MED437
KING SAUD UNIVERSITY

ANATOMY
Team 437

Anatomy of large blood vessels – veins

Lecture 3

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هذا العمل لا يغني عن المصدر الأساسي للمذاكرة

{وَمَنْ يَتَوَكَّلْ عَلَى اللَّهِ فَهُوَ حَسْبُهُ}

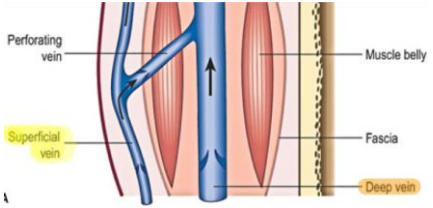
Objectives

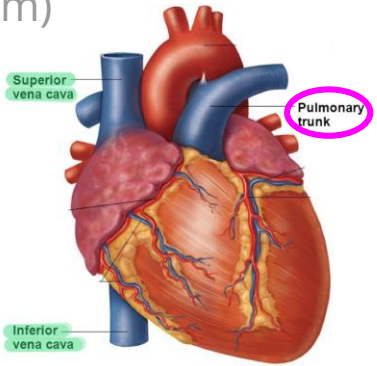
- **Define the veins**, and understand the **general principle** of the **venous system**.
- Describe the **superior & inferior Vena Cava (formation** & their **tributaries)**
  Head & neck
  Thorax & abdomen
  Upper & lower limbs
- List **major veins** and their **(formation** & **tributaries in the body)**
- Describe the **Portal Vein (formation** & **tributaries in the body)**
- Describe the **Portocaval Anastomosis (formation, sites** & **tributaries in the body)**

- Text in BLUE was found only in the boys' slides
- Text in PINK was found only in the girls' slides
- Text in RED is considered important
- Text in GREY is considered extra notes

Veins

- Veins are blood vessels that bring blood back to the heart.
- All veins carry deoxygenated blood
  - with the **exception** of the pulmonary veins (open in the left atrium) and umbilical vein (during fetal development).





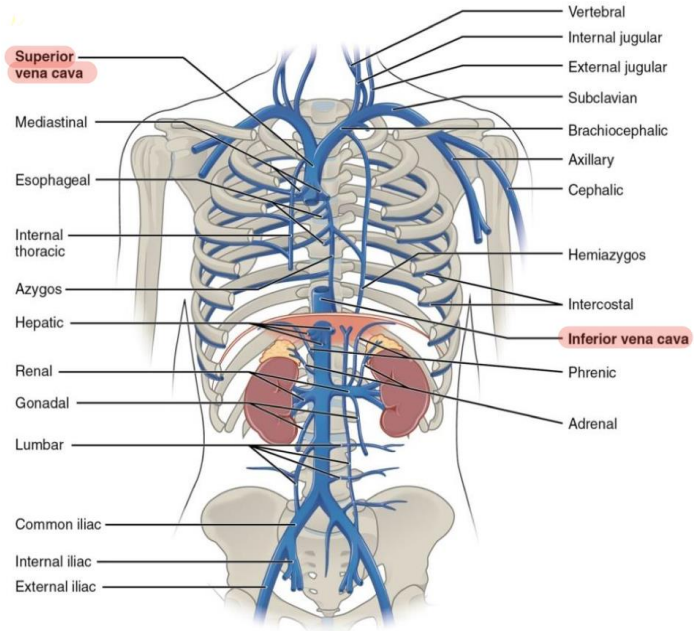
Vein can be classified in 2 ways based on

- Location
  - Superficial veins: close to the surface of the body -NO corresponding arteries
  - Deep veins: found deeper in the body -With corresponding arteries
- Circulation
  - Veins of the systemic circulation: Superior and Inferior vena cava with their tributaries
  - Veins of the portal circulation: Portal vein

Vena Cava

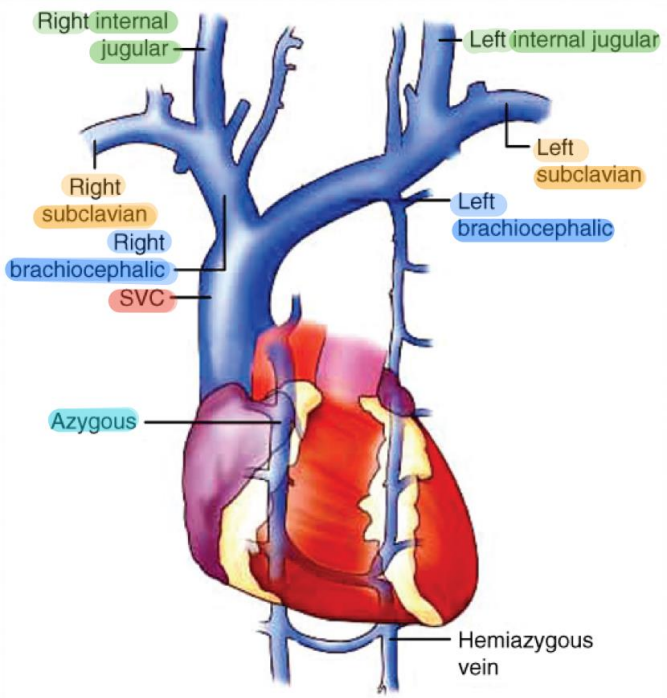
ONLY in boy's slides

- They are two large veins that return deoxygenated blood from the body into the heart.
- There are the **superior** vena cava and the **inferior** vena cava.
- Both empty into the **right atrium.**
- They are located slightly off-center toward the right side of the body.

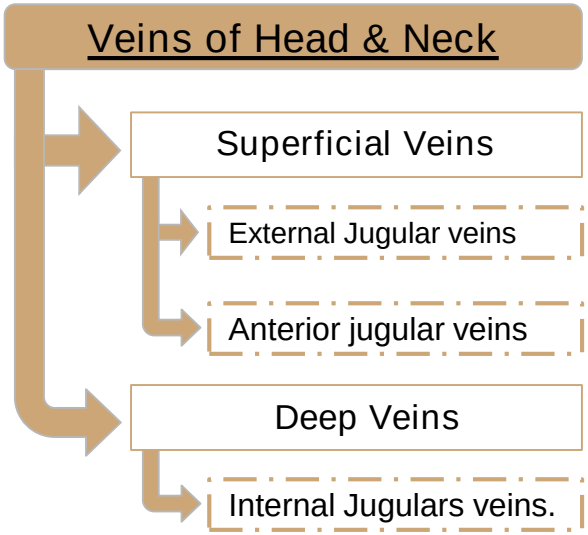


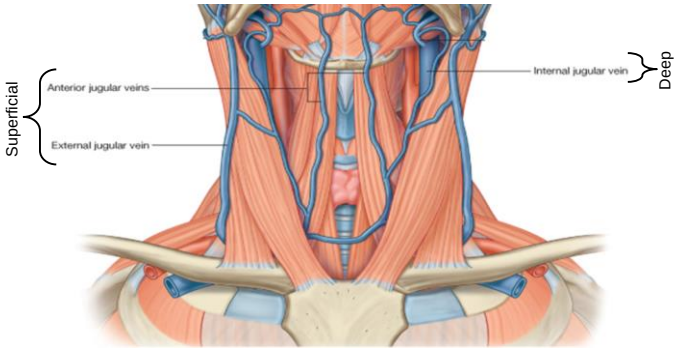
Superior vena cava

- The superior vena cava is above the heart
- Formed by the union "اتحاد" of the right and left Brachiocephalic veins.
  -Brachiocephalic veins are formed by the union of internal jugular and subclavian veins.
- Drains venous blood from :
  Head & neck, Thoracic wall ,Upper limbs
- It Passes downward and enter the **right atrium**.
- Receives azygos vein on the posterior aspect just before it enters the heart.



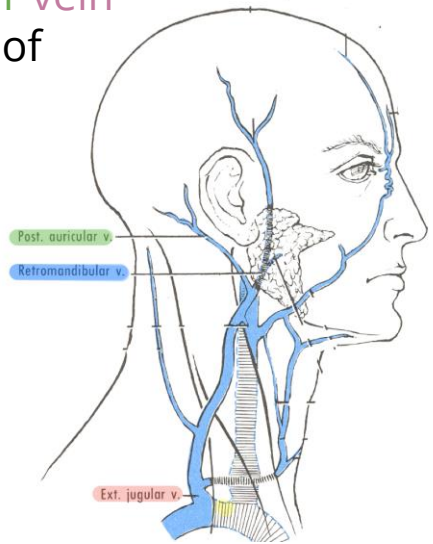
Superficial Veins of Head & Neck





❖ External Jugular Vein:

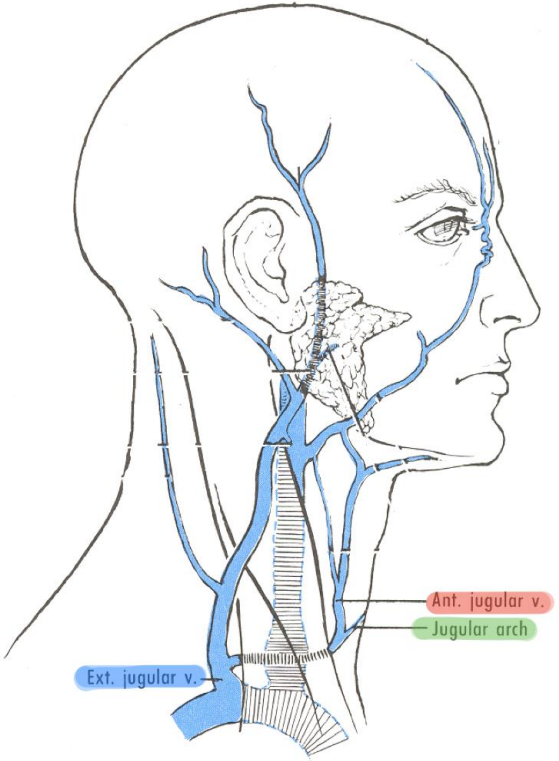
- Lies superficial to the sternomastoid muscle
- Formed by the union of posterior auricular vein and retromandibular vein.
- Begins just behind the angle of mandible by union of posterior auricular vein with the posterior division of retromandibular vein.
- It passes down the neck and it is the **only** tributary. of the **subclavian** vein.
- It drains blood from:
  1- Outside of the skull
  2- Deep parts of the face.



Superficial Veins of head & neck

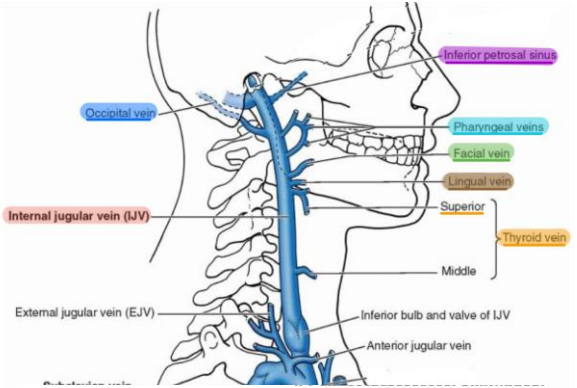
❖ **Anterior jugular veins:**

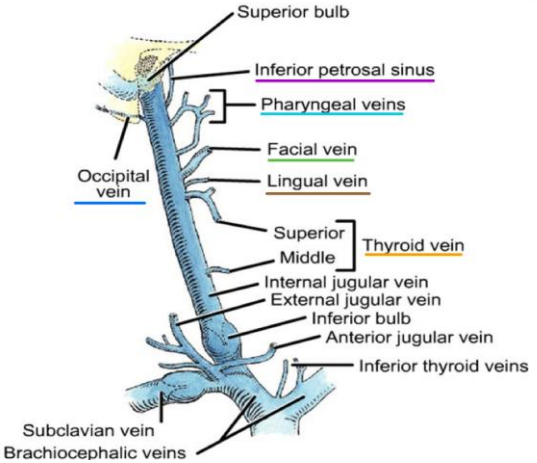
- It begins in the upper part of the neck by the union of the **submental veins.**
- It descends close to the median line of the neck, medial to the **sternomastoid.**
- At the lower part of the neck, it passes laterally **beneath** sternomastoid muscle to **drain into** the external jugular vein.
- Just above the sternum the two anterior jugular veins communicate by a transverse vein to form the **jugular arch.**



Deep Veins of head & neck

- **Internal Jugular vein:**
- Drains blood from the brain,face, head & neck.
- It descends in the neck along with the internal and common carotid arteries and vagus nerve, within the **carotid sheath**.
- Joins the subclavian vein to form the **brachiocephalic** vein.
- **Tributaries** 'branches'**:**
  1-Superior thyroid
  2-Lingual
  3-Facial
  4-Pharyngeal.
  5-Occipital veins
  6-Dural venous sinuses (inferior petrosal sinus).
- These veins drain blood from anterior face, trachea, thyroid, esophagus, larynx, and muscles of the neck.





Venous disorder

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❖ **INFARCTION :**

- Refers to tissue death (necrosis) that is caused by a local lack of oxygen due to obstruction of the tissue's blood supply

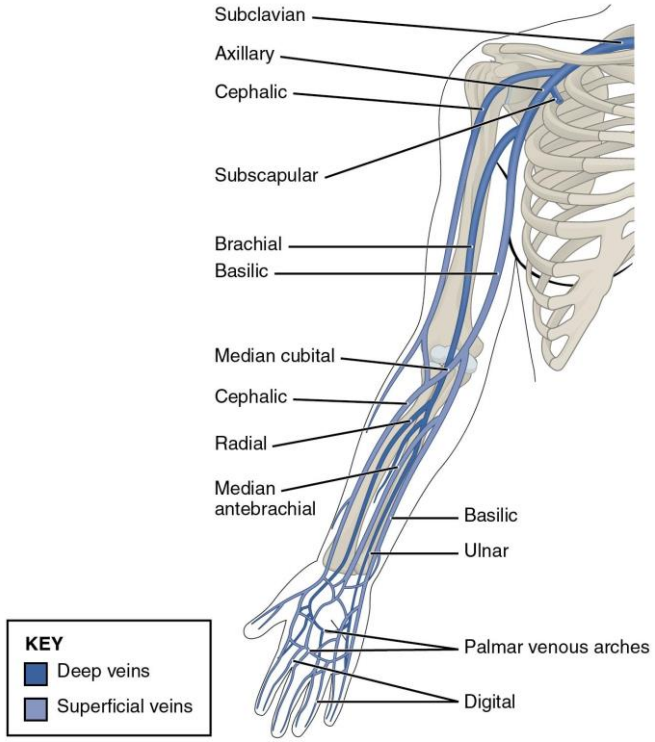
❖ **SINUS THROMBOSIS :**

- **SSS thrombosis**
  - Superior Sagittal Sinus
  - Can complicates ear infection
- **Cavernous Sinus thrombosis**
  - As a complication of infection in the dangerous area of the face
- **Obstruction of venous drainage of the brain leads to Cerebral swelling (edema) and raised Intracranial Pressure.**

Veins of upper limb

Veins of Upper Limbs

- Superficial Veins
  - Cephalic vein
  - Basilic vein
- Deep Veins
  - Venae commitantes
  - Axillary vein



Veins of upper limbs

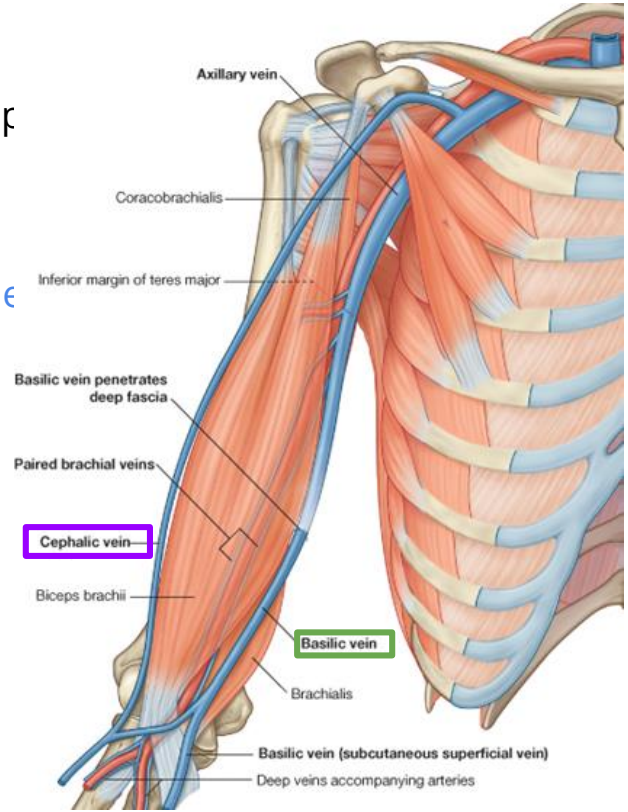
1-Superficial Vein

Cephalic vein

- ➔ Arize from the dorsal venous network of the hand
- ➔ Ascends in the superficial fascia on the lateral side of the bicep (antero-lateral aspect of the upper limb, passing anteriorly at the elbow).
- ➔ At the shoulder, the cephalic vein travels between the deltoid and pectoralis major muscles to enters the axilla region via the calvipectoral triangle.
- ➔ Drains into the Axillary vein. (note that Cephalic is a tributary of the axillary vein)

Basilic vein

- ➔ Originate from the dorsal venous network of the hand.
- ➔ Ascends in the superficial fascia on the **medial** side of the biceps.
- ➔ Halfway up the arm, it pierces the **deep** fascia
- ➔ At the lower border of the teres major it joins the venae **comitantes of the brachial artery to form the Axillary vein.**



Veins of upper limbs

2- Deep Veins

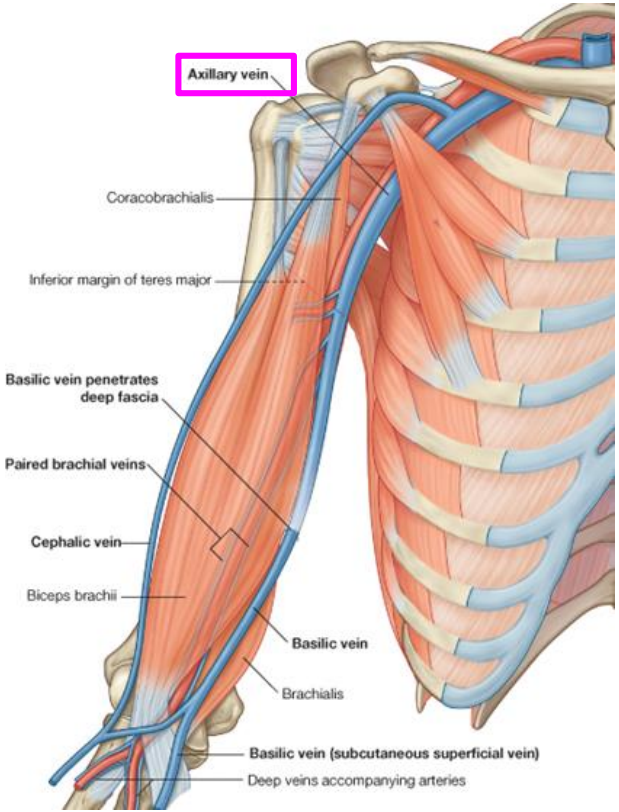
The deep veins of the upper limb are situated underneath the deep fascia.

Venae Commitantes (**paired veins that accompany one artery)**

- ➔ Which accompany all the large arteries and are usually in **pairs.**
- ➔ The brachial veins are the largest in size, and are situated either side of the brachial artery.
- ➔ Ulnar and radial veins are vena comitantes of ulnar and radial arteries.
- ➔ The pulsations of the brachial artery assists the venous return.
- ➔ Perforating veins run between the deep and superficial veins of the upper limb, connecting the two systems together.

Axillary Vein

- ➔ Formed by the union of **basilic vein** and the **venae comitantes (brachial veins)** of the brachial artery.



Veins of upper limbs

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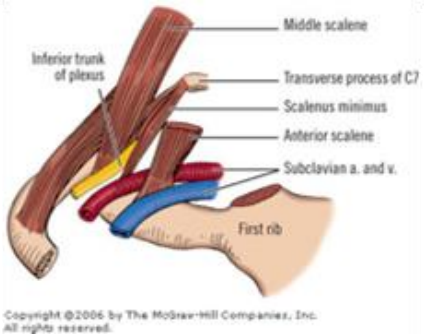
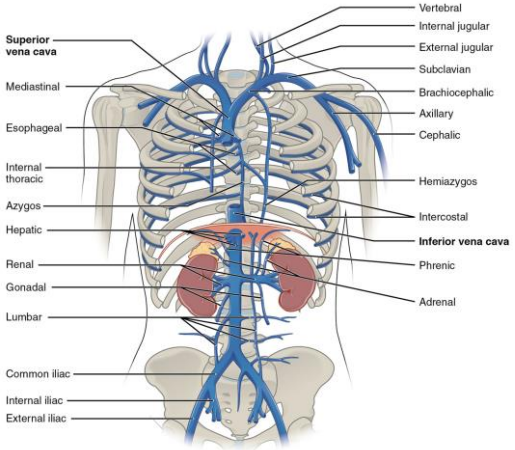
2- Deep Veins

Subclavian Vein

- ➔ Each subclavian vein is a continuation of the axillary vein and runs from the outer border of the first rib to the medial border of anterior scalene muscle.
- ➔ It then joins with the internal jugular vein to form the brachiocephalic vein.
- ➔ The subclavian vein follows the subclavian artery.
- ➔ The right and left brachiocephalic veins form superior vena cava that enters right atrium. anterior to the middle





Pulse points in the upper limb

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AXILLARY PULSE

Located inferiorly of the lateral wall of the axilla.

BRACHIAL PULSE

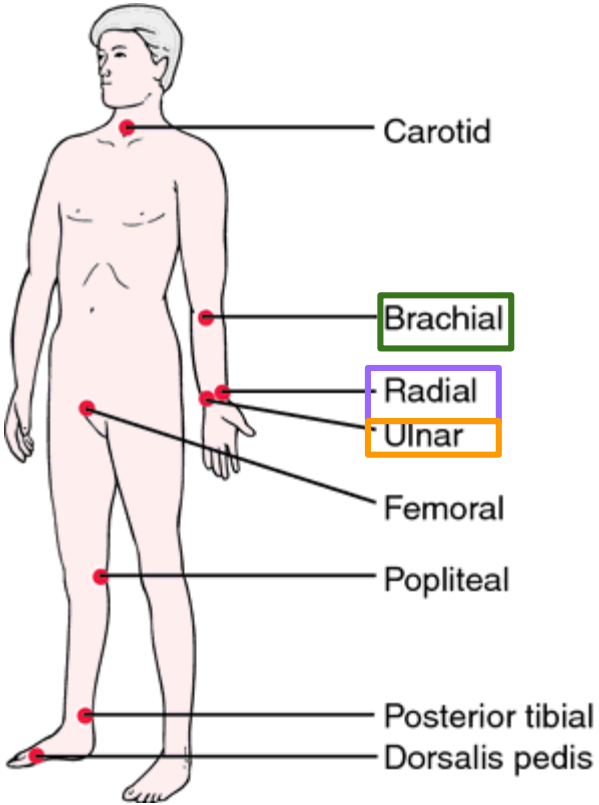
Located on the inside of the upper arm near the elbow, frequently used in place of carotid pulse in infants (brachial artery).

ULNAR PULSE

Located on the medial of the wrist (ulnar artery).

RADIAL PULSE

Located on the lateral of the wrist (radial artery). It can also be found in the anatomical snuff box.



Clinical significance

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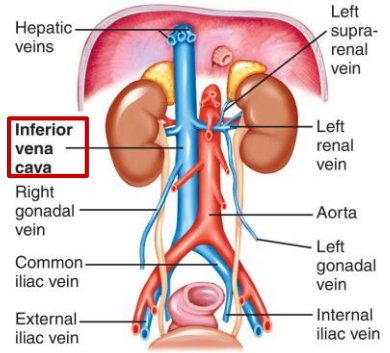
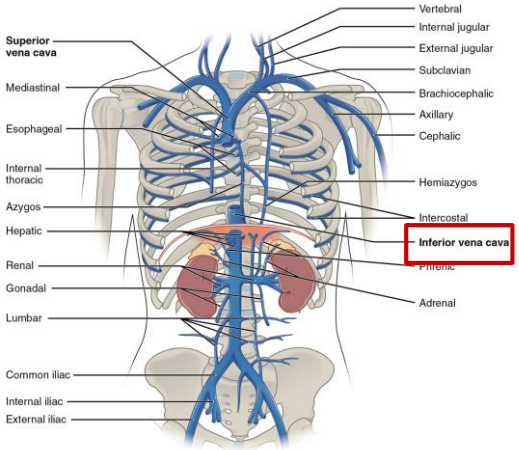
VENEPUNCTURE

- The practice of obtaining intravenous access. This can be for intravenous therapy or obtaining a blood sample.
- The main vein used in venipuncture is the median cubital vein.
- It is a superficial vein that is situated anteriorly at the cubital fossa region.
- It is commonly used due to its accessible and superficial position.

Inferior vena cava

- Drains most of the blood from the body **below the diaphragm to the right atrium.**
- Formed by the union of the two common iliac veins behind the right common iliac artery at the level of **the 5th lumbar vertebra.**
- Ascends on the right side of the aorta.
- Pierces the central tendon of diaphragm at the level of the **8th thoracic vertebra.**
- It is the **largest** vein in the human body.
- Travels up alongside abdominal aorta with blood from lower part of the body.

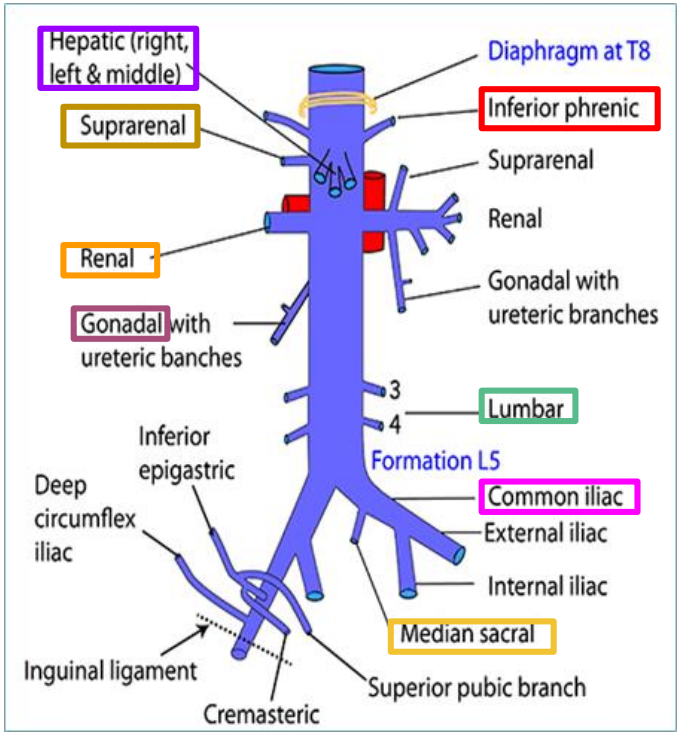




Tributaries of Inferior Vena Cava

IMPORTANT

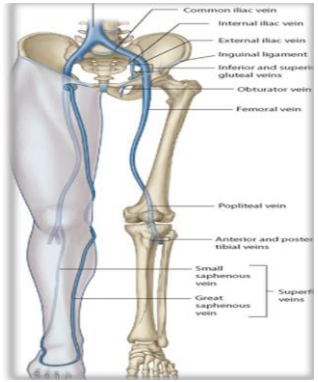
1. Two **common iliac** veins
2. Median **sacral** vein
3. Four paired **lumbar** veins
4. Right **gonadal** vein (the left vein drains into the **left renal vein)**
5. Paired **renal** veins
6. Right **suprarenal** vein (the left vein drains into the **left renal vein)**
7. **Hepatic** veins
8. Paired inferior **phrenic** veins.



Veins of lower limb

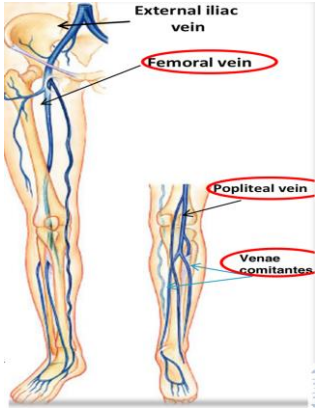
Superficial veins

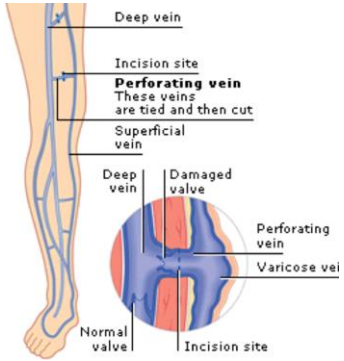
- Form a network in the **subcutaneous tissue.**
- Pattern is variable
- They are the *tributaries* of the:
  - **Great (long) saphenous vein**
  - **Small (short) saphenous vein**



Deep veins

- Comprise the **venae comitantes**, which accompany all the large arteries, usually in pairs.
- **Venae comitantes** unite to form the popliteal vein, which continues as the **femoral vein**.
- Deep veins *Receive* blood from **superficial veins** through **perforating veins.**
- Including:
  - o Anterior and posterior tibial veins
  - o Popliteal vein
  - o Femoral vein

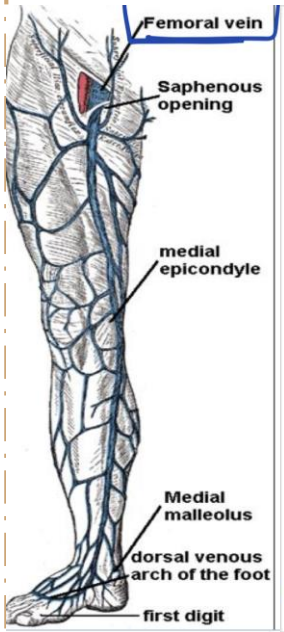


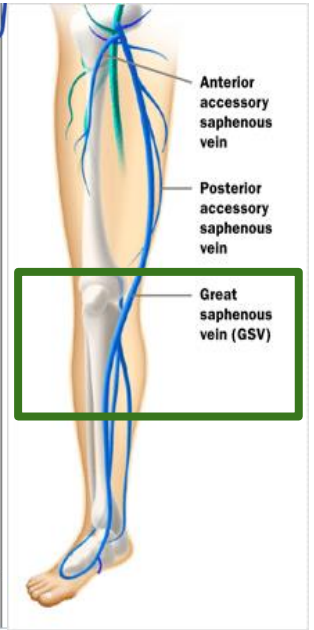


Superficial veins of lower limb

Great saphenous vein

- The longest vein
- **Begins** from the **medial end** of the dorsal venous arch of the foot
- Passes upward *in front* of the medial malleolus with the saphenous nerve.
- Then it ascends in accompany with the saphenous nerve in the superficial fascia over the medial side of the leg
- **Ascends** obliquely upwards, and lies *behind* the medial border of the patella.
- **Passes** *behind* the knee and curves forward around the medial side of the thigh.
- **Hooks** through the lower part of the saphenous opening in the deep fascia to join the **femoral vein** about 1.5 in. (4 cm) below and lateral to the pubic tubercle.





Superficial veins of lower limb

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Great saphenous vein

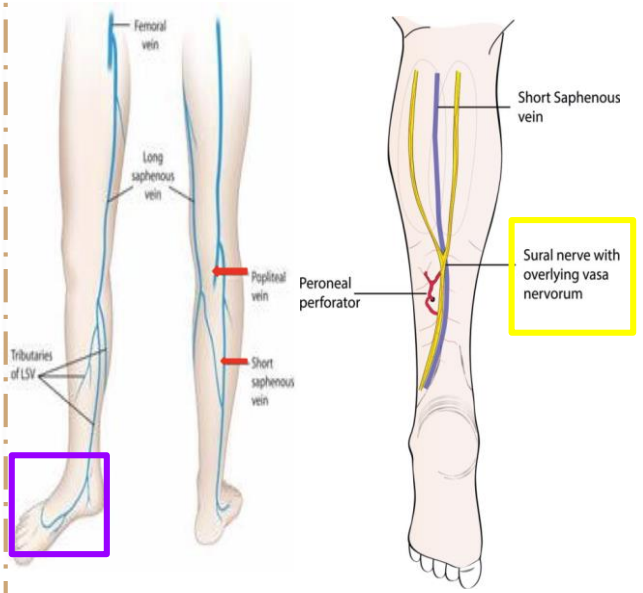
- It is **connected to** the **small saphenous vein** by one or two branches that pass behind the knee.
- It is **connected to** the **deep veins** by numerous perforating veins.
- The perforating veins have valves which allow blood flow from superficial to deep veins.
- It is ***clinically significant*** in coronary bypass surgery and in intravenous delivery of fluids due to venous collapse.
- **The great saphenous vein** is **used in** venous grafting and saphenous vein cutdown may be necessary for inserting the neddle or canula (take care of the saphenous nerve).

Superficial veins of lower limb

Small saphenous vein

- **Arises** from the *lateral end* of the dorsal venous arch.
- **Ascends** *behind* the lateral malleolus in company with the sural nerve.
- **Ascends** along the *lateral border* of the **tendocalcaneus** and then runs up to the *middle of the back of the leg.*

- Pierces the deep fascia in the lower part of the popliteal fossa
- **Drains into the popliteal vein**
- Has numerous valves along its course.
- Anastomosis freely with great saphenous vein



Veins of foot & leg

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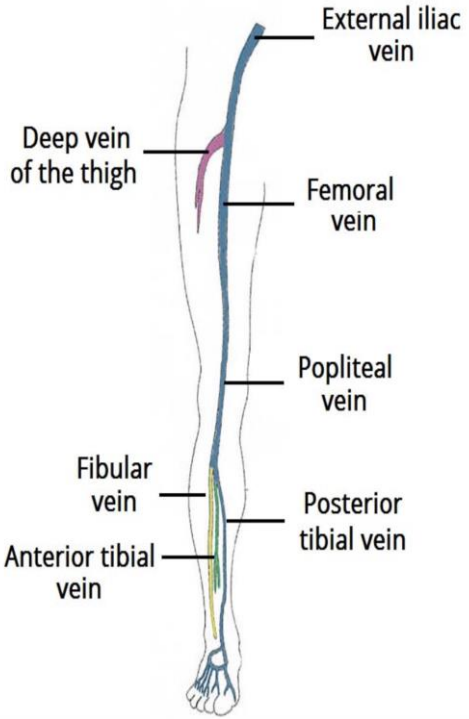
- The *plantar aspect of the foot*, **medial** and **lateral plantar veins** arise. These veins combine to form the posterior tibial and fibular veins.
- The **posterior tibial vein** accompanies the **posterior tibial artery**, entering the *leg posteriorly to the medial malleolus*.
- On the *posterior surface of the knee*, the **anterior tibial**, **posterior tibial** and **fibular veins** unite to form the **popliteal vein.**



Veins of foot & leg

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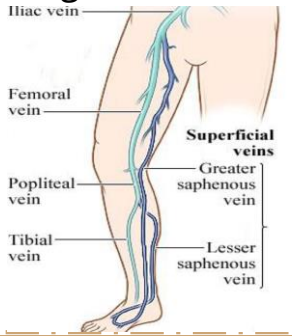
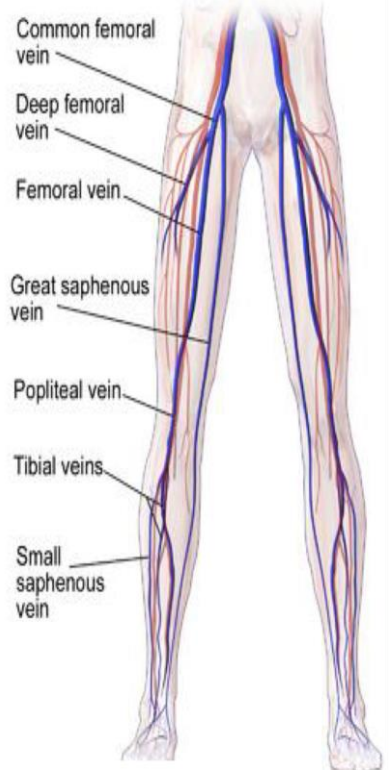
Popliteal vein

- Comprise the venae comitantes, which accompany popliteal artery.
- Formed by the unite of anterior, posterior tibial and fibluar veins.
- **Popliteal vein then continues as the femoral vein.**
- Receive blood from superficial through *perforating veins.*



Femoral vein

- The femoral vein is a blood vessel that accompanies the femoral artery in the femoral sheath.
- It is a continuation of the popliteal vein.
- **Ends** at the inferior margin of the inguinal ligament, where it becomes the **external iliac vein.**
- External iliac join internal iliac to form **common iliac veins**.
- Both right and left common iliac veins form **inferior vena cava** that drains the entire low part of the body.
- Inferior vena cava drains into ***right atrium.***



Pulse points in the lower limb

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FEMORAL PULSE

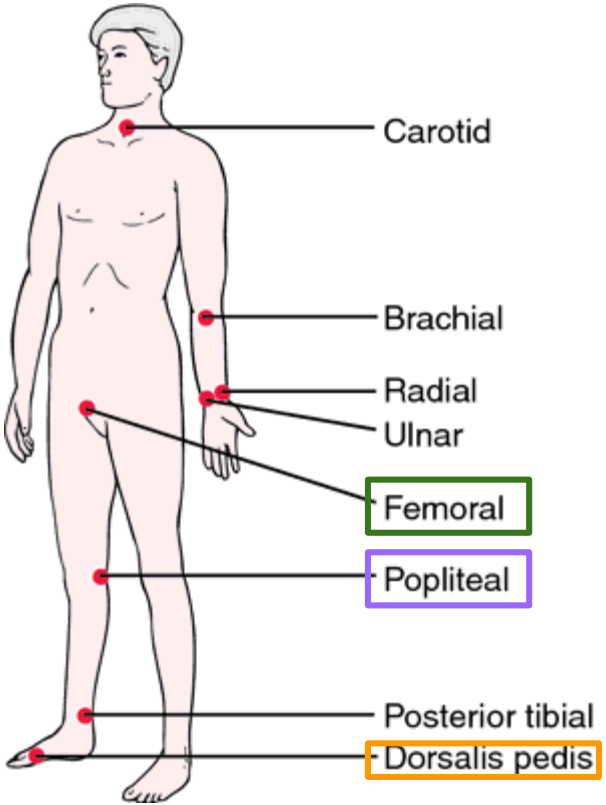
Located in the inner thigh, at the mid-inguinal point, halfway between the pubic symphysis and anterior superior iliac spine (femoral artery)

POPLITEAL PULSE

Located above the knee in the popliteal fossa. The patient bends the knee at approximately 124°, and the physician holds it in both hands to find the popliteal artery in the pit behind the knee (Popliteal artery).

DORSALIS PEDIS PULSE

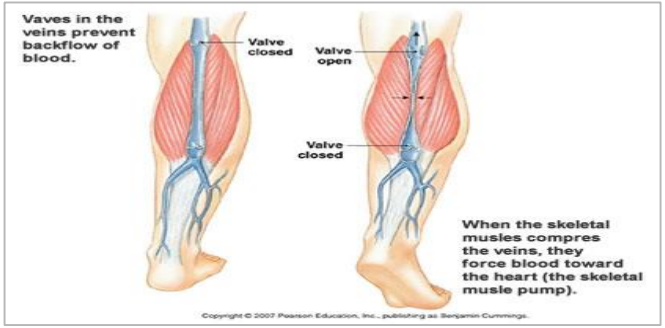
Located on top of the foot, immediately lateral to the extensor of hallucis longus (dorsalis pedis artery).



Mechanism of Venous Return from LL (FYI)

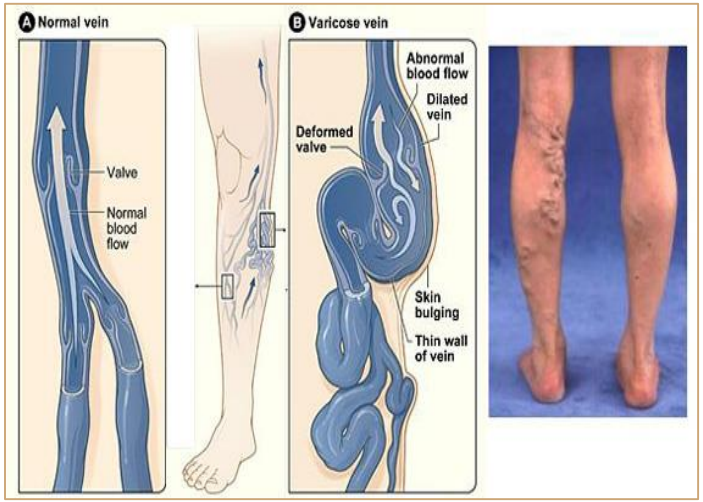
(FYI = for your information)

- Much of the saphenous blood passes from superficial to deep veins through the perforating veins.
- The blood is pumped upwards in the deep veins by the contraction of the calf muscles (calf pump).
- This action of calf pump is assisted by the tight sleeve of deep fascia surrounding these muscles.



Varicose Veins

- If the valves in the perforating veins become incompetent, the direction of blood flow is reversed and the veins become varicosed.
- Most common in posterior & medial parts of the lower limb, particularly in old people.



Factors aming blood return

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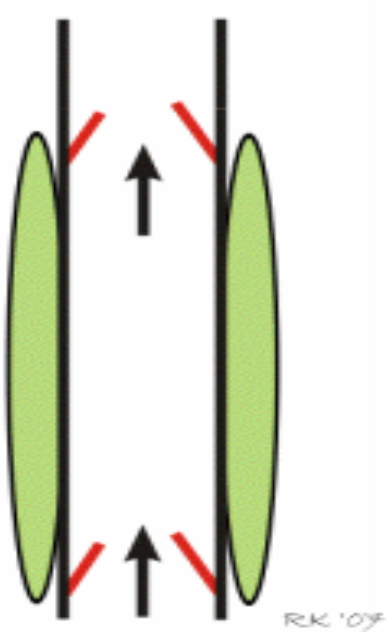
FACTORS AIMING BLOOD RETURN

- **Muscle Contraction:** rhythmical contraction of limb muscles as occurs during normal locomotory activity (walking, running, swimming) promotes venous return by the muscle pump mechanism.
- **Respiratory Pump:** during respiratory inspiration, the venous return increases because of a decrease in right atrial pressure.
- **Decreased Venous Compliance:** sympathetic activation of veins decreases venous compliance, increases central venous pressure and promotes venous return.
- **Gravity:** the effects of gravity on venous return seem paradoxical because when a person stands up hydrostatic forces cause the right atrial pressure to decrease and the venous pressure in the dependent limbs to increase.



Deep vein Thrombosis (DVT)

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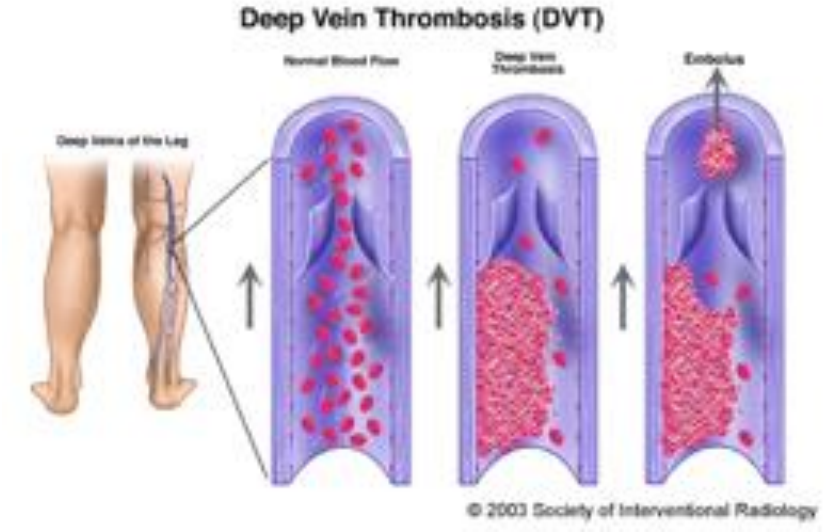
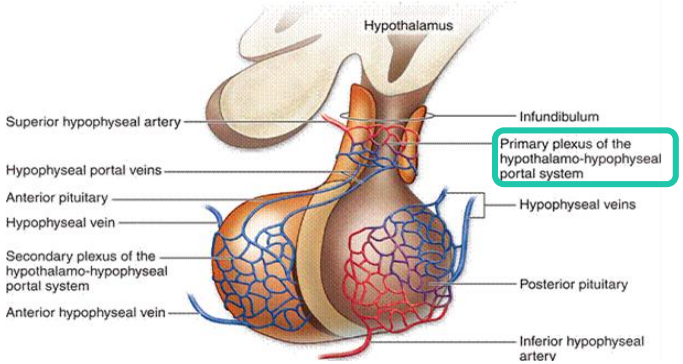
- Occurs when a blood clot (thrombus) forms in one or more of the deep veins in your body, usually in your legs. Deep vein thrombosis can cause leg pain or swelling, but may occur without any symptoms.
- Deep vein thrombosis is a serious condition because blood clots in your veins can break loose, travel through your bloodstream and lodge in your lungs, blocking blood flow (pulmonary embolism).

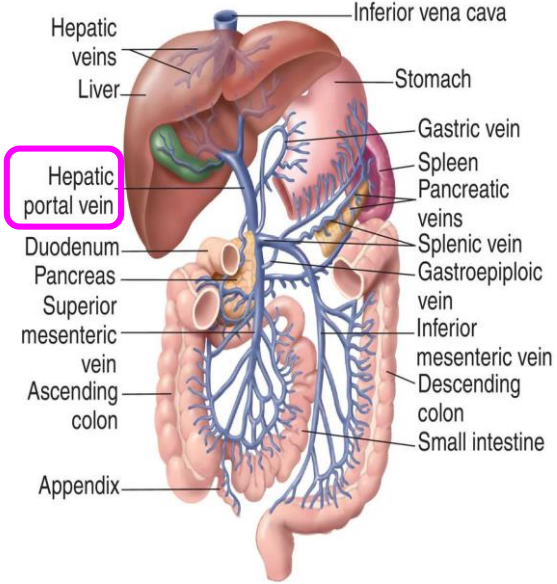


Portal Circulation

Portal Circulation

- A portal venous system is a series of veins or venules that directly connect two capillary beds (of arteriole & venule).
- Examples of such systems include the hepatic portal vein and hypophyseal portal system.

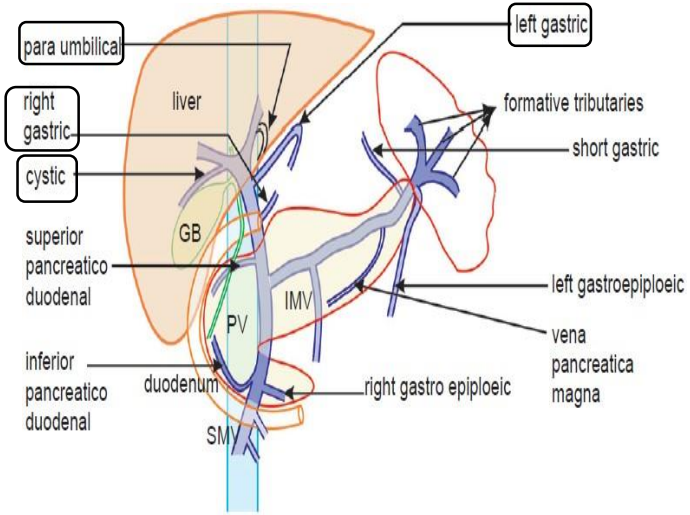




Hepatic Circulation

Hepatic Portal Vein

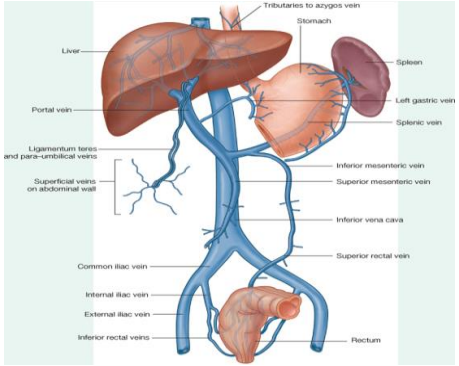
- Drains blood from the gastrointestinal tract and spleen to the liver.
- It is formed by the union of the superior mesenteric and splenic veins behind the neck of pancreas.
- Immediately before reaching the liver, the portal vein divides into right and left that enter the liver.
- **Tributaries:**
  - **Right** and **Left** Gastric veins.
  - **Cystic vein** from the gallbladder joins its right branch.
  - **Paraumbilical veins** that drain veins from anterior abdominal wall to the hepatic portal vein.

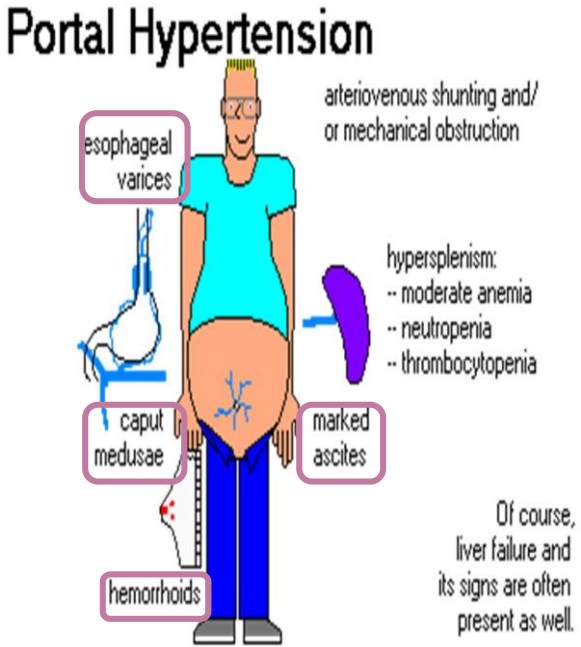


Portocaval Anastomosis

Portocaval Anastomosis

- A portocaval anastomosis (also known as portal systemic anastomosis) is a specific type of anastomosis that occurs between the veins of portal circulation and those of systemic circulation (IVC).
- The anastomotic channels become dilated (varicosed) in case of portal hypertension.





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Sites of Portocaval Anastomosis

Site	Portocaval Anastomosis		Associated condition
	Portal Vein	Systemic Vein	
Lower end of esophagus	Left gastric vein	Esophageal branch of azygos vein	Esophageal Varices
Lower part of rectum (or upper part of anal canal)	Superior rectal vein	Middle and inferior rectal vein	Hemorrhoids
Paraumbilical region	Paraumbilical veins	Superficial epigastric vein	Caput Medusae
Retroperitoneal	Colic veins	Veins of the posterior abdominal wall (retroperitoneal veins)	--
Patent ductus venosus (intrahepatic portosystemic shunt)	Umbilical vein + portal vein	Inferior Vena Cava	--
Patent ductus venosus (intrahepatic portosystemic shunt) : Portosystemic shunts may be congenital or may be acquired with diseases that cause portal hypertension. (Hepatomegaly, ascitis and signs of portal hypertension).			
Bare area of liver	There is some anastomosis between portal venous channels in the liver and azygous system of veins above the diaphragm.		

MCQs

(1) All veins carry deoxygenated blood except:

A) Pulmonary veins B) Umbilical vein

C) Jugular vein D) A+B

(2) Which one of the following is receiving the azygos vein?

A) Superior vena cava B) Inferior vena cava

C) Pulmonary veins D) Umbilical vein

(3) Which one of the following is not a superficial vein?

A) External jugular veins

B) Internal jugular veins

C) Anterior jugular veins

D) Posterior jugular veins

(4) Which one of the following is a tributary for the internal jugular vein ?

A) Anterior jugular vein

B) Transverse cervical vein

C) Occipital veins

D) Suprascapular vein

(5) Which one of the following is not a tributary for the inferior vena cava?

A) Median sacral vein B) Right gonadal vein

C) Inferior petrosal sinus D) Hepatic veins

MCQs

(6) If the valves in the _____ become incompetent, the direction of blood flow is reversed and the veins become varicose:

A) Femoral vein B) Perforating veins
C) Popliteal vein D) Small Saphenous Vein

(7) Which one of these factors decrease the venous pressure?

A) Gravity
B) Decreased Venous Compliance
C) Muscle contraction
D) Respiratory pump

(8) Cystic vein joins _____ of portal vein?

A) Left branch B) Right branch
C) A+B D) None of them

(9) The anastomotic channels of portocaval become dilated (varicose) in case of:

A) Portal hypertension B) Hypertension
C) Portal hypotension D) Hypotension

(10) Where is the anastomosis between portal venous channels in the liver and azygous system of veins above the diaphragm?

A) Lower part of rectum
B) Retroperitoneal
C) Lower end of esophagus
D) Bare area of liver

Answers

(1) D
(2) A
(3) B
(4) C
(5) C
(6) B
(7) A
(8) B
(9) A
(10) D

Team Members

Team leader: Faisal Fahad Alsaif

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Abdulelah Aldossari
Abdulrahman Alduhayyim
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Abdulaziz Al-drgam
Ali Alammari
Saleh Almoaiqel
Majed Aljohani

Team leader: Rawan Mohammad Alharbi

Abeer Alabduljabbar
Afnan Almustafa
Ahad Algrain
Albandari Alshaye
AlFhadah alsaleem
Ghaida Alsanad
Lojain Azizalrahman
Majd AlBarrak
Maha barakah
Nouf Alotaibi
Rinad Alghoraiby
Wejdan Albadrani