) Umbilical venous plexus

(1) Rectal venous plexus

Prostatic/vesical venous plexus is not mentioned (8)

- Moore's Clinical Anatomy only mentions 4 of them:

1. Rectal
2. Umbilical
3. Oesophageal
4. Veins of Retzius & Retroperitoneal veins.
- (5). Intrahepatic portosystemic anastomoses)

Important rule:

In a venous plexus system:

- One vein to hepatic portal system
- One vein to caval (systemic) system

THESE ARE LINKED AND CAN WORK BOTH WAYS WHEN NEEDED (often dominant one way)

This is a golden rule with few exceptions

Rectal venous plexus

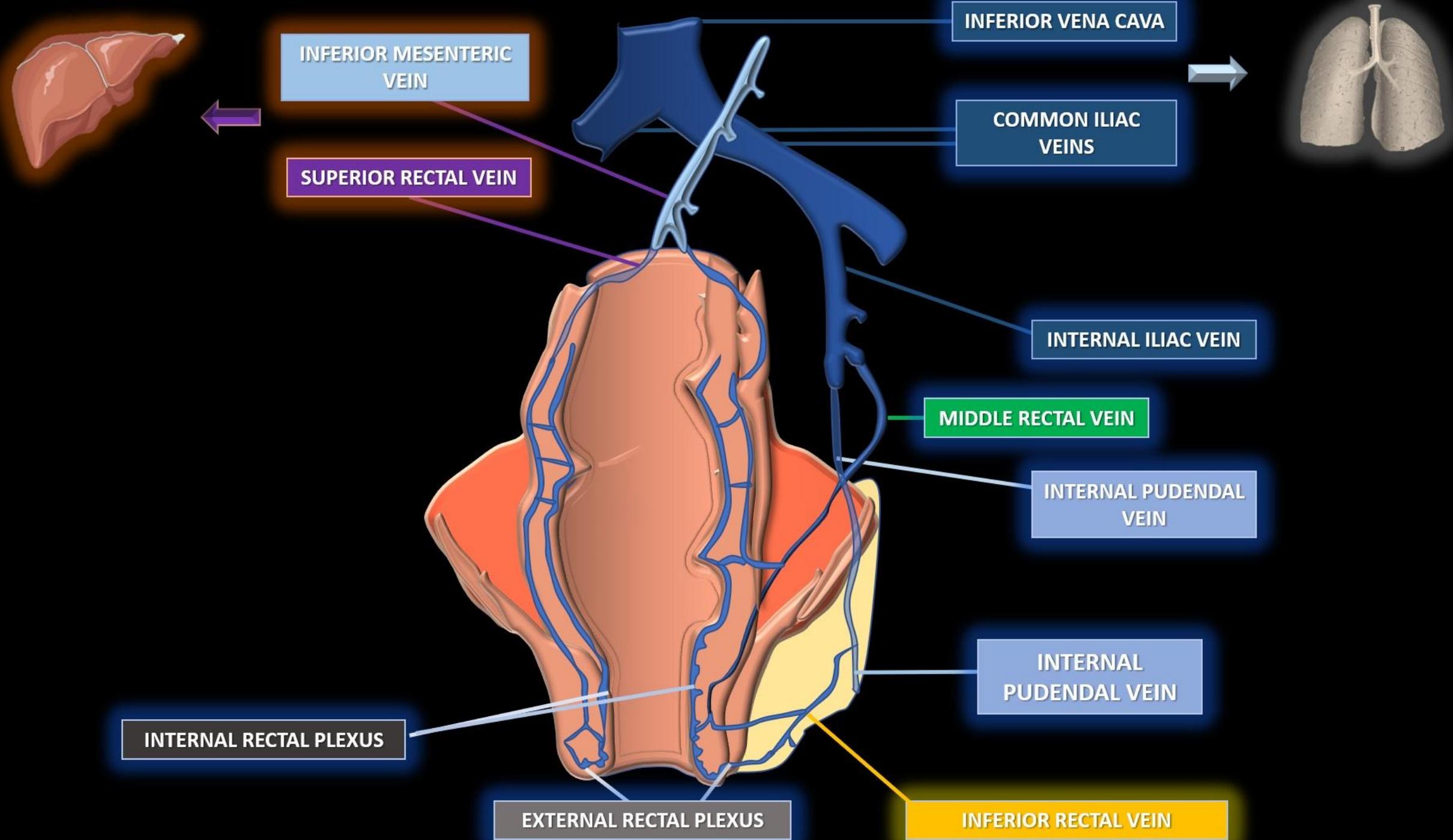
- *Superior rectal vein* → *Inferior mesenteric vein* (*hepatic portal system*)
- *Middle rectal vein* → *Internal iliac vein* (*caval system*)
- *Inferior rectal vein* → *Internal pudendal vein* → *Internal iliac vein* (*caval system*)

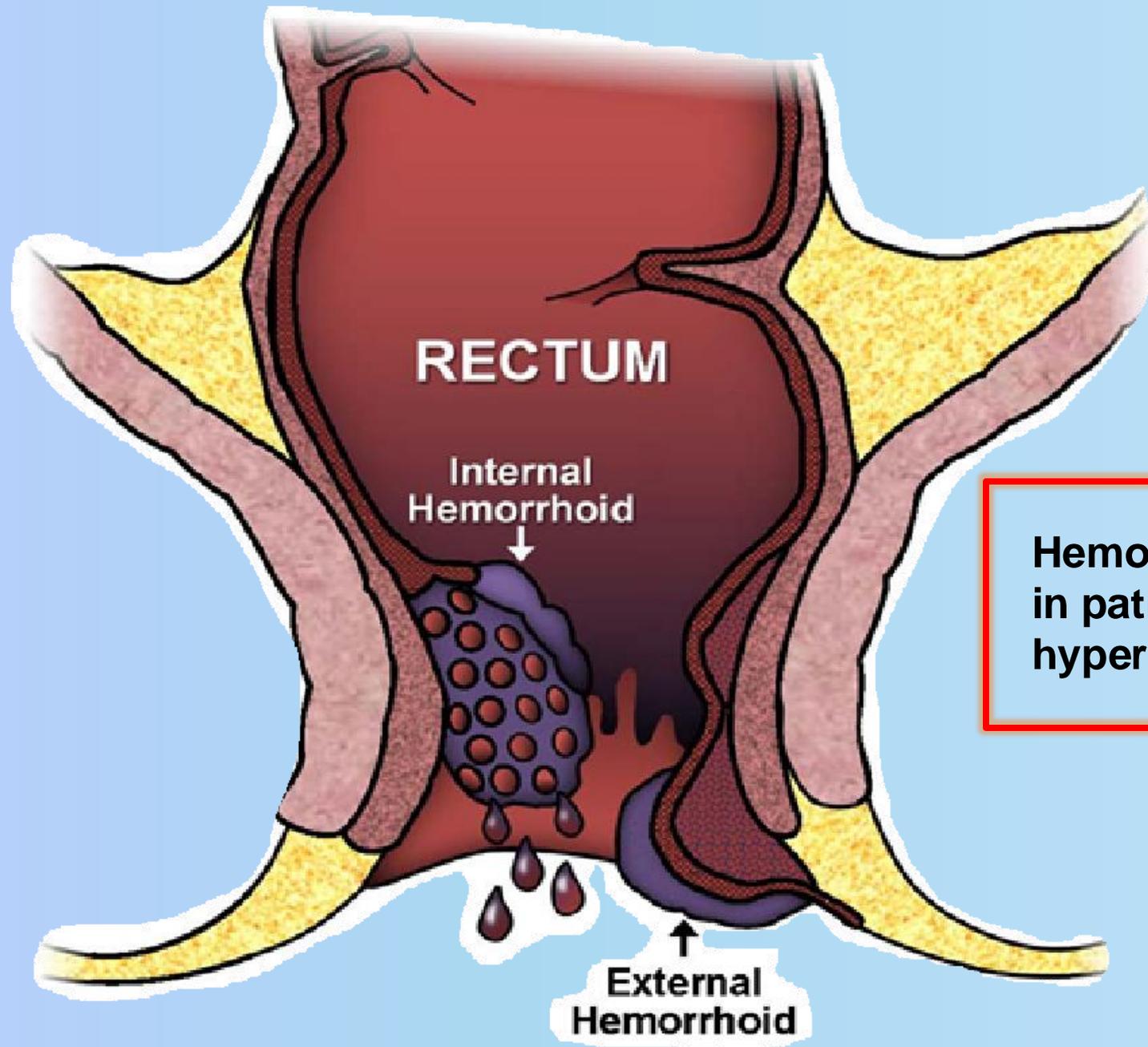
What is the point of this venous plexus?

The blood of the rectum can mix in this plexus, despite draining the specific parts.

This allows for an alternative route in case the caval/hepatic portal system has some issues, like a blockage.

Also – the rectum is a weirdly positioned organ!





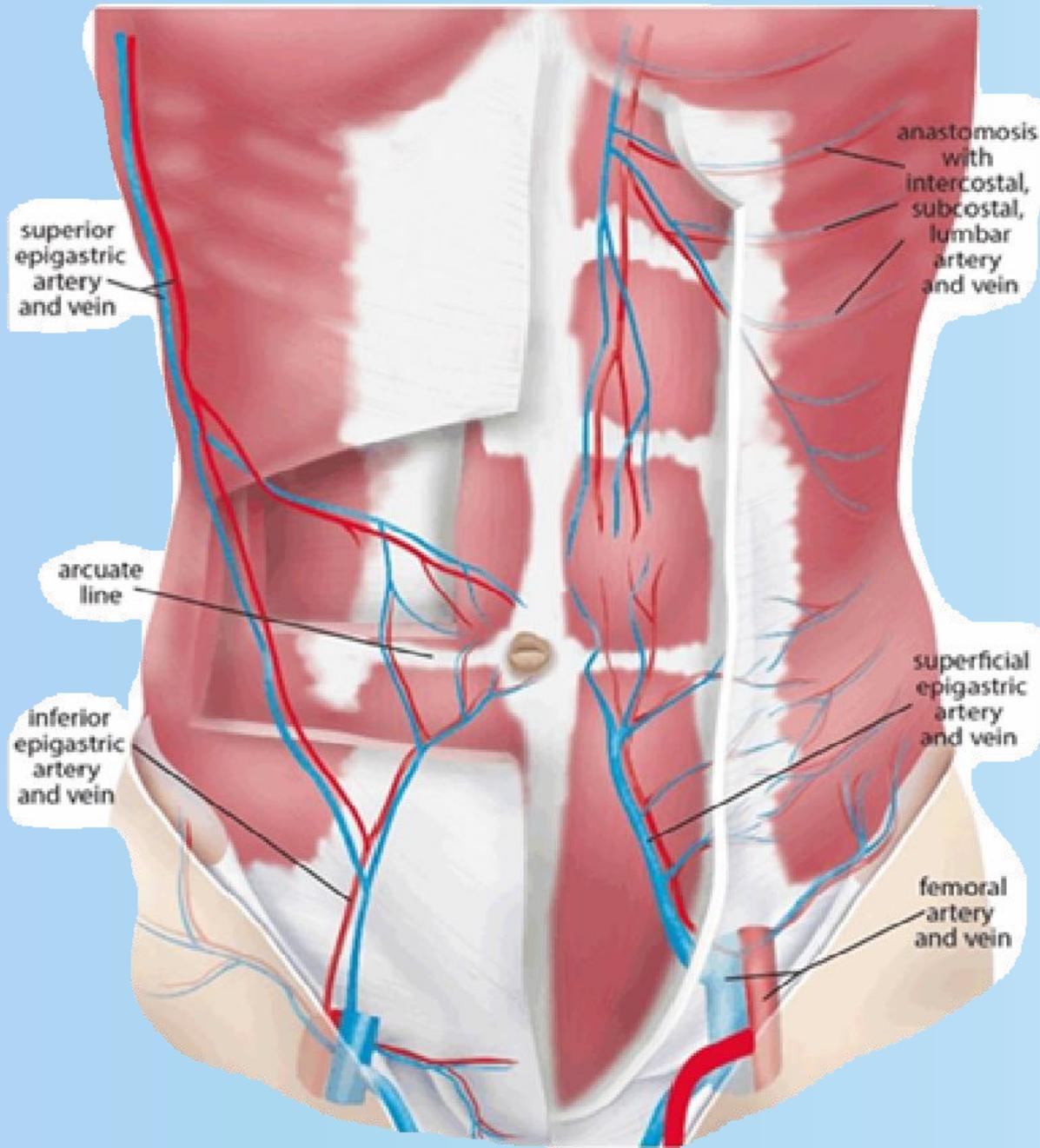
Hemorrhoids will bleed heavier in patients that have portal hypertension

Umbilical venous plexus

- Will drain the abdominal wall and the plexus is at the umbilicus.

Two relevant veins:

1. Paraumbilical vein → *(Hepatic portal system)*
2. Epigastric veins (Superficial, superior and inferior) → *(caval system)*
 - Superior epigastric vein → Internal thoracic vein
 - Inferior epigastric vein → External iliac vein
 - Superficial epigastric vein → Great saphenous vein/femoral vein





Caput medusae:

Due to increased
portal-systemic
pressure

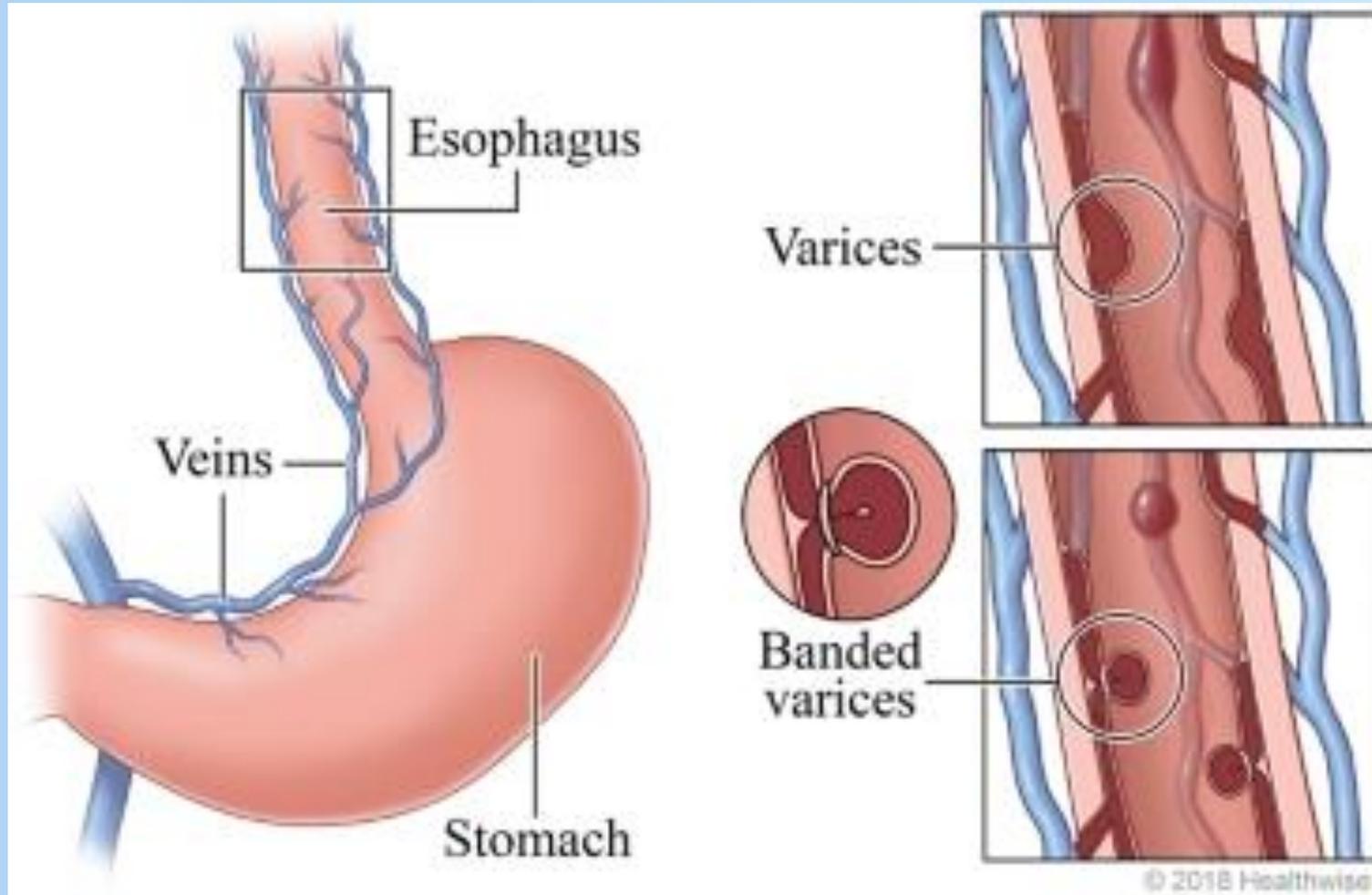
Oesophageal venous plexus

- Right gastric vein → (Hepatic portal system)
- Left gastric vein → Both (Hepatic portal system) and (caval system through the Azygos vein).
- Can cause oesophageal varices which is extremely dangerous! Treatment?

Avoid oesophageal varices in the first place.

Ruptured oesophageal varices

(severe bleeding due to rupture of the veins - hard to save the patient when it happens)



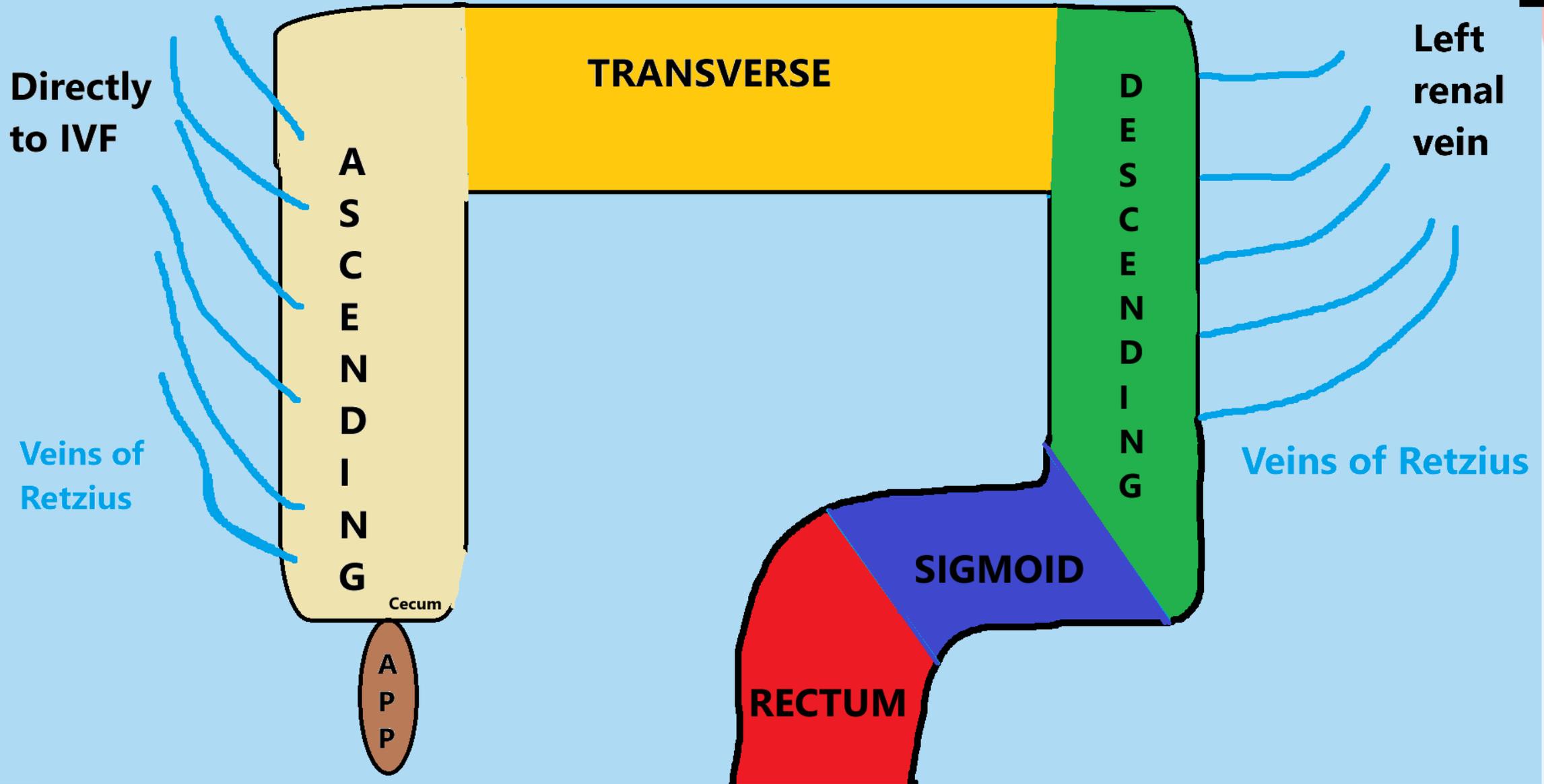
Veins of Retzius & Retroperitoneal portocaval veins

- Will drain into the caval system.
- They drain to the caval system because they drain the retroperitoneal organs that normally drain into the hepatic portal system:
 - Duodenum
 - Spleen
 - Head, neck and body of pancreas
 - **Ascending colon**
 - **Descending colon**

An example with veins of Retzius:

- **Ascending colon** → Directly to inferior vena cava (right side)
- **Descending colon** → Directly to the left renal vein (left side)

R



Hepatic portal system

My 2 statements:

1 The organs/structures that drain into the **hepatic portal system** can be considered «**dirty**». They need to be cleaned by the liver to avoid spreading infections/dealing with toxic components, or they are in relation to other «dirty» organs.

2 The organs that drain into the **caval system** can be considered «**clean**» organs. they can filtrate or clean themselves without the help of the liver, and they deal with toxic components.

Let`s test it!

Organs draining into hepatic portal system

Abdominal oesophagus + Stomach

Small intestine:

Duodenum, jejunum and ileum

Pancreas

Gallbladder

Colon:

Cecum + appendix, ascending, transverse, descending, sigmoid.

Spleen

Greater omentum & Lesser omentum

Anterior part of the abdominal wall and diaphragm

Rectum

GI tract

Natural gut flora (bacteria) + potential food poisoning, *absorption of drugs etc.*

Lymphatic organs, but is at high risk for damage after abdominal trauma + high responsibility.
Spleen also breaks down erythrocytes (bilirubin)

Relates to **paraumbilical vein**

Venous plexus checkpoint
+ GI tract

Organs draining into hepatic portal system	Veins:
Abdominal oesophagus + Stomach	Right gastric vein and left gastric veins
<p><u>Small intestine:</u></p> Duodenum, jejunum and ileum	The small intestine is drained by the superior mesenteric vein. Duodenum is drained by superior pancreaticoduodenal veins --> portal vein
Pancreas	- Anterior superior and posterior pancreaticoduodenal veins --> sup. Mesenteric and splenic vein)
Gallbladder	Cystic vein
<p><u>Colon:</u></p> Cecum + appendix, ascending, transverse, descending, sigmoid.	Colic veins, sigmoidal veins, ileocolic vein (appendicular vein) --> Superior/inferior mesenteric vein --> Portal system)
Spleen	Splenic vein --> Portal vein
Greater omentum & Lesser omentum	- Greater omentum will be drained by gastro-omental veins (right and left) --> splenic vein/portal vein. - Lesser omentum will be drained by gastric veins (right and left) --> portal vein
Anterior part of the abdominal wall and diaphragm	Paraumbilical vein (drains into cystic vein) --> Portal vein
Rectum	The superior rectal vein drains into the inferior mesenteric vein

Healthy individual



Portosystemic blood flow

(when the hepatic portal system does not work)

The blood flow is guided by the pressure

- Lower pressure = blood wants to flow in that direction
- Higher pressure = hard for blood to flow in that direction. Blood flows another way with less pressure

Part 1

NB:

Red organs on the left are the organs mentioned above as the 4 major venous plexuses that drain into both caval and portal system!

The red to the right are the «back-up veins kicking in when the portal system does not work (except for the checkpoints).

Portosystemic anastomosis (when portal system does not work)	Veins: Red=caval Blue=portal
<p>Abdominal oesophagus + Stomach</p>	<p>Right gastric vein and left gastric veins (The left gastric vein goes to both caval and portal --> Azygos vein).</p>
<p><u>Small intestine:</u> Duodenum, jejunum and ileum</p>	<p>The small intestine is drained by the superior mesenteric vein. Duodenum is drained by superior pancreaticoduodenal veins and retroperitoneal veins</p>
<p>Pancreas</p>	<p>Anterior superior and posterior pancreaticoduodenal veins (--> sup. Mesenteric and splenic vein) Retroperitoneal veins of (head, neck and body)</p>
<p>Gallbladder</p>	<p>Cystic vein Paraumbilical vein (through cystic vein in reverse, then to epigastric veins) or Cholecystic veins into hepatic veins.</p>
<p><u>Colon</u> Cecum + appendix, ascending, transverse, descending, sigmoid</p>	<p>Superior mesenteric vein Veins of Retzius</p>



Part 2

Spleen	Splenic vein Retroperitoneal veins
Greater omentum & Lesser omentum	- Greater omentum will be drained by gastro-omental veins (right and left) --> splenic vein/portal vein. - Lesser omentum will be drained by gastric veins (right and left) --> portal vein Oesophageal veins + left gastric vein --> Azygos vein
Anterior part of the abdominal wall and diaphragm (Umbilical area)	Paraumbilical vein (drains into cystic vein) Epigastric veins: superior, inferior and superficial (drains into caval system)
Rectum	The superior rectal vein drains into the inferior mesenteric vein - Inferior rectal veins drain into internal iliac vein and the inferior rectal vein drain into the pudendal vein --> IVF

Caval system

Organs draining into caval system	Veins
Kidneys + upper part of ureters	Right and left renal veins
Adrenal glands	<p><u>Right and left suprarenal veins</u></p> <p>Right suprarenal vein --> Directly to inferior vena cava</p> <p>Left suprarenal vein --> Left renal vein --> inferior vena cava</p>
Bladder + lower part of ureters	Vesical venous plexus --> vesical veins --> Internal iliac vein --> vertebral
Gonads (testes and ovaries) + lower part of ureters	<p><u>Testicular/ovarian veins (gonadal veins)</u></p> <p>Right gonadal vein --> Directly to inferior vena cava</p> <p>Left gonadal vein --> Renal vein --> Inferior vena cava</p>
Female reproductive organ	<p>Drains into caval system.</p> <p><u>Contributors:</u> Vaginal venous plexus, uterine vein, hypogastric venous plexus, internal pudendal vein</p>
Prostate	Prostate venous plexus (PVP) --> Vesical venous plexus (to vesical veins) OR from PVP directly to internal vertebral plexus.

Kidneys filtrate. The rest are related to the kidneys

Must be clean/safe for fertilisation

Lactobacillus bacteria lowers pH + Must keep fetus safe

Must protect the sperm cells

Organs draining into caval system

Kidneys + upper part of ureters

Adrenal glands

Bladder + lower part of ureters

Gonads (testes and ovaries)
+
lower part of ureters

Female reproductive organ

Prostate

Organs draining into hepatic portal system

Abdominal oesophagus + Stomach

Small intestine:

Duodenum, jejunum and ileum

Pancreas

Gallbladder

Colon:

Cecum + appendix, ascending, transverse, descending, sigmoid.

Spleen

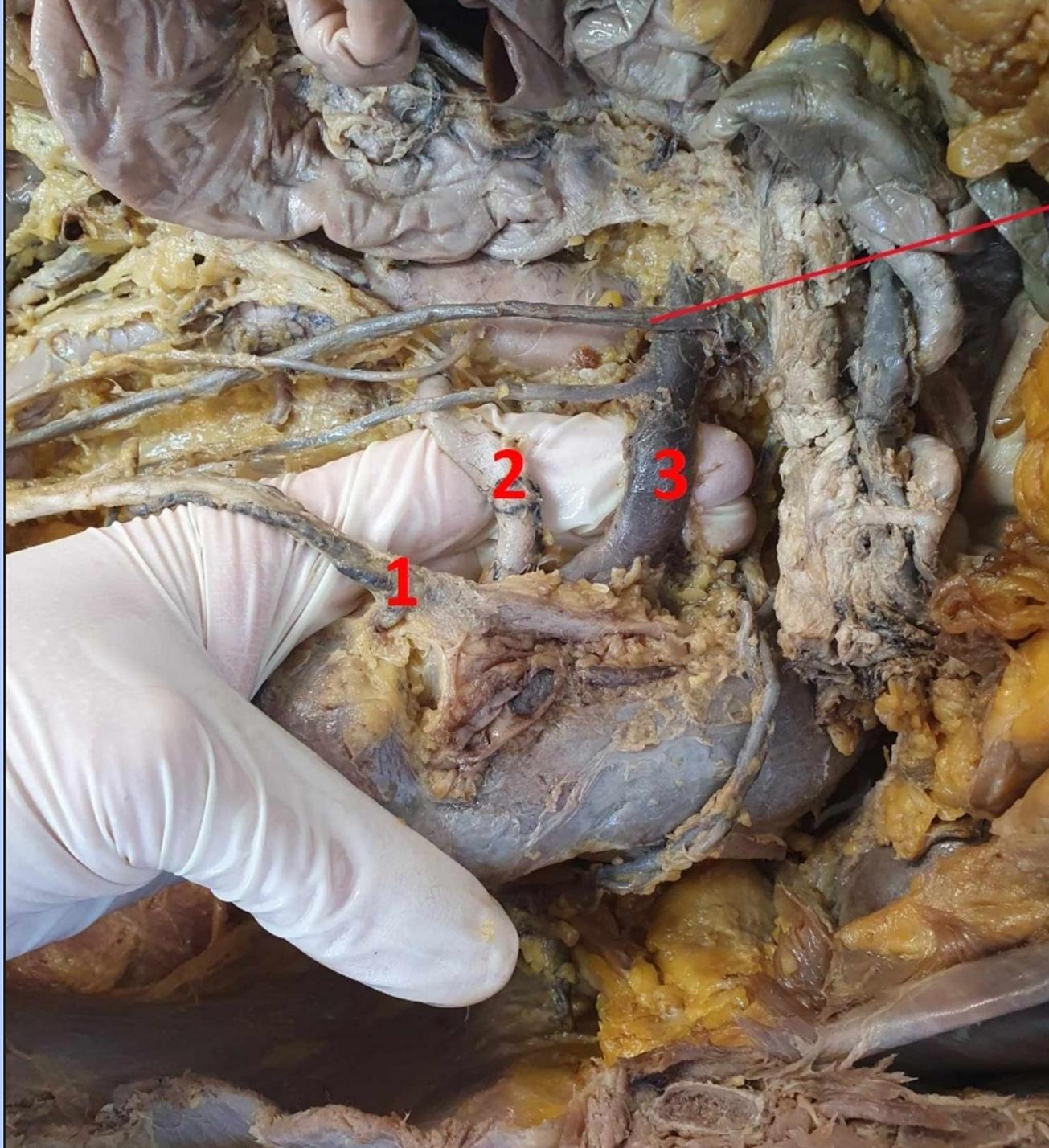
Greater omentum & Lesser omentum

Anterior part of the abdominal wall and diaphragm

Rectum

Mostly in the pelvis →

GI organs + high risk for damage ←



Inferior mesenteric vein

1. Ureter (left side)
2. Renal artery (left side)
3. Renal vein (left side)





Left side:

Testicular artery

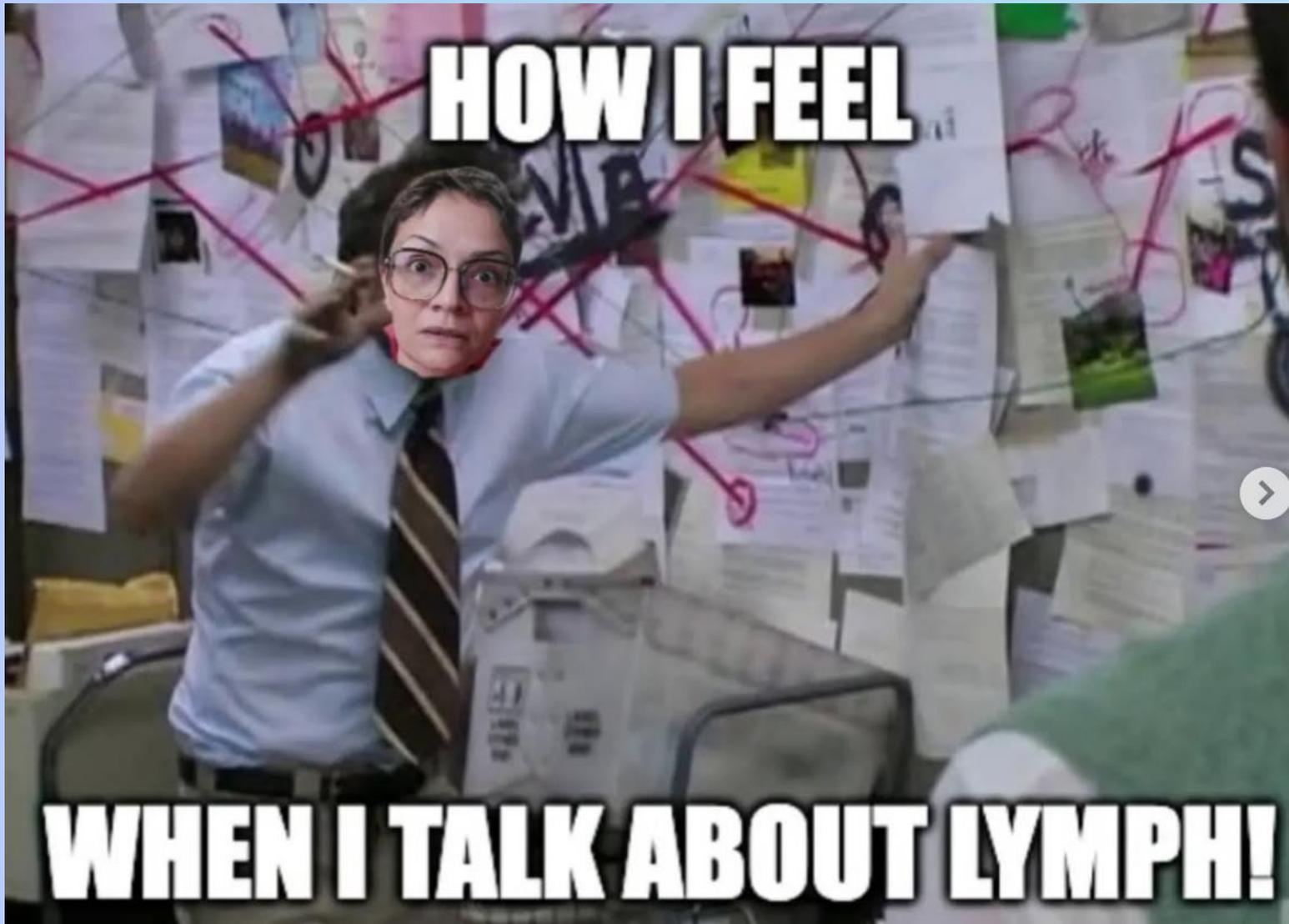
Testicular vein

Renal artery

Renal vein

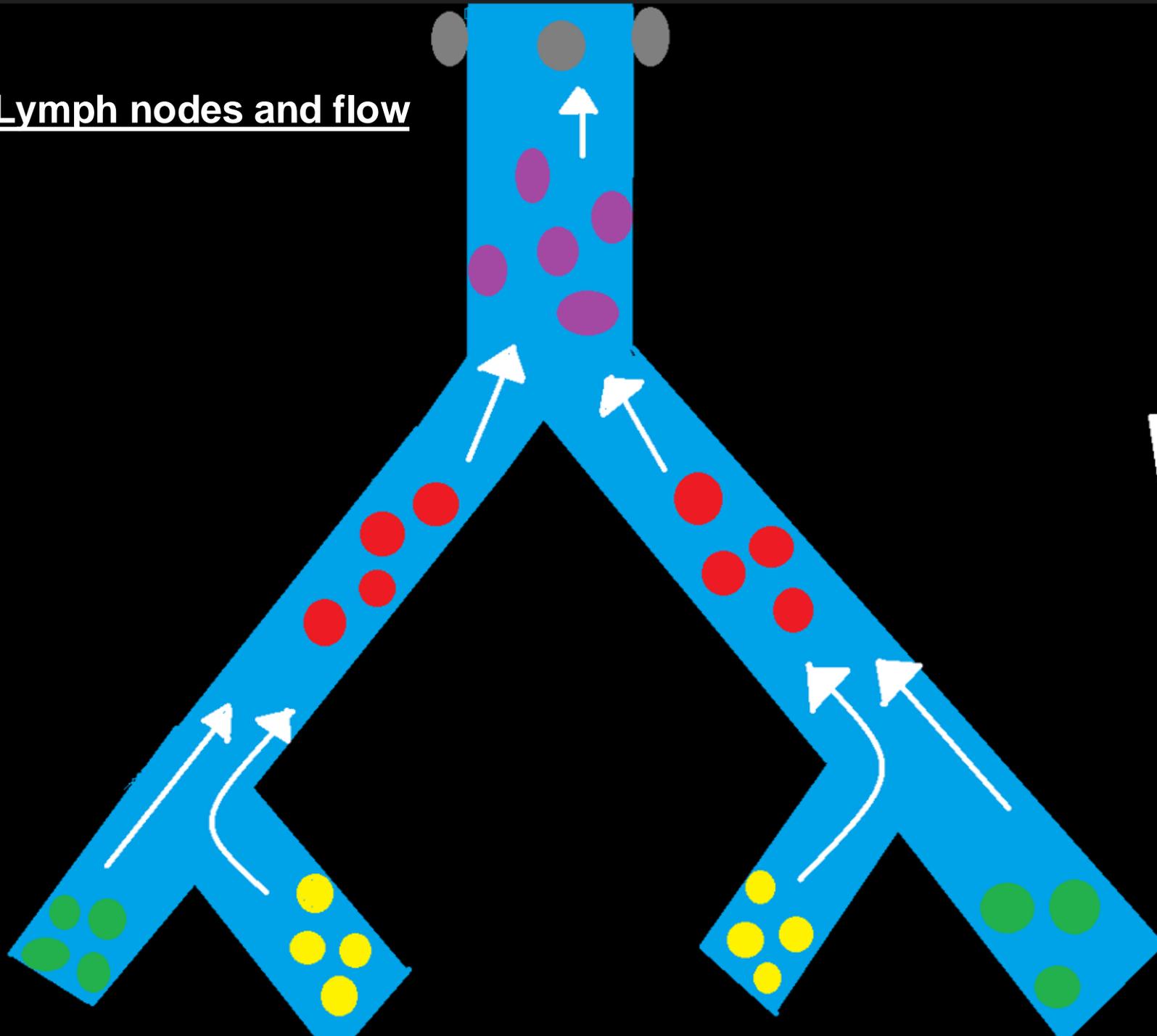


Lymphatic drainage of pelvis and abdomen



- ❖ Relevant lymph nodes **with flow**
- ❖ Drainage of female reproductive organs
- ❖ Testes and scrotum.

Lymph nodes and flow



Internal iliac lymph nodes

External iliac lymph nodes

Common iliac lymph nodes

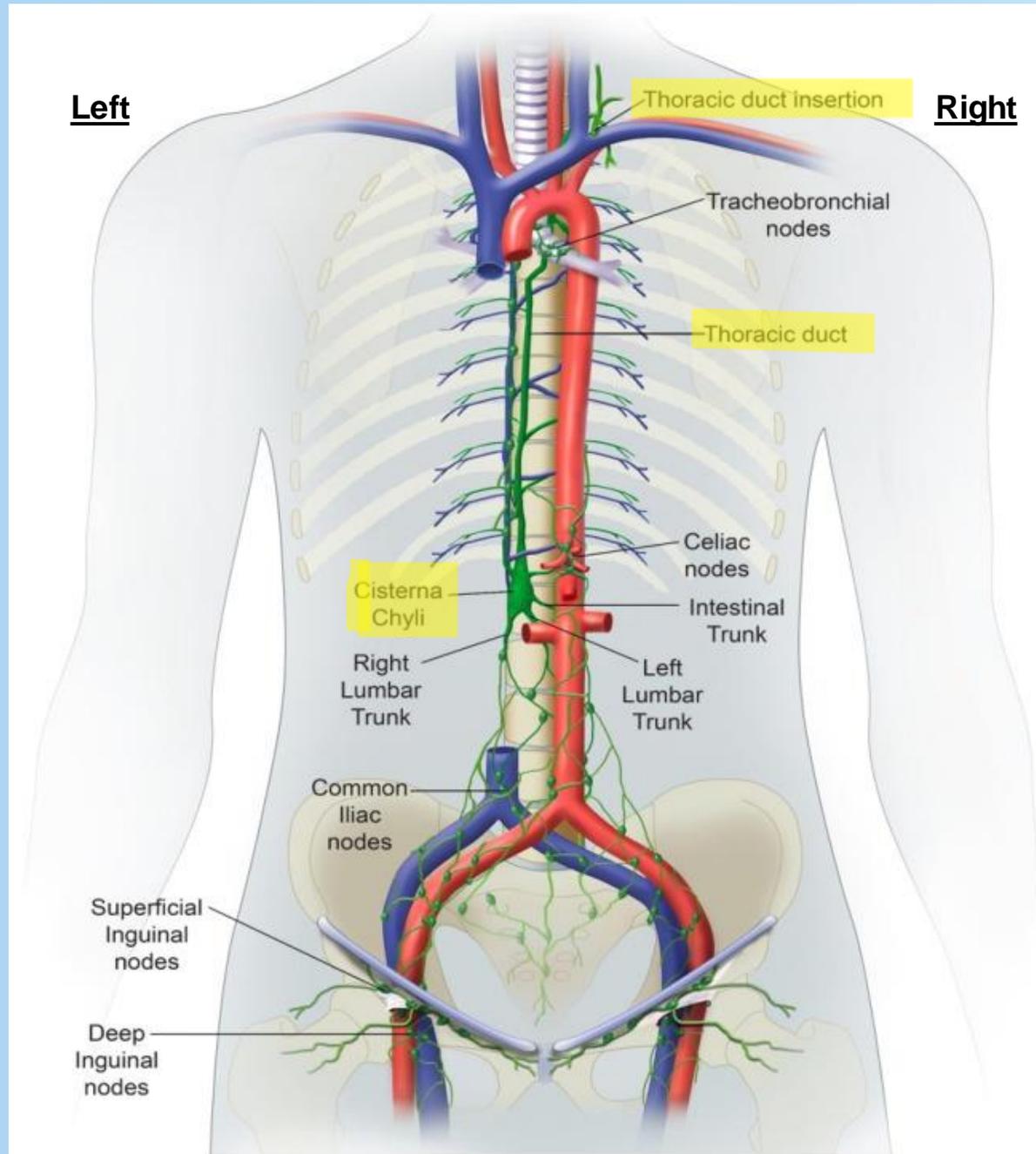
Lumbar lymph nodes

Para-aortic lymph nodes

Cisterna chyli

--> Thoracic duct





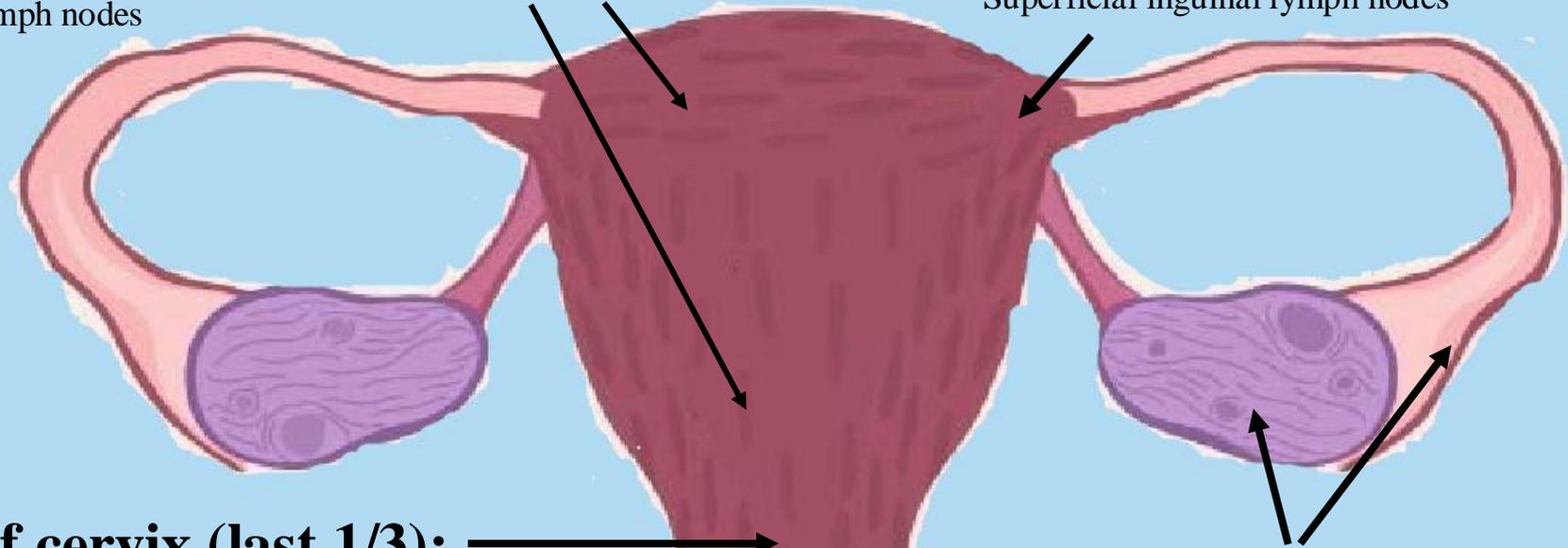
Lymphatic drainage of female reproduction organ

Anterior 2/3 of uterus (from fundus):

Internal iliac lymph nodes

Uterine horn:

Superficial inguinal lymph nodes



Supravaginal part of cervix (last 1/3):

Parametrial lymph nodes

(→ then drain into internal iliac lymph nodes)

Ovaries + Fallopian tubes:

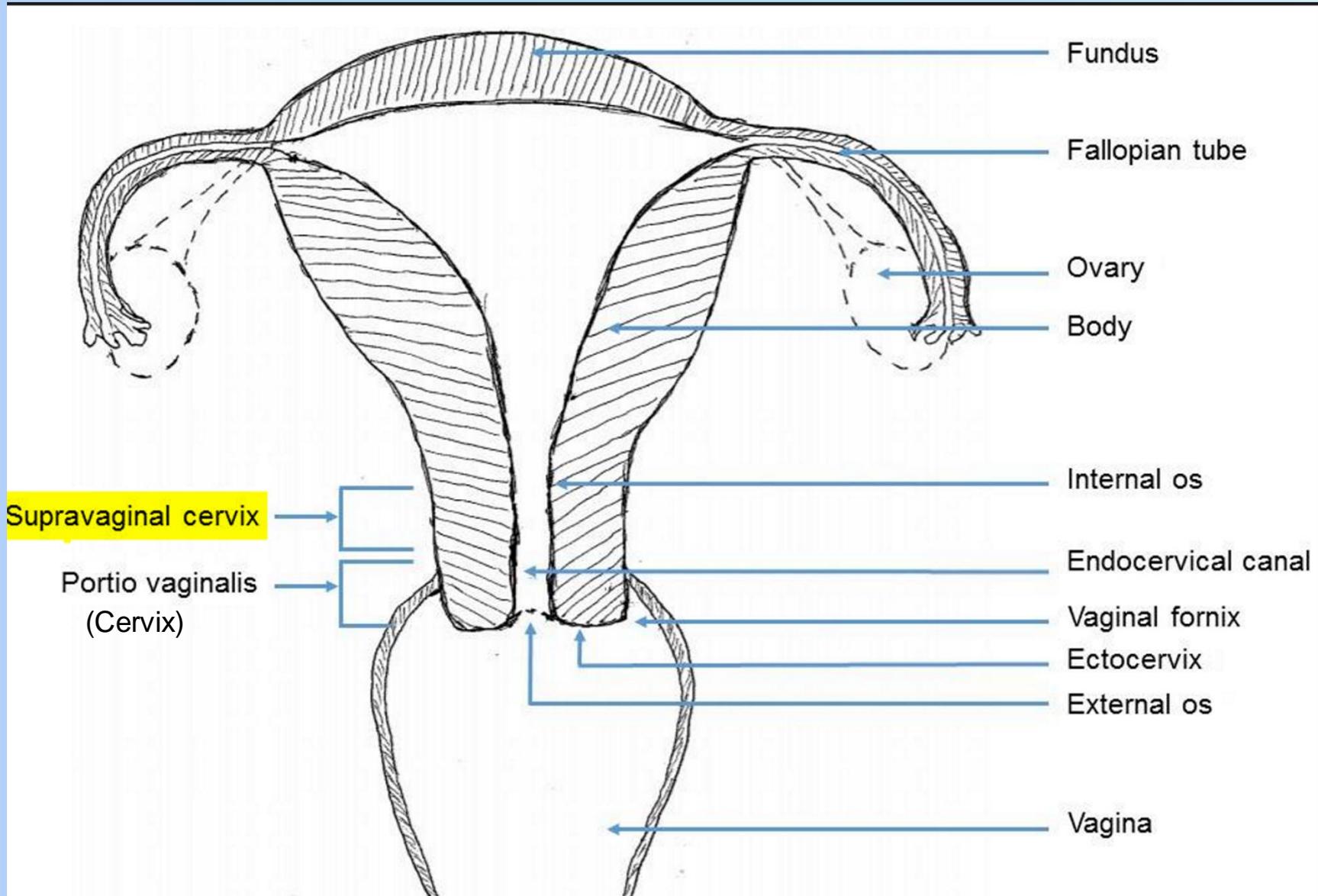
Lumbar/para-aortic lymph nodes

Cervix:

Internal iliac lymph nodes

Perineum (vagina, labia, clitoris):

Superficial inguinal lymph nodes



1: Round ligament of the uterus

Superficial
inguinal lymph
node

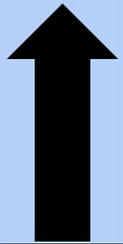
NB:

Round ligament of uterus leaves the inguinal canal through the deep inguinal ring, just as the spermatic cord does in men. This is why the round ligament of the uterus drain into the superficial inguinal lymph nodes



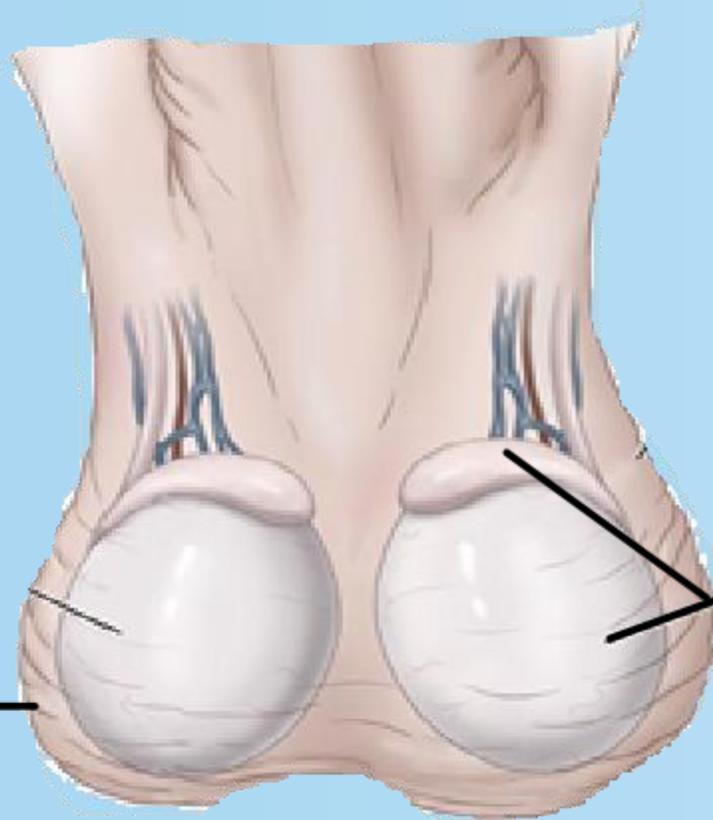
Lymphatic drainage of testes and scrotum

The scrotum is formed by the fusing of labia majora during the fetal stage



Scrotum:

Superficial inguinal lymph nodes
→
Deep inguinal lymph nodes



Testes develop in the abdomen and then descend to the pelvis

→ This explains the lymph and venous drainage.



Testicle + epididymis:

Lumbar lymph nodes
→
Para-aortic lymph nodes