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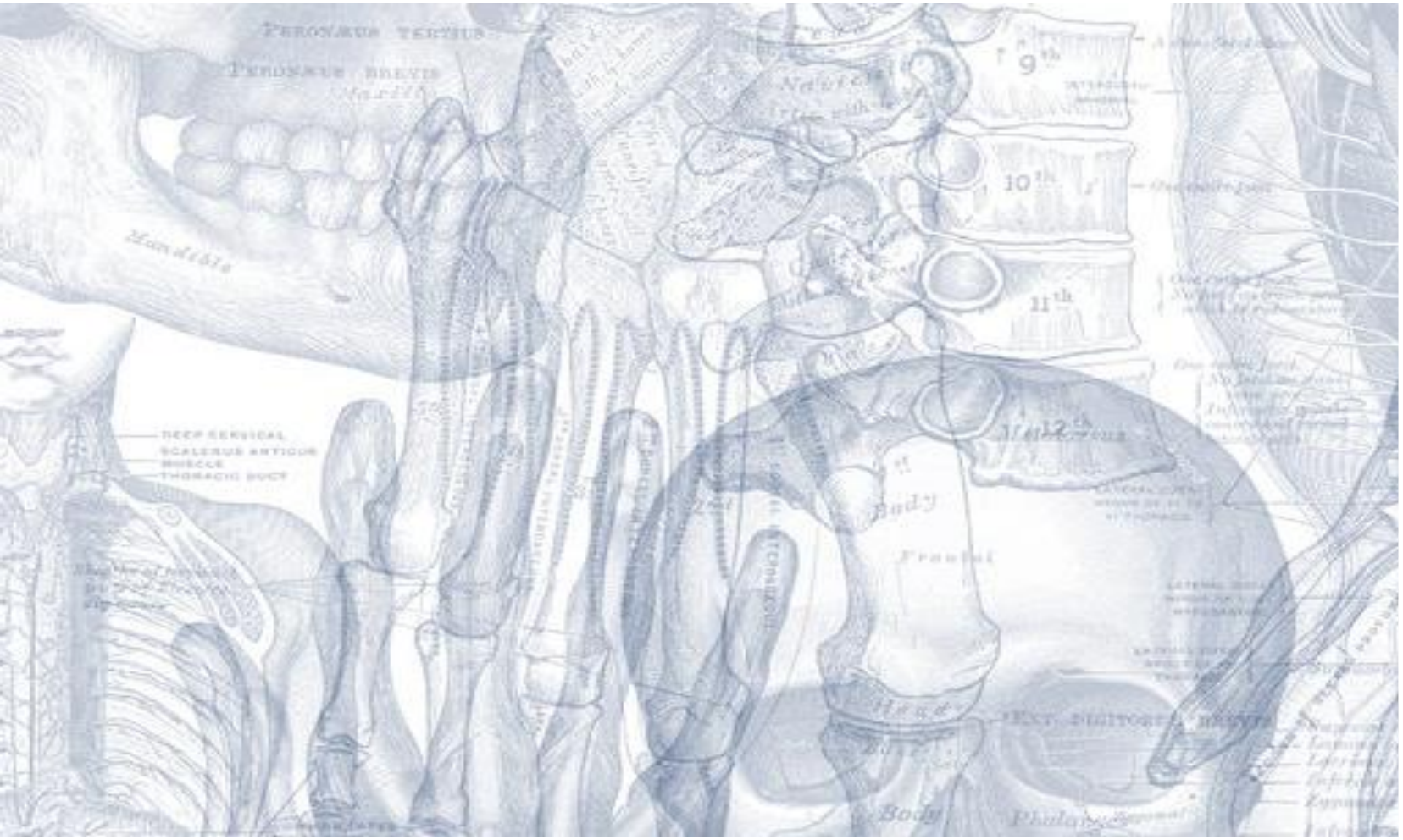


ANATOMY
TEAM 436

436
MEDICINE
KING SAUD UNIVERSITY

Revised by
شوق الأحمري & طراد الوكيل

Vasculature of Lower Limb

Editing File

Color Code

- Important
- Doctors Notes
- Notes/Extra explanation

Objectives

- List the main arteries of the lower limb.
- Describe their origin, course distribution & branches.
- List the main arterial anastomosis .
- List the sites where you feel the arterial pulse.
- Differentiate the veins of LL into superficial & deep
- Describe their origin, course & termination and tributaries
- Some related clinical points

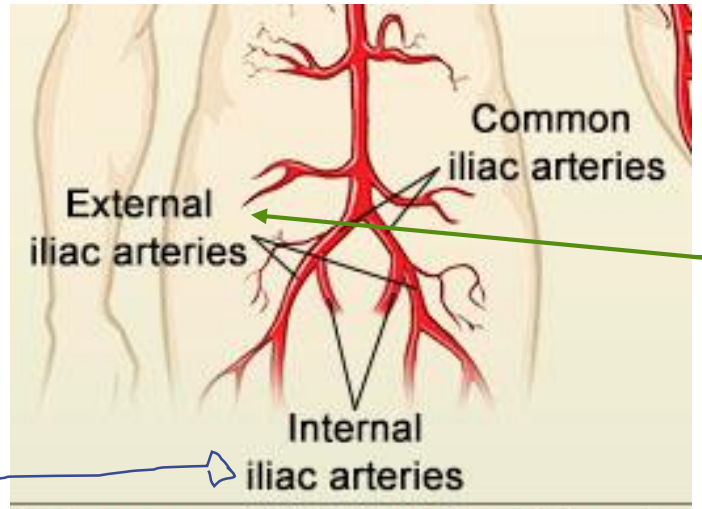
Overview of the lecture:

Arteries

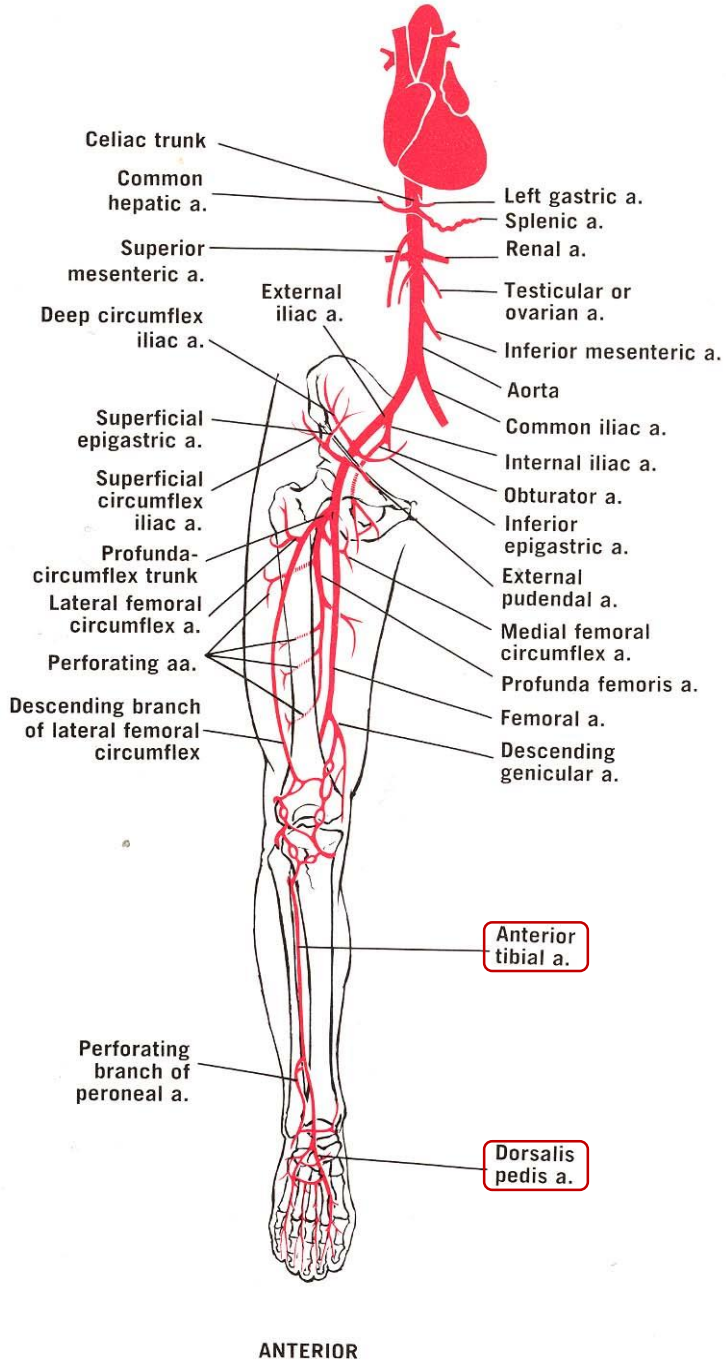
Veins

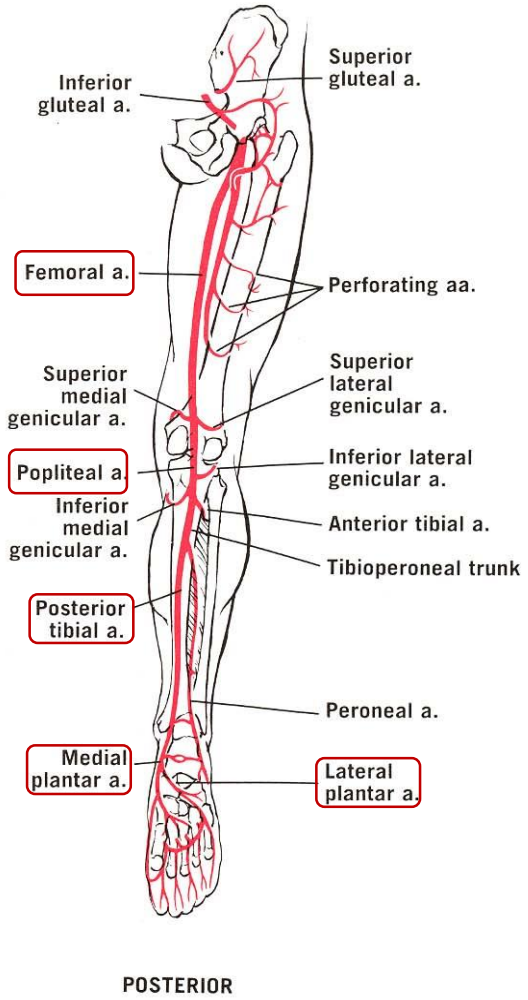
Arteries Of Lower Limb

Extra



The common iliac arteries bifurcate into the external and internal iliac arteries, which supply blood to the pelvic region and the legs.(Lower limp)





Femoral Artery

It is the main arterial supply to the lower limb.

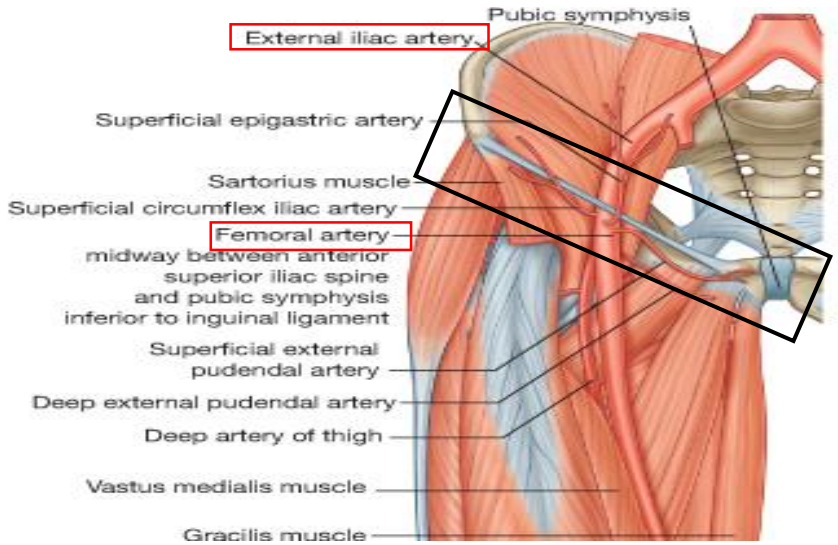
Origin:

It is the continuation of the **External iliac artery.**

Beginning:

How does it enter the thigh?

Behind the inguinal ligament (it is btw *anterior superior iliac spine & pubic tubercle)*, midway at the midinguinal point (هنا يصبح اسمه Femoral a) between *the anterior superior iliac spine* and the *symphysis pubis*.

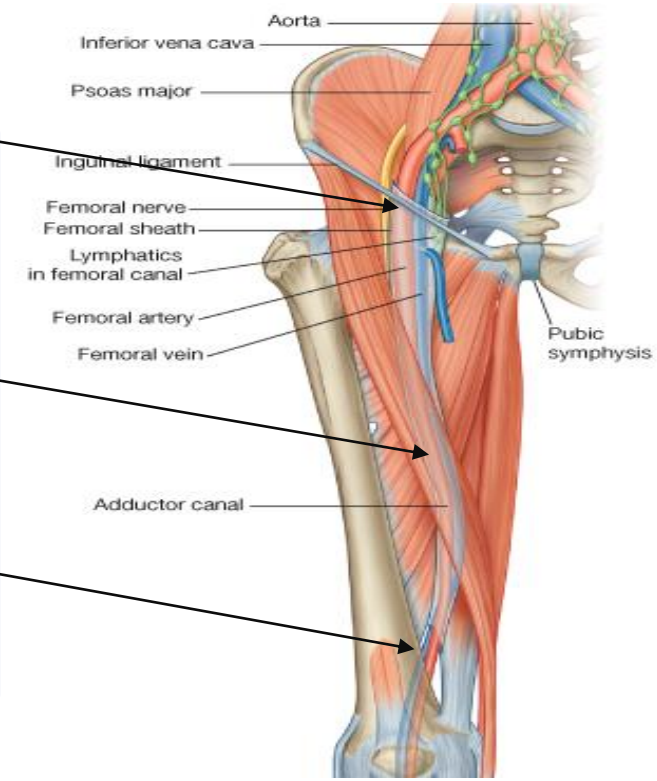


Femoral artery /vein

At the inguinal ligament:
The vein lies medial to the artery.

At the apex of the femoral triangle:
The vein lies posterior to the artery.

At the opening in the adductor magnus:
The vein lies lateral to the artery



Termination

The ***femoral*** artery terminates(ينتهي) by passing through the Adductor Canal (deep to sartorius)

It exits the canal by passing through **the Adductor Hiatus** (& enters popliteal fossa) and becomes the Popliteal artery.

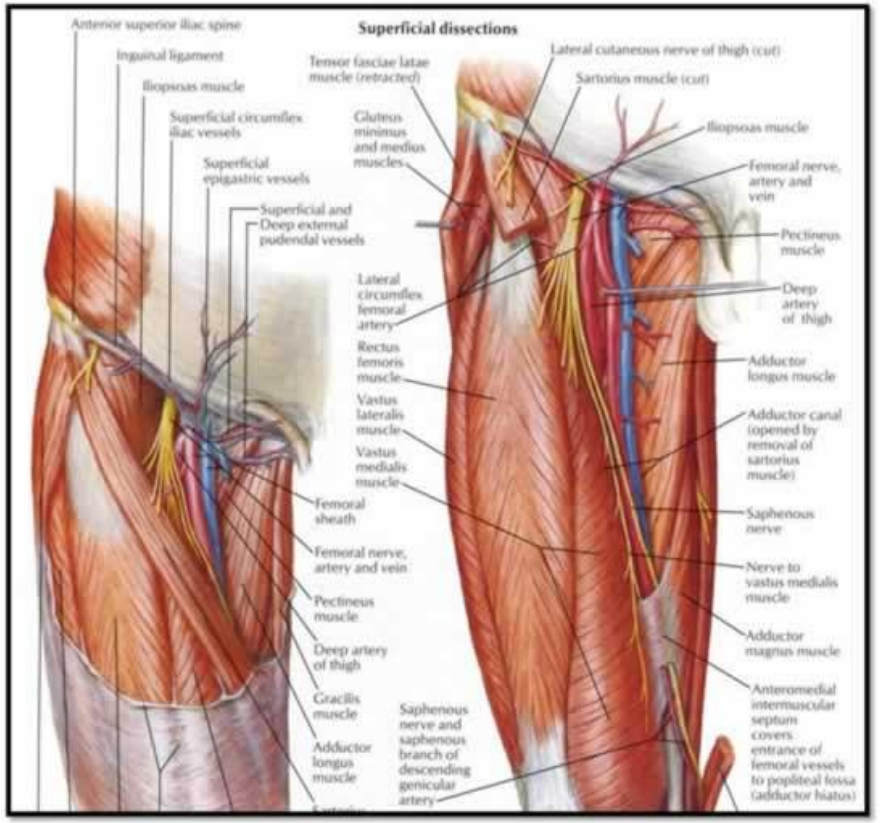
Femoral Artery

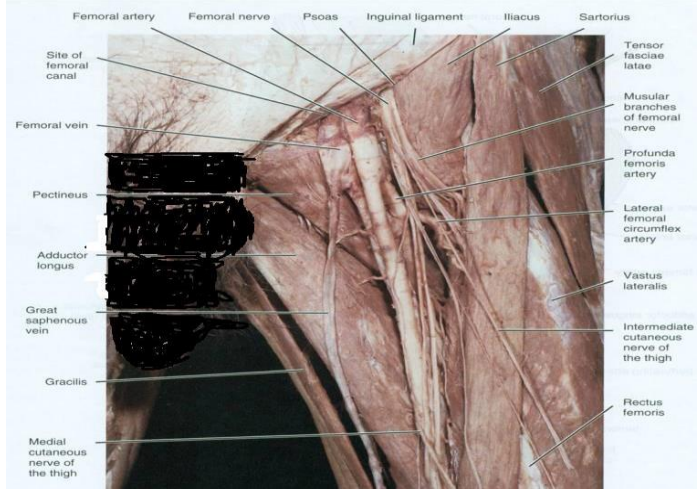
Relation

Upper part: Skin & fascia.(its superficial)
Lower part: Sartorius.

Relations (in the femoral triangle)

- **Anteriorly**
- **Laterally** — Femoral nerve and its branches
  "VAN" from medial to lateral
- **Medially** — Femoral vein
- **Posteriorly** — Psoas (separates it from the hip joint), Pectineus & Addcutor longus





Femoral Artery
Branches

*3 superficial and 2 deep

Where the internal Genitalia gets its supply from branch (Superficial internal Pudendal & Deep internal Pudendal) of internal iliac artery

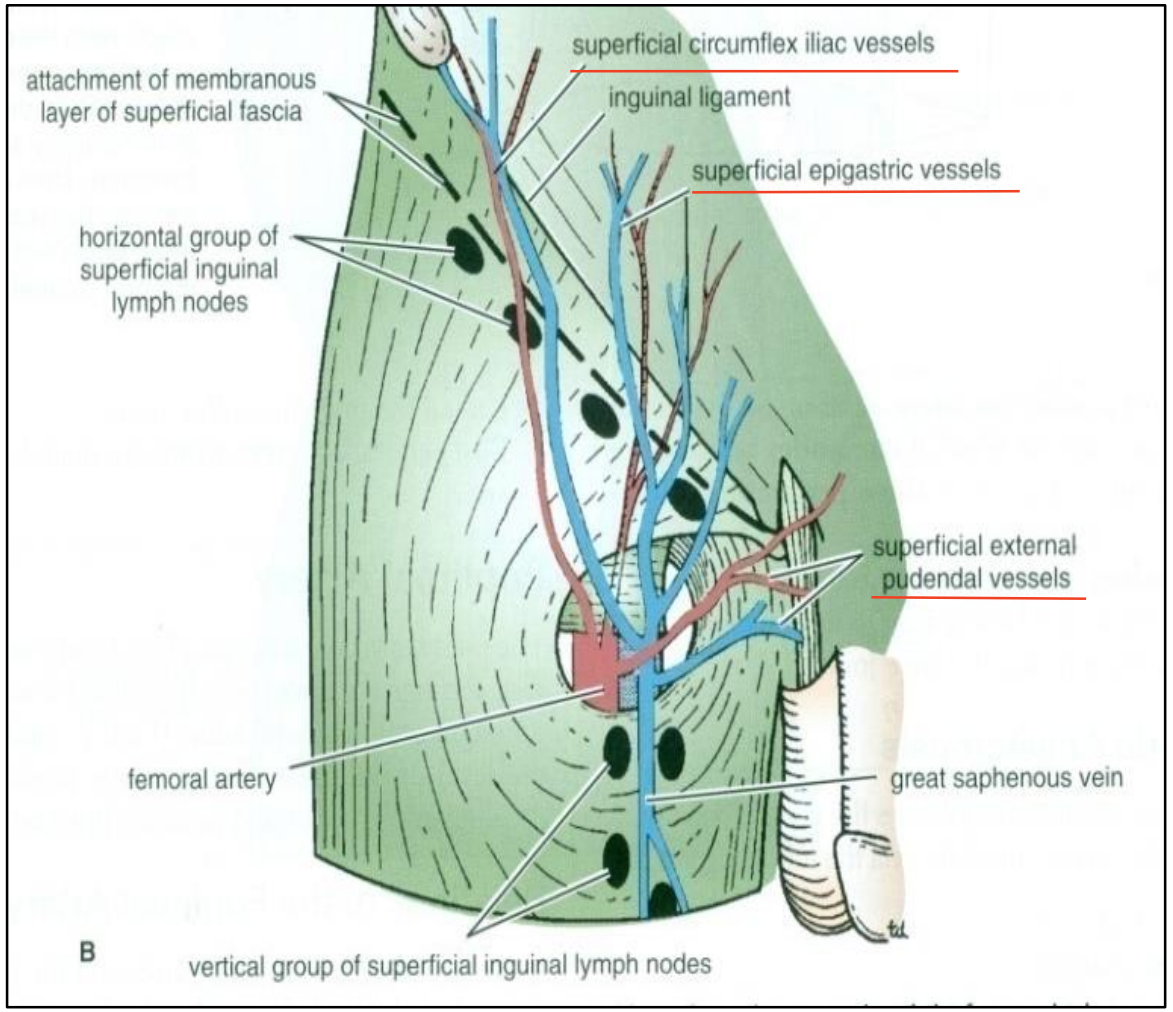
The femoral artery supplies:
Lower abdominal wall, Thigh & External Genitalia, through the following branches:

1. Superficial Epigastric.(supply Lower abdominal wall)
2. Superficial Circumflex iliac.(passing upward & lateral)+(supply Lower abdominal wall)
3. Superficial External Pudendal.
4. Deep External Pudendal.

(supply External Genitalia)

5. **Profunda Femoris** (Deep Artery of Thigh)

أهم وأكبر تفرع^
يتفرع منه lateral side
Then pass behind it to be medial and supply the medial side of thigh



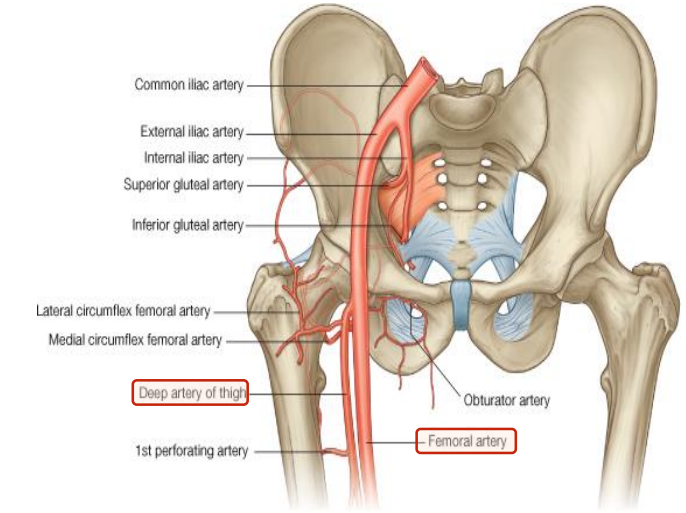
Pudendal = of or relating to or near the pudendum(الفرْج)

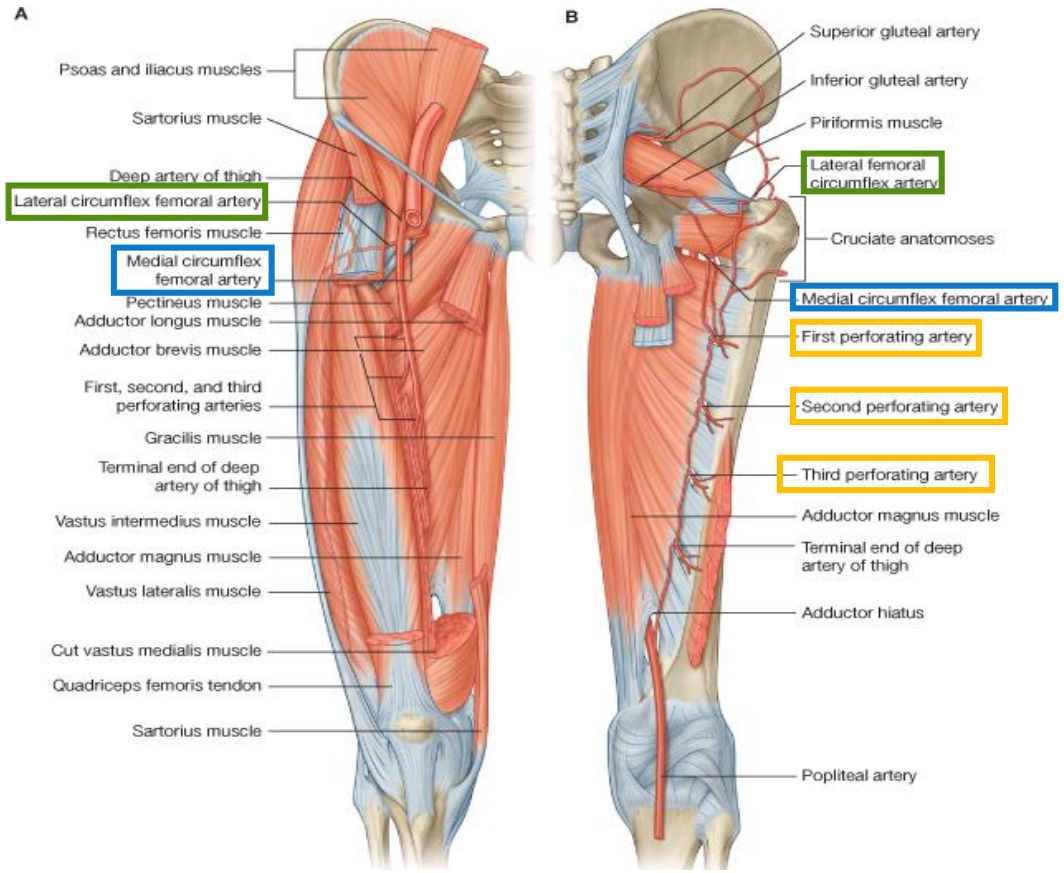
Branches Of Femoral Artery:

Profunda Femoris Artery:

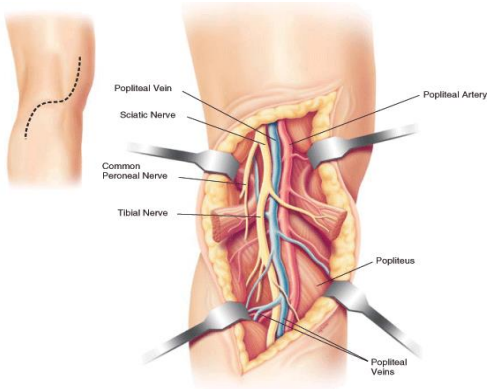
عشانه مهم وكبير ندرسه بالتفصيل

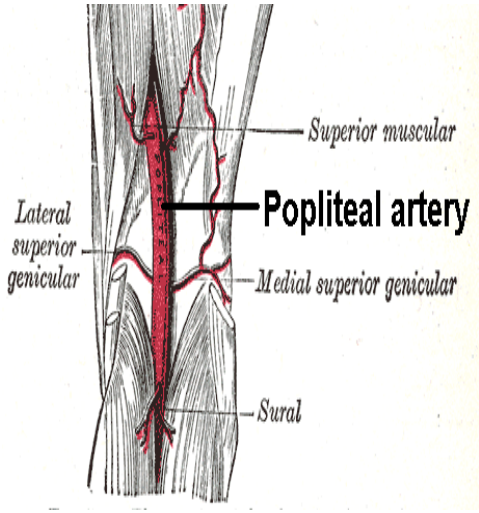
- It is an important**, large artery to the medial compartment of the thigh.** It is the main arterial supply to the thigh.
- Arises from the lateral side of the femoral artery(4cm below the inguinal ligament).
- It Passes ***medially behind*** the femoral vessels.
- Branches:
  - Medial & Lateral circumflex femoral arteries.
  - Three Perforating arteries. The **perforating arteries**, usually three in number, are so named because they **perforate(pierce)(تثقب-تخترق)** the tendon of the Adductor magnus to reach the back of the thigh.
  - It ends by becoming the 4th perforating artery.





Popliteal Artery





- **It is the continuation of Femoral artery.**
- **It enters the Popliteal fossa through an opening in the Adductor Magnus.**

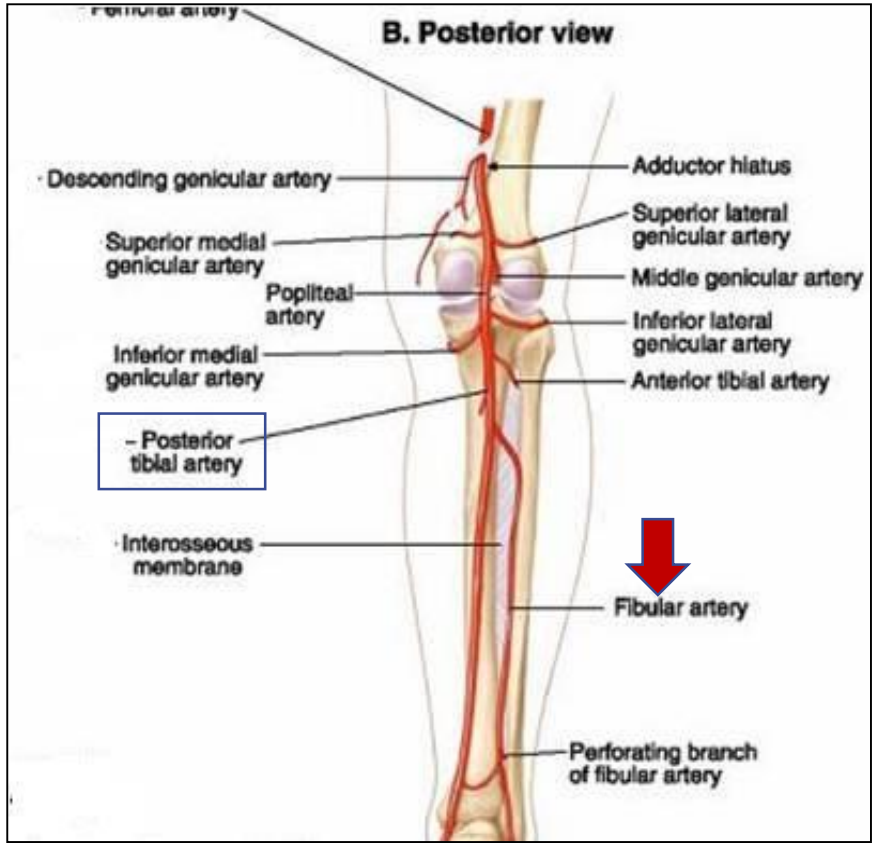
- Is a It is the deepest structure in the Popliteal Fossa (posterior to the Popliteal Vein & Tibial Nerve)

Remember: Tibial Nerve is the most superficial structure here

عشان كذا الواحد ممكن يتعور في التيبيل نيرف بس ما يكون فيه نزيف

ولما يكون فيه كسر في الجزء السفلي من الفيمر احتمال كبير يقطعه, فلما احد ينكسر في هذا المكان لازم محد يحركه وينقل علطول للمستشفى

- it runs close (the closest structure) to the capsule of the knee joint.



- Termination:

It Ends At the lower border of Popliteus muscle, it dividies into:

➢ *Anterior* and *Posterior Tibial Arteries.*

Popliteal Artery

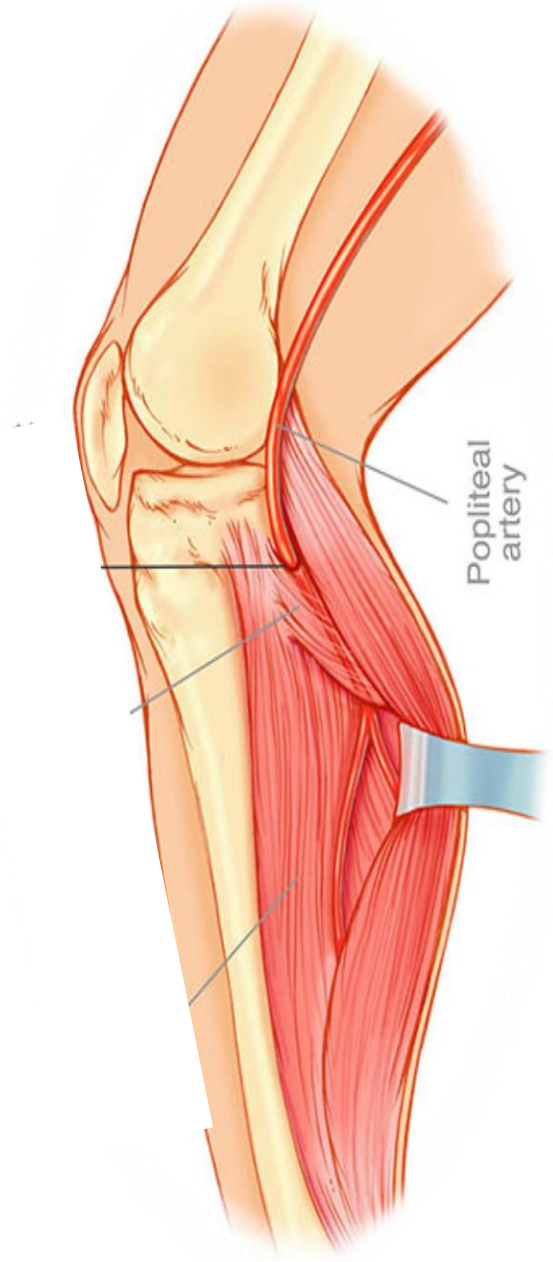
Relations:

Anterior:

- Popliteal surface of the femur.
- Knee joint.
- Popliteus muscle.

Posterior:

- Popliteal vein.
- Tibial nerve.
- skin and fascia.



Popliteal Artery

Branches (before Termination):

- **Muscular: (+articular to the knee joint)**

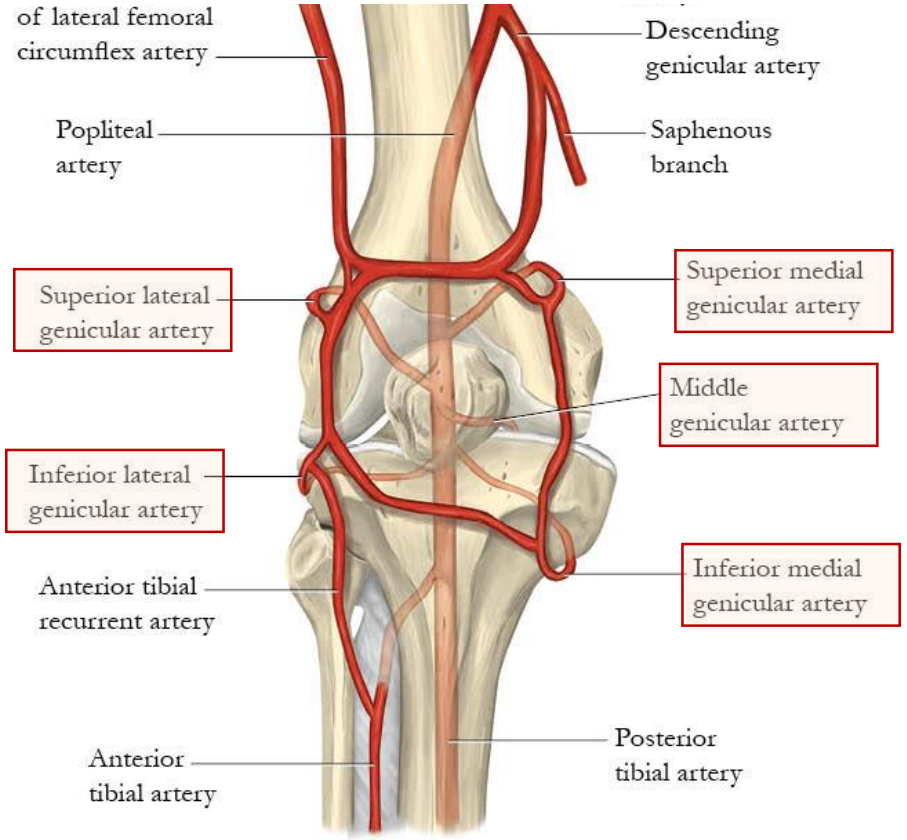
  Five Genicular* branches to the articular capsule and ligaments of the knee joint.

- **Genicular Anastomosis:**

  Formed from the Five genicular branches of the popliteal artery.

  It is an important anastomosis around the knee.

  هنا أهميتها It compensates (يعوض) for the narrowing of the Popliteal artery during prolonged flexion of the knee. مثل الجلسة بين السجدتين في الصلاة



Anterior view

*Genicular means related to the knee

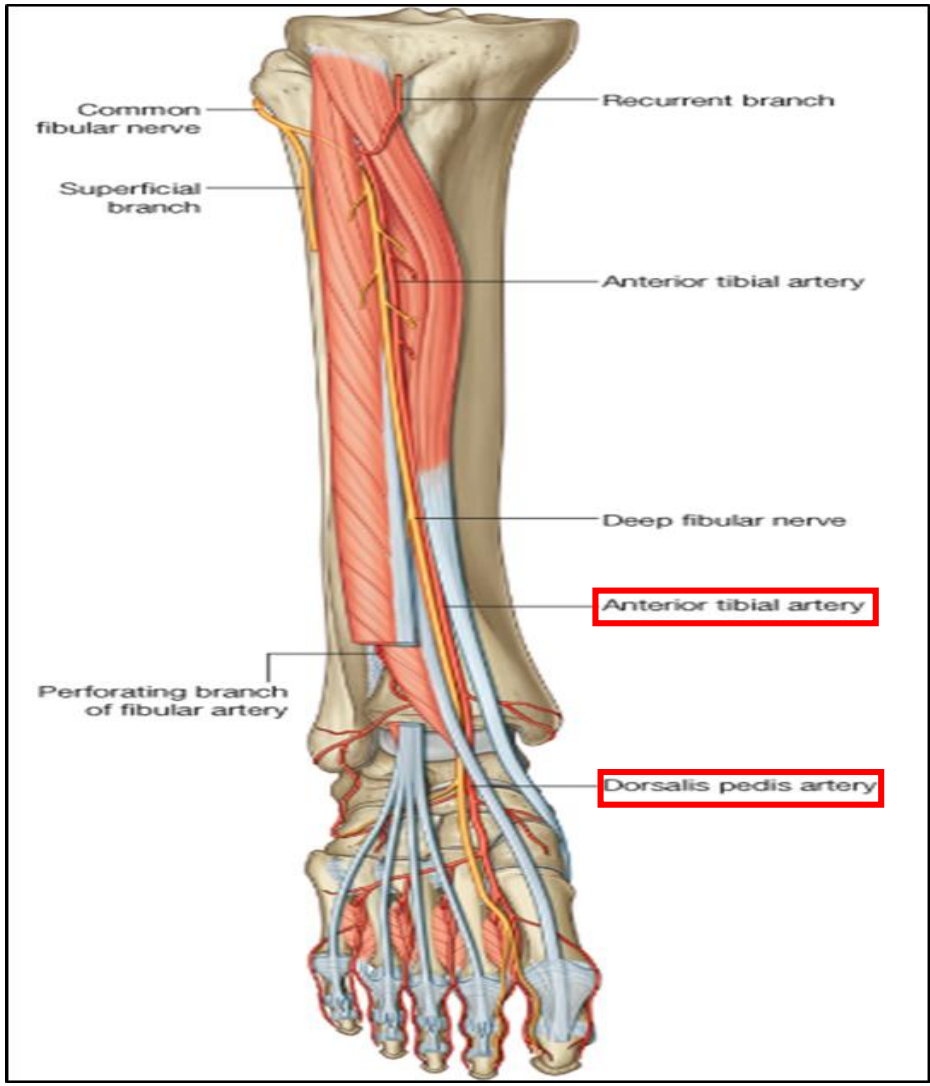
لكن د.جميلة قالت أن معناها شيء له علاقة بالمفاصل عموماً

Anterior Tibial Artery:

- It is the **smaller** of the two terminal branches of the popliteal artery.
- It enters the **anterior** compartment of the leg through an opening in the upper part of the interosseous membrane). Where it descends with (company with) the Deep Peroneal nerve.
- It supplies structures in the *Anterior Compartment* of the Leg & Dorsum of foot.
- In its upper part, it is Deep.
  In its lower part, it is Superficial (in front of the lower end of the tibia)
- Branches:

Muscular& Anastomotic

- It ends at the ankle joint midway between the malleoli where it becomes the Dorsalis Pedis artery



Pedis = foot

Dorsalis Pedis Artery:

***A diminished dorsalis pedis pulse usually suggests vascular insufficiency resulting from arterial disease**

- *It is the main source of blood supply to the toes.*
- Begins in front of ankle joint as a continuation of the Anterior Tibial artery.
- It is superficial in position.
- Crossed by the inferior extensor retinaculum and the first tendon of extensor digitorum brevis.
- Medially:

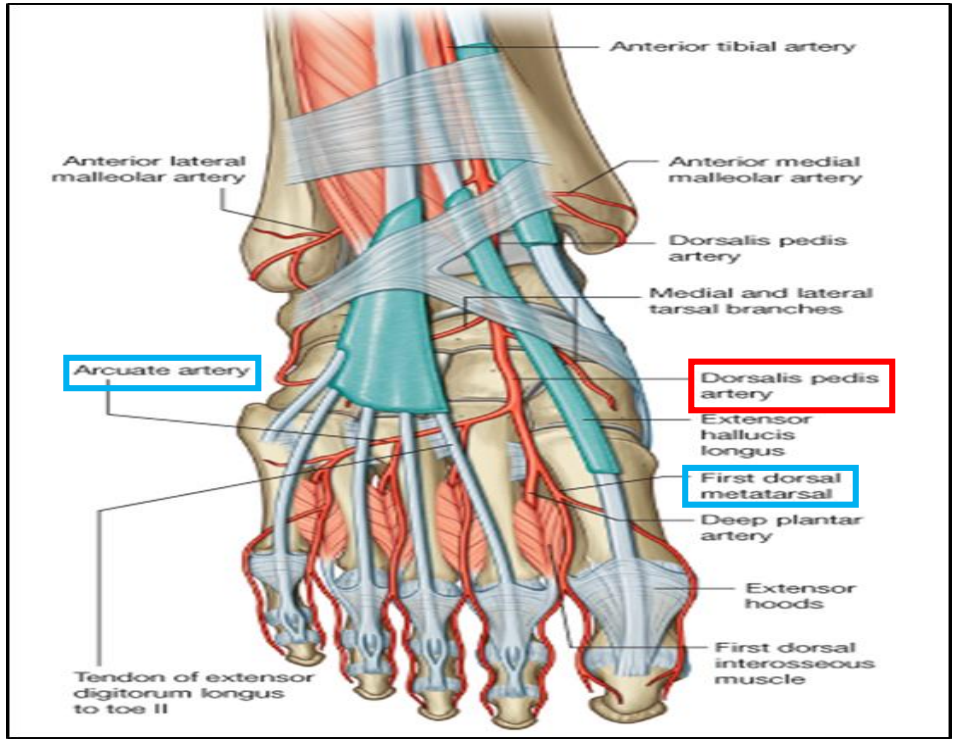
Tendon of extensor hallucis longus.

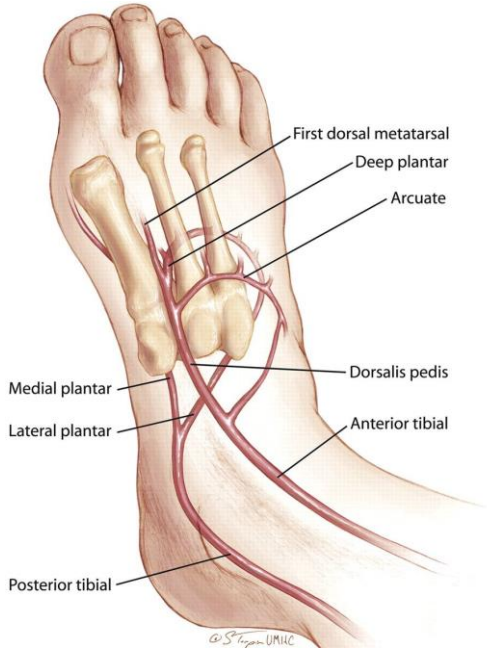
- Laterally:

1.Deep peroneal nerve

2.extensor digitorum longus.

- It Terminates by passing between the two heads of *the 1st dorsal interosseous* muscle*. Where it divides into deep plantar artery and 1st dorsal metatarsal artery (to the sole to join the plantar arch) and the first dorsal metatarsal artery.
- It joins the *Lateral plantar artery* to complete the *Plantar Arch*.
- Branches:
  - *1.Lateral tarsal artery.*
  - *2.Arcuate artery*. (to make Arcuate arch)
  - *3.1st dorsal metatarsal artery.*





*interosseous = بين العظام

Posterior Tibial Artery:

The **larger** terminal branch of the popliteal Artery. provides the main blood supply to the **Posterior**(+lateral) compartment of the Leg & **Sole** of the Foot.

Above: lies on the posterior surface of Tibialis Posterior.

Below on the posterior surface of Tibia.

Its lower part is covered by Skin & Fascia only.

Passes Behind Medial Malleolus , Deep to Flexor Retinaculum .

Terminates by dividing into: Medial & Lateral plantar arteries.

Branches:

1. Peroneal (Fibular) artery:

large artery, descends behind the fibula (the largest and most important branch of the lateral compartment of the leg).

It gives :

1. Nutrient artery to the fibula.
2. Muscular branches.
3. Perforating branch to lower part of front of leg.
4. Shares in the Anastomosis around the ankle joint.

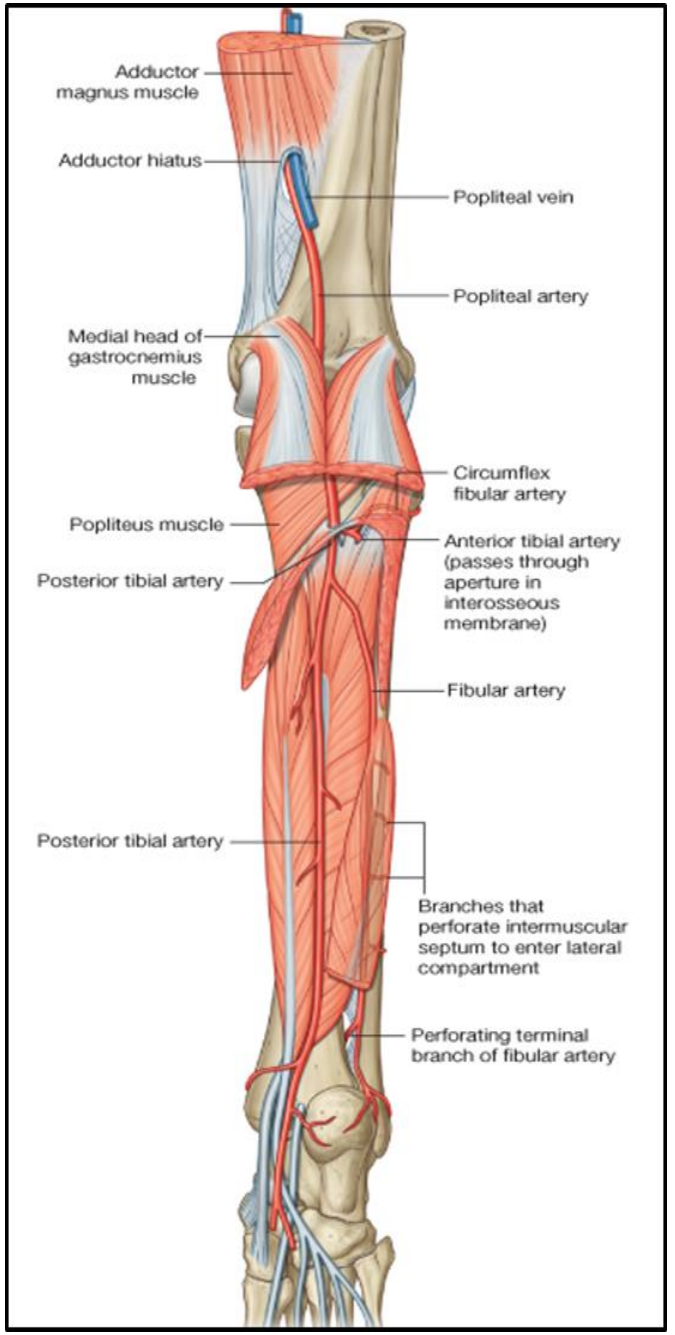
2.Nutrient* artery to the tibia**.** (the largest nutrient artery of the body). Each bone in the body has nutrient artery

3. Calcaneal arteries: supply the Heel. لما يقع شخص من ارتفاع وينكسر الكعب ما يحتاج يجبسونه لأنه غني بالبلود سبلاي

4. Anastomotic branches to anastomosis around ankle joint.

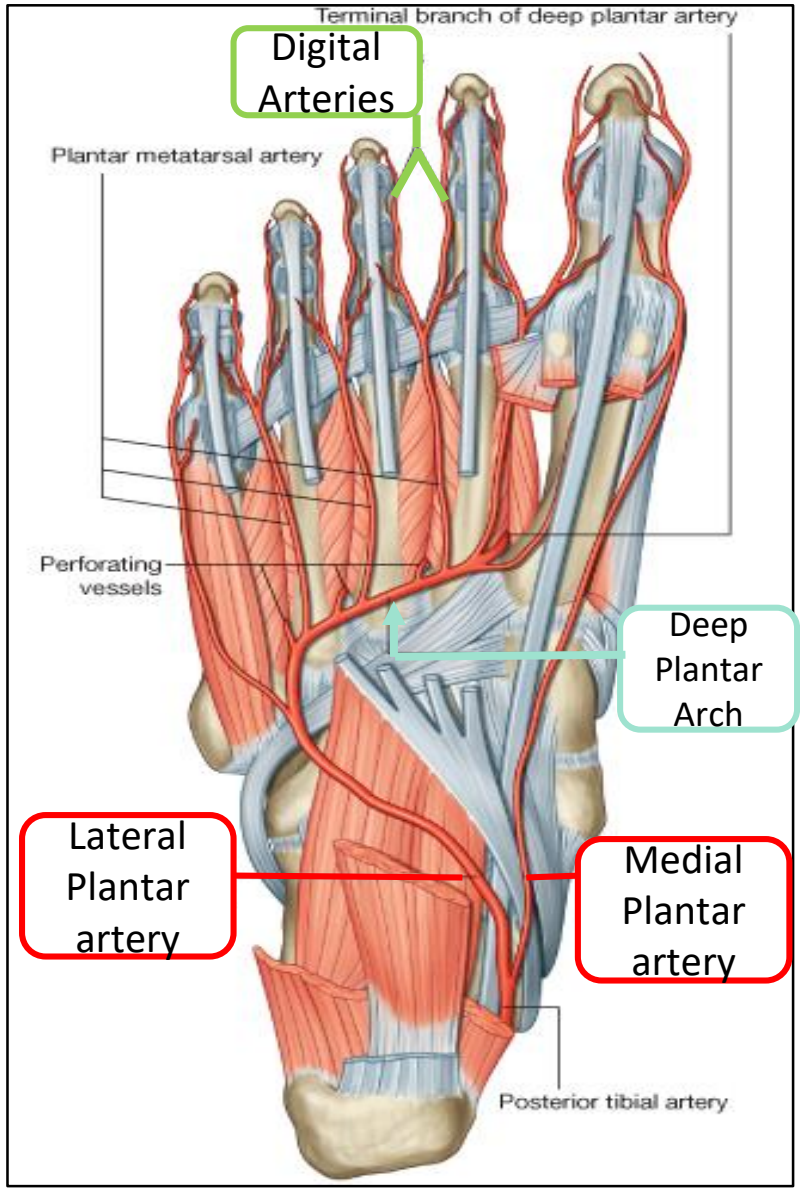
5. Medial & Lateral plantar arteries.

*Nutrient= أي ارتري داخل لعظم يغذيه



Lateral Plantar Artery:

- The ***larger*** terminal branch of the posterior tibial artery.
- ***At the base of the 5th metatarsal bone,*** it curves ***medially*** to form the Plantar Arch.
- Which Joins the *Dorsalis pedis* artery at the proximal end of the 1st intermetatarsal space.
- Plantar arch is completed by *lateral plantar artery and* branch from *dorsalis pedis artery.*
- Branches: Muscular, Articular and Cutaneous.
- The Plantar Arch gives Plantar Digital Arteries. + planter metatarsel
- The arch supplies the skin, fascia and muscles in the sole and plantar digital arteries to the adjacent digits .



Helpful video

Medial Plantar Artery:

- The smaller terminal branch of the posterior tibial artery.
- Arises **beneath** the Flexor Retinaculum.
- Ends by supplying the medial side of the big toe.It supplies mainly the muscles of the great toe, and gives most of plantar digital arteries.
- Its superficial branch ***supplies the skin of the medial side of the sole (***of the big toe)***.***
- ***Branches:*** Muscular, Articular and Cutaneous.

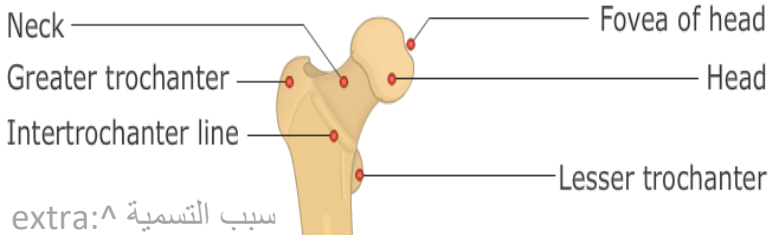
Remember: Arcuate arch in the dorsum of foot
Plantar arch In the sole of foot

Arterial Anastomosis:

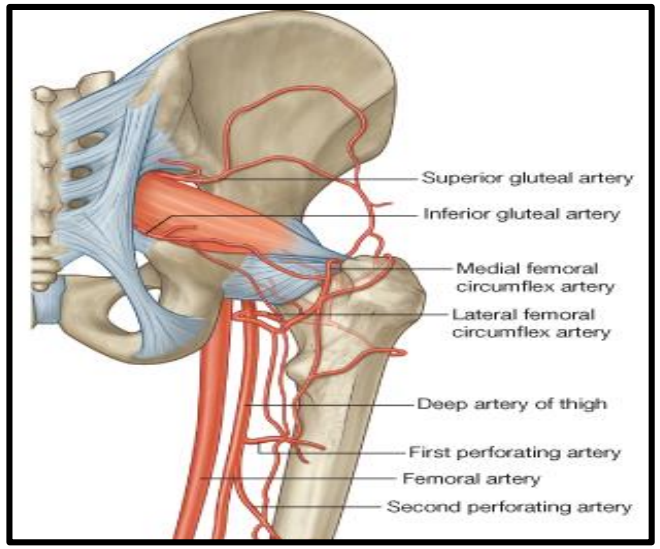
*Note: cruciate means they are arranged in a cross/plus sign

TROCHANTERIC

(supplies the head and neck of femur) هنا أهميته



extra:^ سبب التسمية



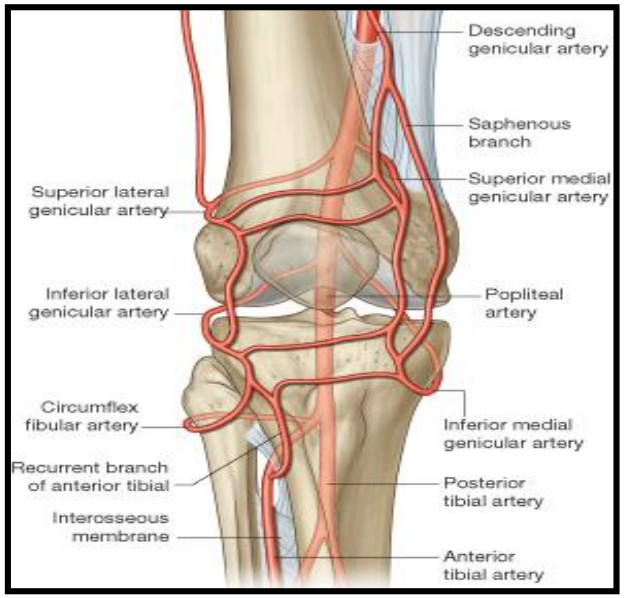
1. Superior gluteal.
2. Inferior gluteal.
3. Medial circumflex femoral.
4. Lateral circumflex femoral

د.جميلة تقول بس رقم 3 و 4 في هذا الانستموزز

Genicular Anastomosis:

Around the knee

أهميتها It compensates for the narrowing of the Popliteal artery during prolonged flexion of the knee.

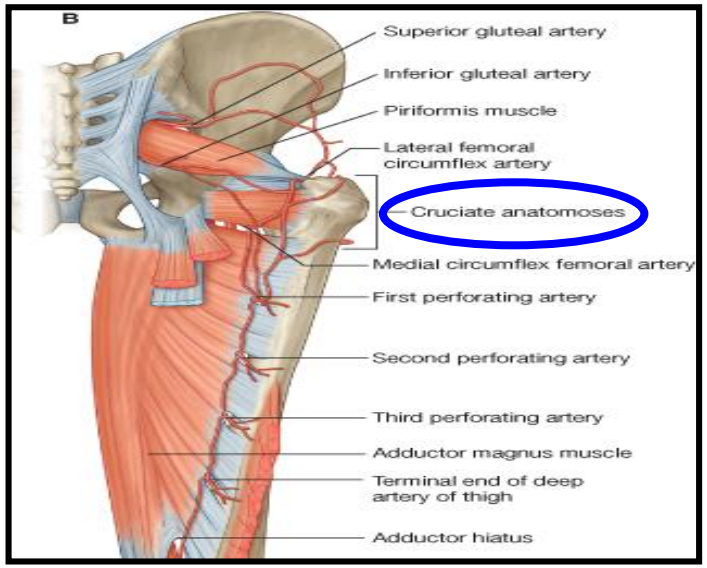


Formed from the Five genicular branches of the popliteal artery.

Cruciate*

Provides connection between Internal iliac and Femoral arteries (external iliac).

(It supplies blood to the lower limb in case of ligation of the femoral artery) هنا أهميته



1. Inferior gluteal. ← (تحت)
2. Medial circumflex femoral. ← يمين
3. Lateral circumflex femoral. ← يسار
4. First perforating ← (فوق)

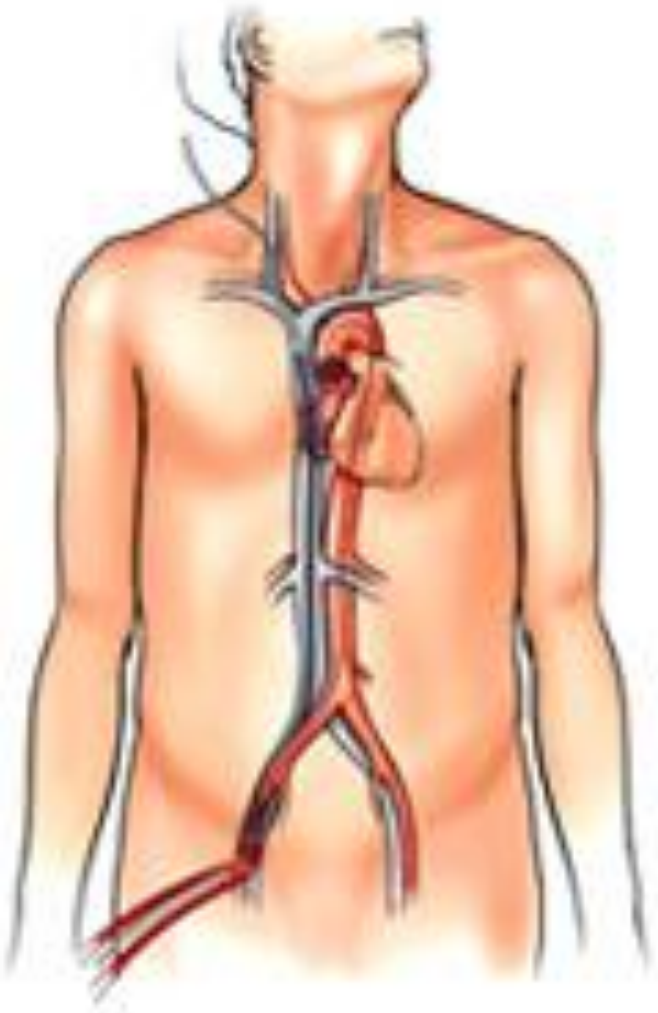
1: branch of Internal iliac , 2,3,4: branches of Profunda Femoris = Femoral arteries = external iliac

بما انهم على شكل + فهم أربعة فروع

Cannulation of Femoral Artery

- because of the **superficial** position of the femoral artery, it is used for left cardiac angiography*.

- A long catheter is inserted percutaneously (عبر الجلد) into the artery and passed up the external iliac artery, common iliac artery , aorta to the left ventricle.



* Angio = blood vessels

Where To Feel The Peripheral Arterial Pulse ?

Femoral artery:

Inferior to the lingual ligament and midway between the anterior superior iliac spine and symphysis pubis.

How to Stop bleeding from the femoral artery? (مؤقتاً)

By pressing the artery directly posterior against the superior pubic ramus and the femoral head.

Popliteal artery:

Because of the deep position of the artery, its pulsations are best felt in the inferior (lower)part of the popliteal fossa (here the artery is related to the tibia). نضغط باتجاه التيبيا*Deep in the popliteal fossa medial to the midline.*

Weakening or loss of the popliteal pulse is a sign of femoral artery obstruction.

Sites of Peripheral Arterial Pulse

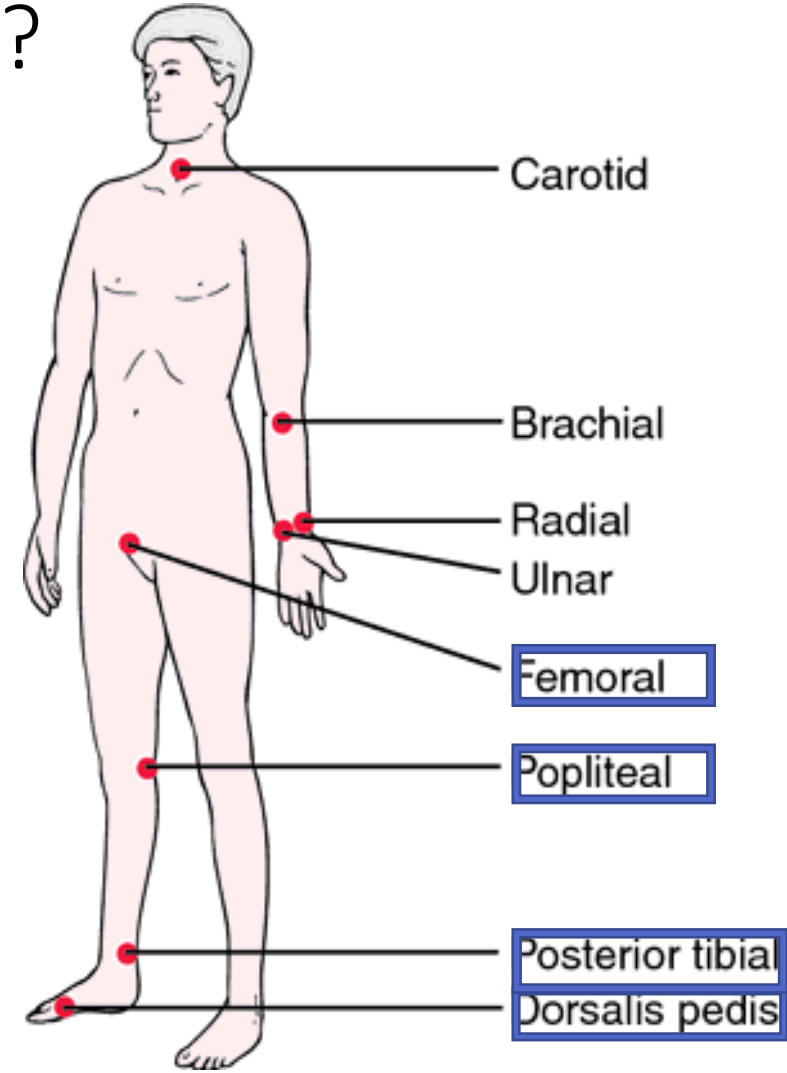
Posterior tibial artery:

Taken Postero inferior to the medial malleolus (in the groove between the malleolus and the heel) The flexor retinaculum must be relaxed by inverting the foot. Palpation of PT pulse is essential for examining patients with **occlusive**(انسداد) **peripheral arterial diseases**.

Dorsalis pedis artery:

It is easy to be felt being subcutaneous, over the tarsal bones between the tendons of Extensor hallucis longus and Extensor digitorum longus

Some people have congenitally non palpable DP pulse, the anomaly is usually bilateral. أما لو في رجل واحدة فقط ففي مشكلة في الفسلز لكن مو جينية



Veins Of Lower Limb:

The veins of the LL are classified into:

- Superficial system
- Deep system

The superficial & deep veins have valves which are more numerous in the deep veins.

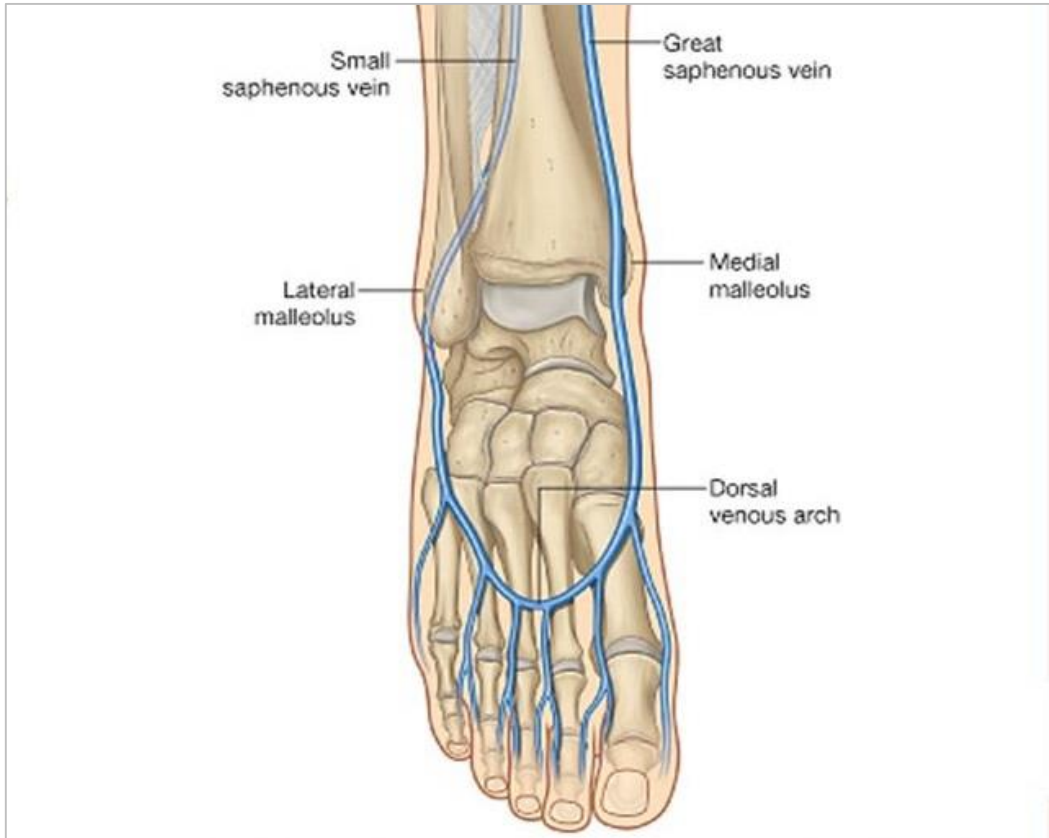
The blood passes from the superficial to the deep veins.

دائماً

Superficial Veins : lie in the subcutaneous tissue (GSV , SSV) : Dorsal Venous arch (network) Receives most of the blood of the foot through Digital and Communicating veins.

Then it's Drained on the Medial side by ***the Great Saphenous vein***. Lateral side by the Small saphenous vein.

Deep veins: deep to the deep fascia and accompany all major arteries (Femoral, Popliteal veins).



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GSV : Grater saphenous vein , SSV : Small saphenous vein

Great Saphenous Vein:

- The **Longest** Superficial vein of the body.
- Begins from the medial end of the dorsal venous arch (as the medial marginal vein).الصمامات فيها أكثر لأنها أطول فتقريباً فيها 12 صمام

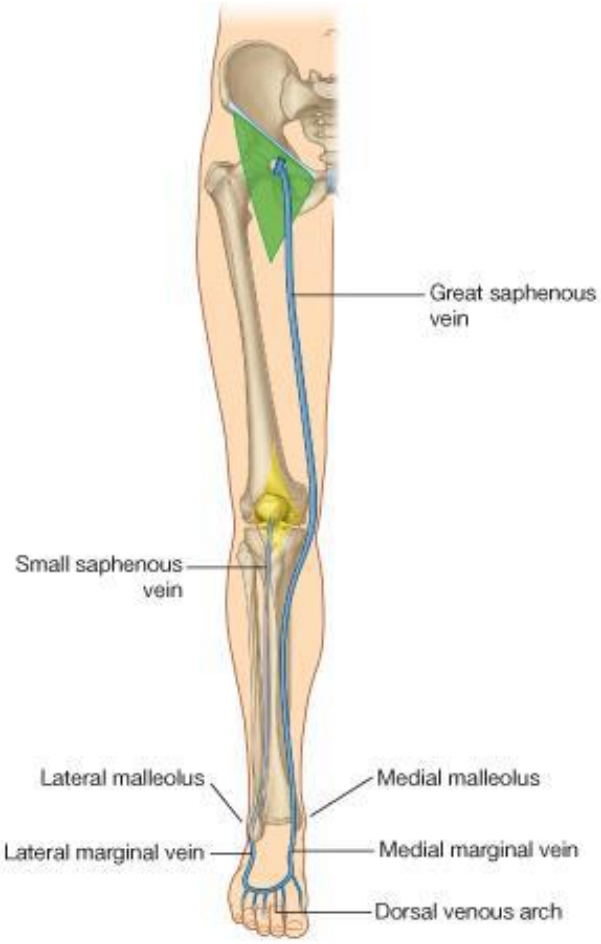
Ascends:

A-In front of the Medial Malleolus(وهذا المكان ثابت عن كل الناس) accompanied by the (Saphenous nerve).

B- Posterior to the Medial Condyle of the femur.

C- Passes through the Saphenous Opening (in the facsia) (2.5-3.25) cm below and lateral to the pubic tubercle.

- Terminates in: Femoral Vein.
- *Because of its constant position in front of the medial malleolus, it is used for saphenous cutdown especially in infants, obese and shocked patients.*
- *عشان موقعه ثابت دائما فنقدر بعد ندخل فيه حقنة وريدية اذا احتجنا في الطوارئ مثلاً*



What is cut-down?

Venous **cut-down** is an emergency **procedure** in which the vein is exposed surgically and then a cannula is inserted into the vein under direct vision. It is used to get vascular access in trauma and hypovolemic shock patients when peripheral cannulation is difficult or impossible. The saphenous vein is most commonly used.

Small Saphenous Vein:

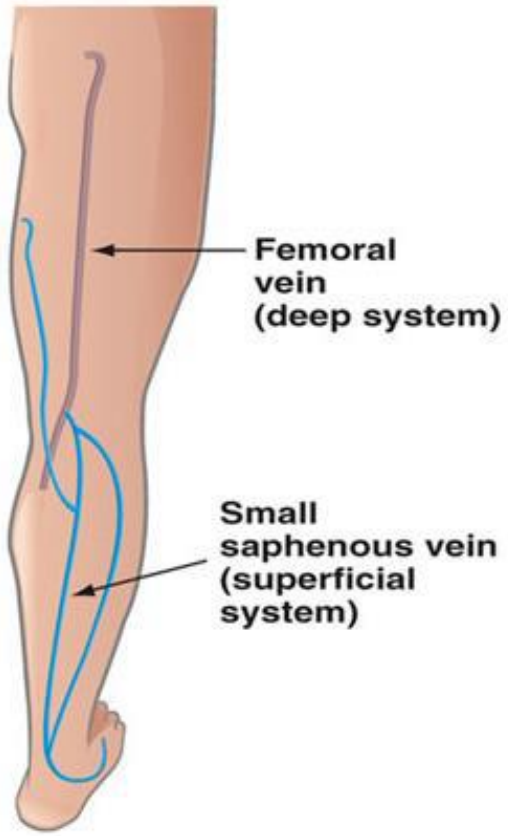
- Originates from the **lateral** end of the dorsal venous arch.
- Where the great one Begins from the **medial** end of the dorsal venous arch

- Ascends:
- **Behind** the **lateral** Malleolus along with the **Sural** nerve; along the middle of the back leg (in company with the Sural nerve)
- Where the great one Ascends **In front of** the **Medial** Malleolus (المكان الثابت عن كل الناس) accompanied by the **Saphenous** nerve).

- Termination:

1. It may join the Great Saphenous vein.
2. joins the Popliteal vein
3. Or *Bifurcates:

One branch joins the Great saphenous and the other joins the Popliteal vein. يختلف من شخص لآخر



*Bifurcates: Divides into two parts

Deep Veins:

Popliteal vein:

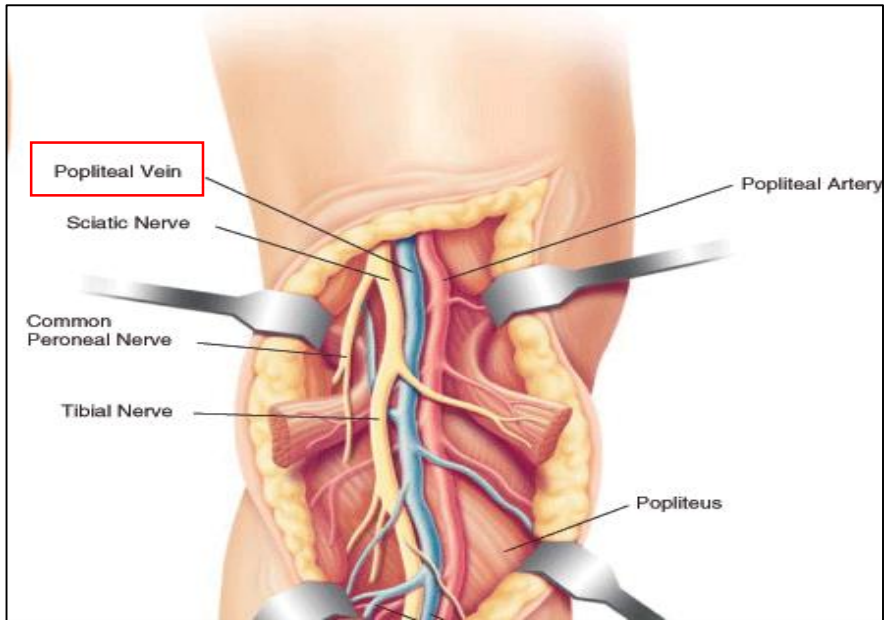
formed by the union of venae comitantes around the anterior and posterior tibial artery.

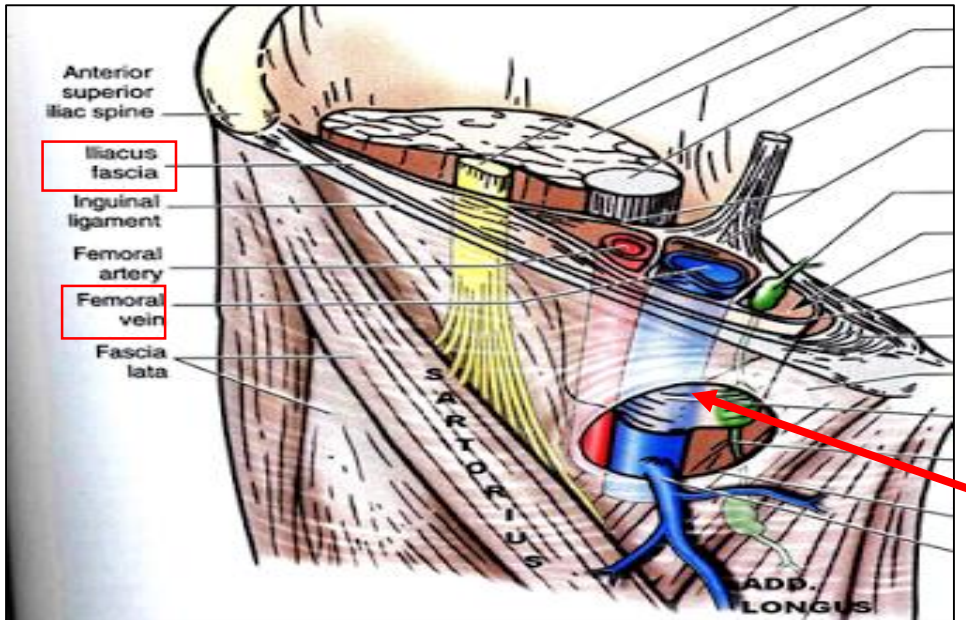
It is posterior to popliteal artery.

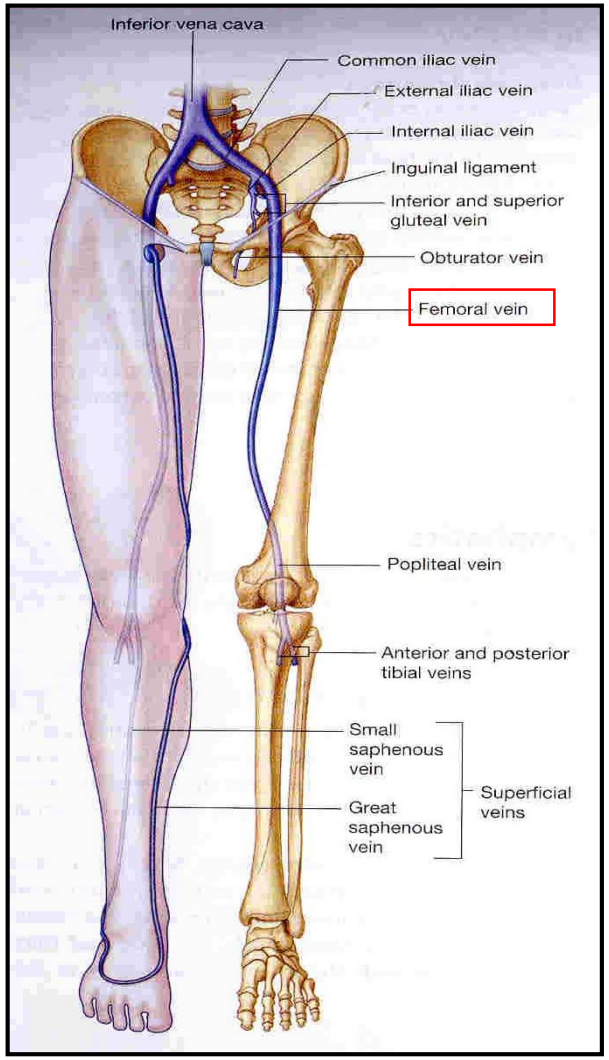
Femoral vein: A continuation of popliteal vein.

Course:

1. Enters the thigh by passing through the **opening** in adductor magnus.
2. Leaves the thigh in (through) the **Intermediate** compartment of **femoral sheath**.
3. Passes behind inguinal ligament to become external iliac vein.







هذه الصورة لإيضاح النقطة 2 و 3

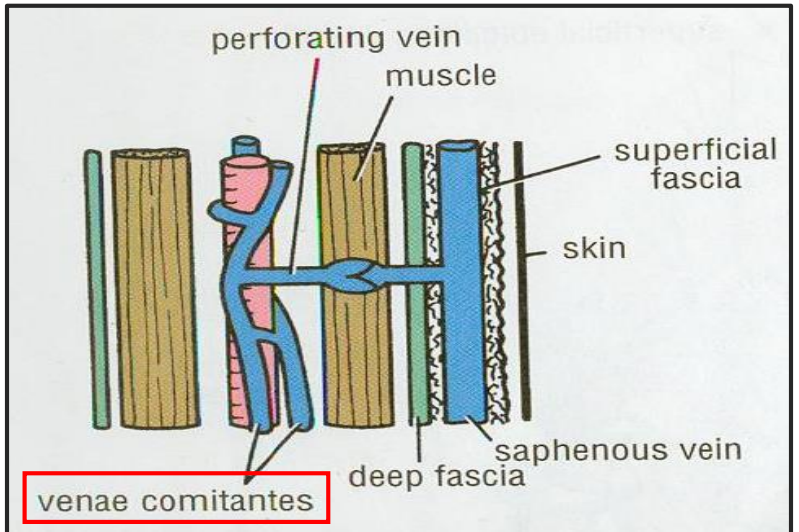
Femoral sheath surrounding artery & vein and lymph node

Venae Comitantes:

- They are deep veins that accompany all the major arteries and their branches.
- Usually paired
- They are contained within the vascular sheath of the artery, whose pulsations help to compress and **move blood** in the veins especially during exercise.

(the arteries help in moving the blood through the venae comitantes)هنا أهميتها

عشان كذا لما الواحد يطول وهو واقف يغمى عليه لأنه الدم ما قدر يرجع للقب , فالعسكري مثلا اللي يحتاج يوقف لمدة طويلة لازم بين فترة وفترة يحرك عضلات ساقه خاصةً



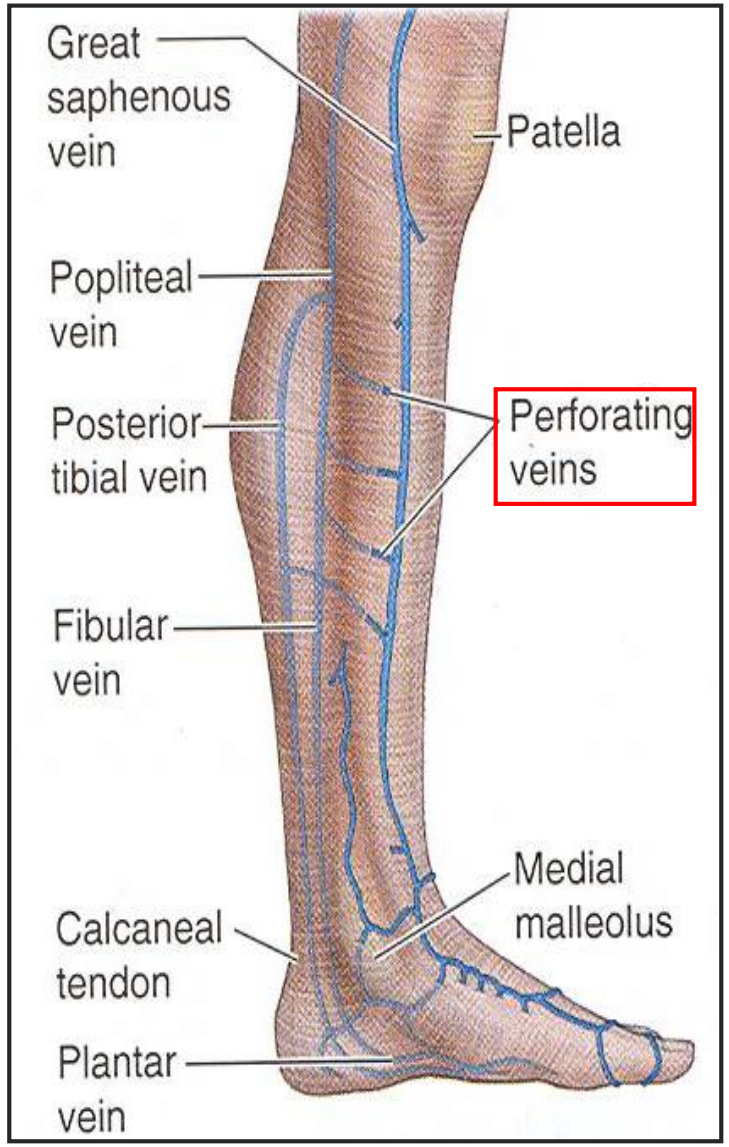
Perforating Veins:

Connect superficial veins (great saphenous vein) with the deep veins along the medial side of the calf.

Penetrate the deep fascia (وهذا سبب تسميتها) close to their origin from the superficial veins.
The perforating veins pass through the deep fascia at an **oblique** angle so during muscular contraction, they are compressed. This also prevents blood flowing from the deep to the superficial veins..

Their valves only allow blood to flow from the superficial veins to the deep veins.

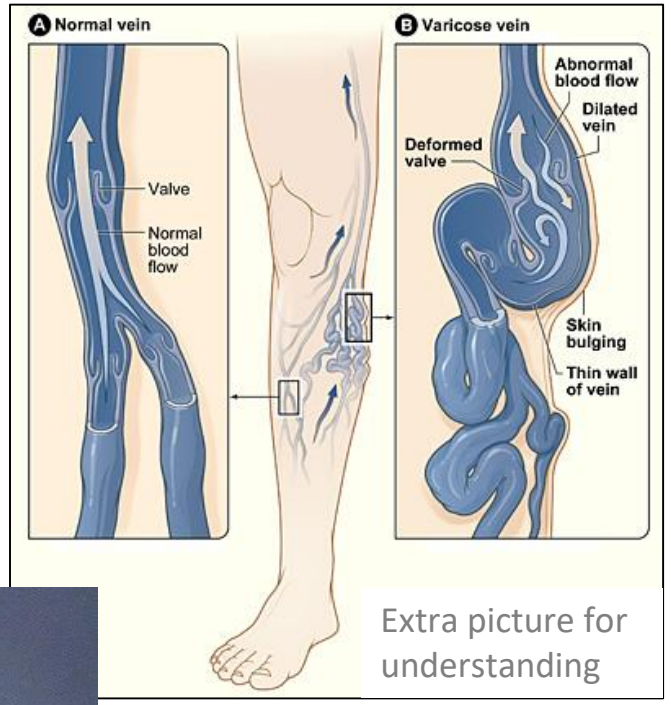
In some cases, such as in varicose veins, the valves weaken, leading to the flow of blood in the opposite direction (from deep to superficial)



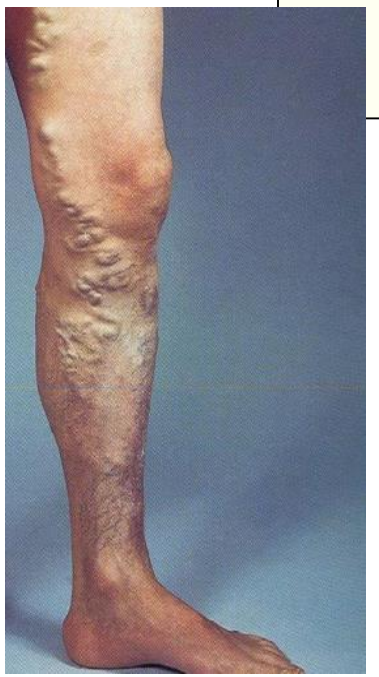
Varicose Veins:= الدوالي

Only on the girls' slides

Varicose veins		
definition:	Cause:	Result:
• It is the **dilatation** and degeneration of the superficial veins that may be complicated by **ulcers**. • It is more common in the **posteromedial part** of the lower limb.	It is because of the **incompetence of the valves** in the perforating veins or valves within the great saphenous vein itself. فالدم ما صار يروح للأوردة العميقة ويتجمع في السطحية فقط أو حتى ينتقل من العميقة للسطحية ! **incompetence of the valves** ممكن يكون بسبب الحمل أو ضعف طبيعي فيها أو ورم	This allows the passage of high pressure blood from the deep veins to the superficial veins فتتوسع الأوردة السطحية نتيجة تجمع الدم فيها ويصير لون الدم أغمق ثم تتلفف(تتعرك) *مثل الصورة* ثم يتفجر وهذا التفجر يسبب قرحة ! اسمها Varicose ulcer



Extra picture for understanding



Deep Vein Thrombosis (DVT) :

Only on the girls' slides

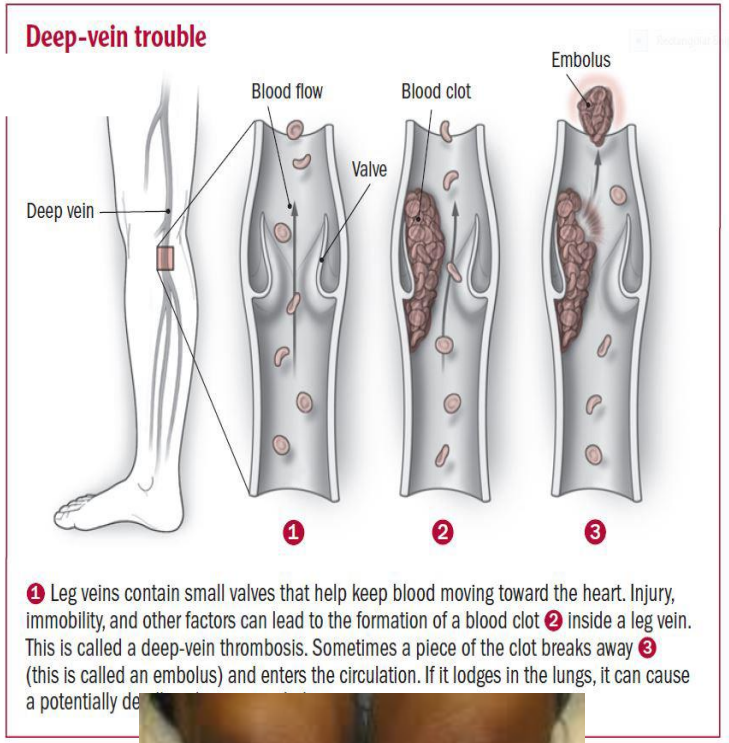
- Definition: it is when a blood clot (thrombus) forms in c... of the deep veins of the lower limb.

- The veins of the lower limb are subject to venous thrombosis after a bone fracture. أو بسبب الاستلقاء على السرير لمدة طويلة
- Venous stasis is the main cause by pressure on the veins from the bedding during **prolonged hospital stay** and aggravated by **muscular inactivity**.فالمريض بعد الجراحة لازم يتحرك

- **Thrombophlebitis** (inflammation of the wall of a vein with associated thrombosis) may develop around the vein.

- **Pulmonary thromboembolism** (blockage of a pulmonary artery in the lung) may occur when a thrombus breaks free from the lower limb vein and passes to the lungs.

فمثلاً بعد 7 أيام من الجراحة تصيب المريض هذه الحالة بسبب أنه ما تحرك! فانتقلت الجلطة من أوردة الأطراف السفلى إلى الأوردة الرئوية ثم للرئة !



MCQs

1. At the opening of adductor magnus the femoral vein lies ..... to the femoral artery ?

A. Lateral

B. Medial

C. Anterior

D. Posterior

2. Which one of the following Completes the Plantar arch ?

A. Lateral Plantar Artery

B. Lateral tarsal artery.

C. Dorsalis Pedis Artery

D. A and C

3. Which of the following is Inferior to the lingual ligament and midway between the anterior superior iliac spine and symphysis pubis?

A-Posterior Tibial

B-Popliteal

C-Femoral

D-Dorsalis Pedis

4. The superficial vein has more valves than the deep vein :

A- True

B-False

5. The popliteal vein is ……. to popliteal artery:

A. Anterior

B. Posterior

C. Medial

D. Lateral

Answers:

1.A

2.D

3.C

4.B

5.B

SAQ

Q1.Mention the terminal branch of Posterior Tibial Artery.

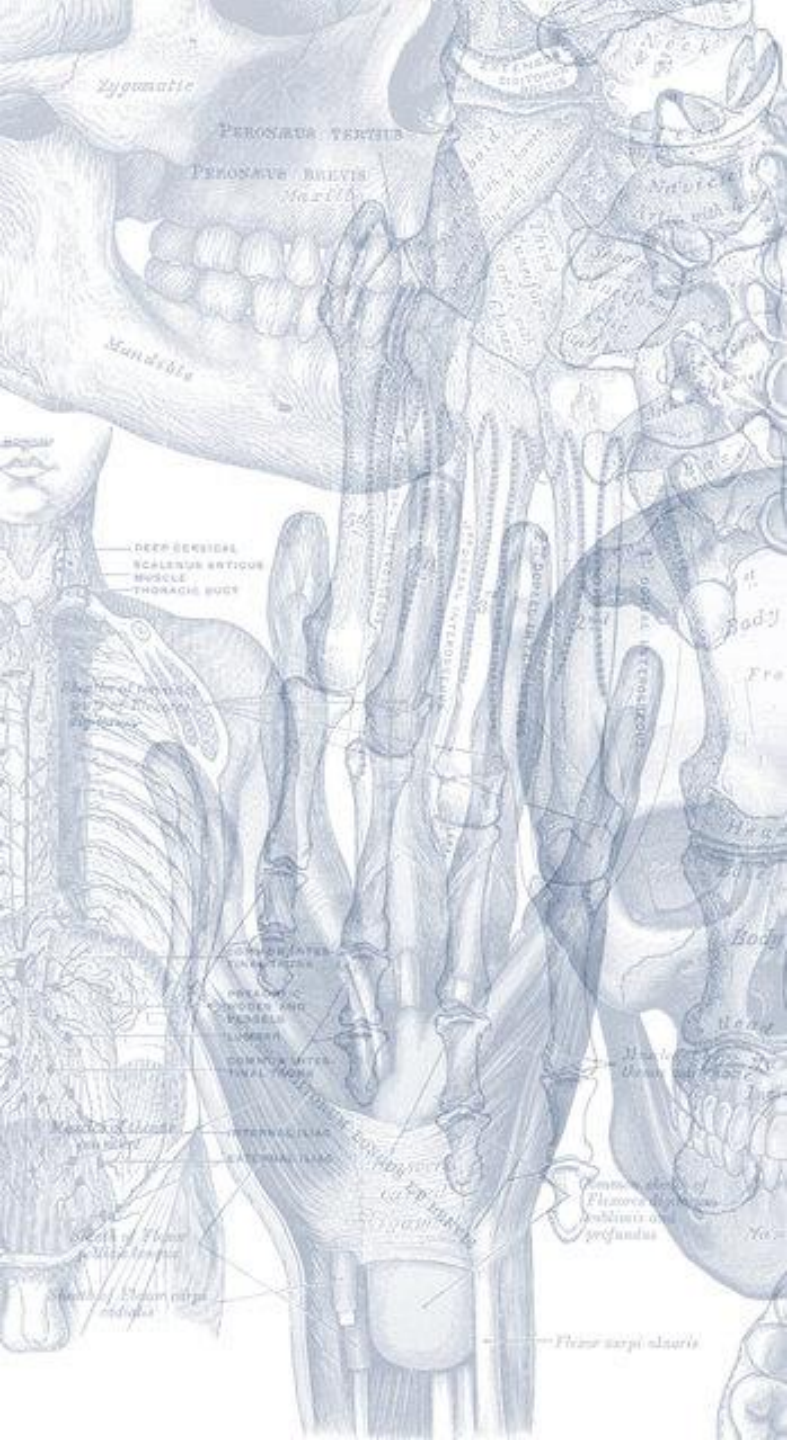
Q2.What are the sites of peripheral arterial pulse?

Q3.Describe the function of perforating veins.

Q1:
1-medial plantar arteries.
2-lateral plantar arteries.

Q2:
1-Femoral
2-Popliteal
3-Posterior Tibial
4-Dorsalis Pedis

Q3:They connect the superficial veins to the deep veins, and they maintain the blood flow from the superficial veins to the deep veins.



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