



University of Baghdad

College of Medicine

2023-2024



Title: Posterior compartment of the leg

Grade: One

Module: HSF-I

Speaker: Prof. Dr. Malak A. Taha

Date: 5-6/3/2024



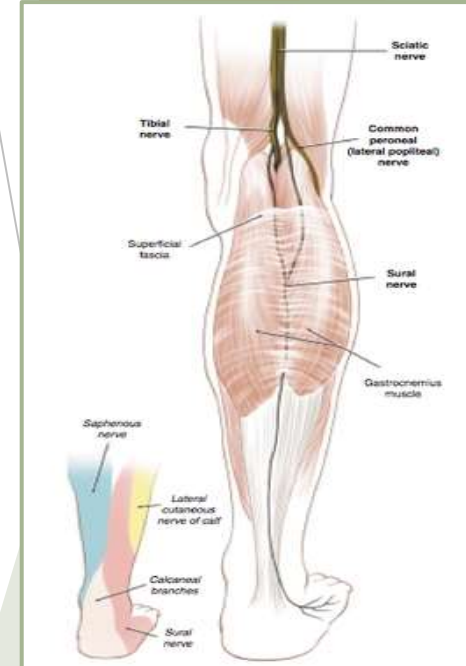
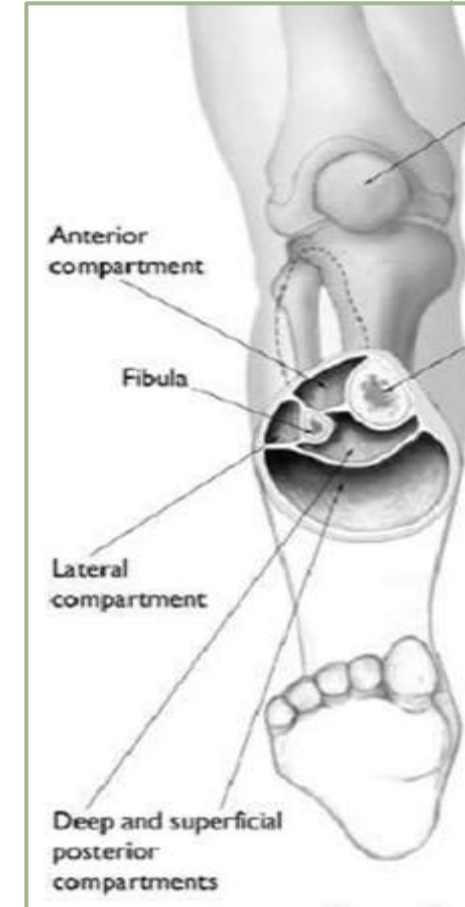


Objectives

- **Define** the compartments of the leg
- **Describe** the calf muscles & their layers
- **Define** the veins of this region
- **Follow** the course & branches of neurovascular bundles in this region
- **State** some clinical correlates

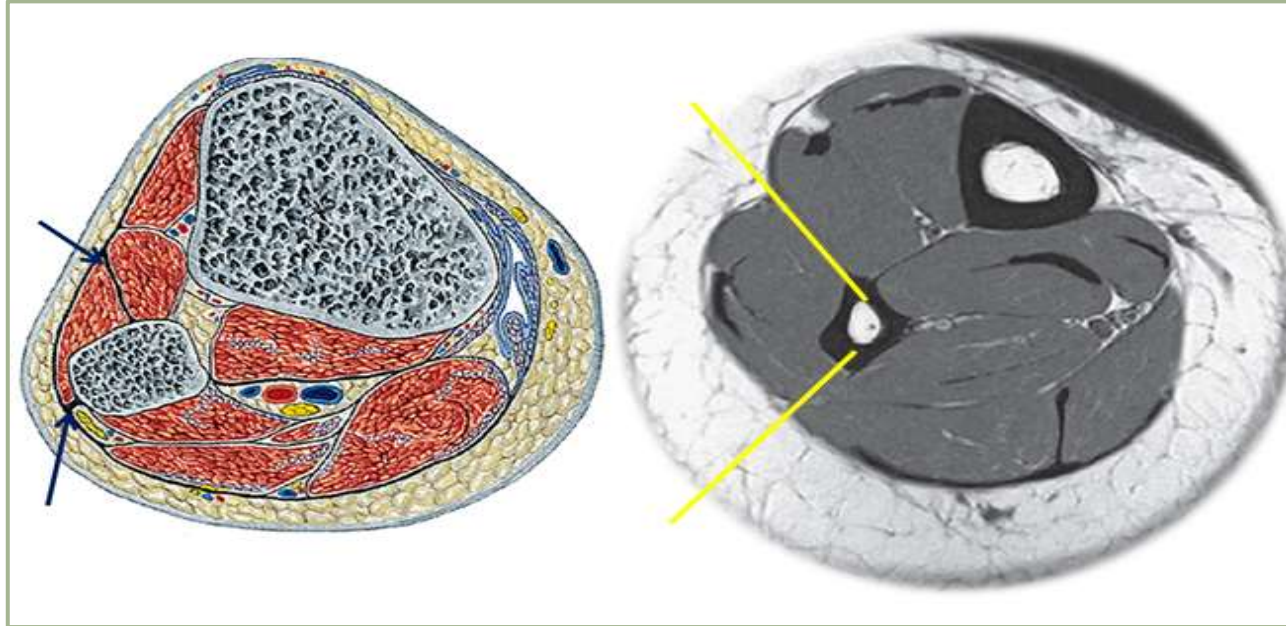
Leg fascia

- **Fascia lata** continues over the leg as the **crural fascia**
- Superiorly the fascia is attached to the **bones in the upper leg**, reinforced by the **patellar retinacula**
- Lower down it is attached to **the malleoli & posterior surface of calcaneus**



ORGANIZATION OF LEG

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- The leg fascia sends **2 intermuscular septa, anterior & posterior** dividing the leg into 3 compartments, flexor (superficial & deep), extensor & peroneal

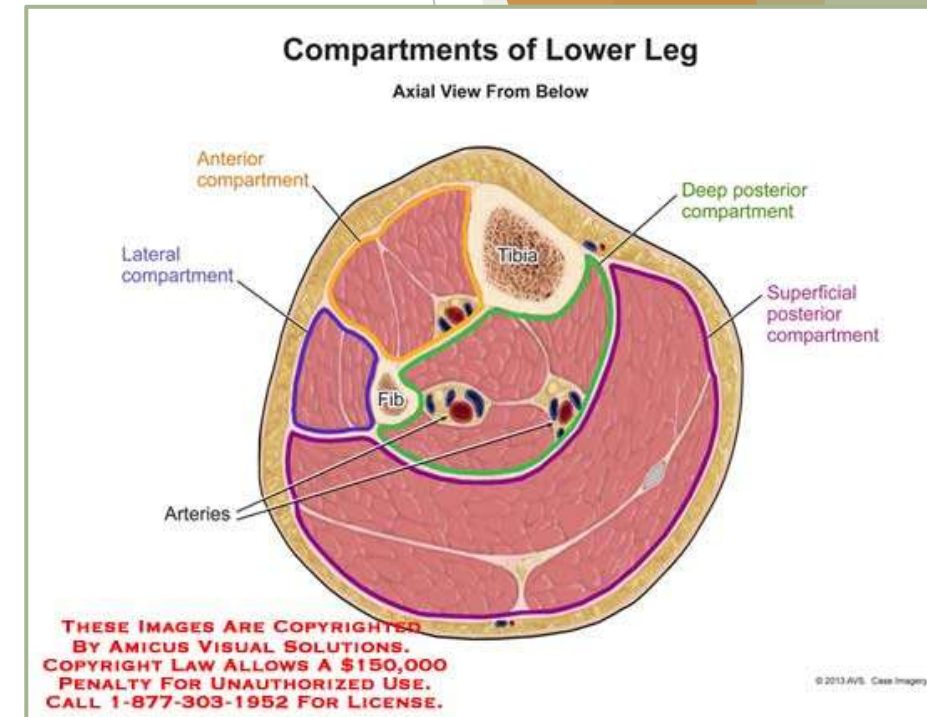
The **anterior, lateral, and posterior compartments** of the leg are formed by

- ✓ the **anterior and posterior intermuscular septa**,
- ✓ the **interosseous membrane**,
- ✓ the **two leg bones** to which they attach



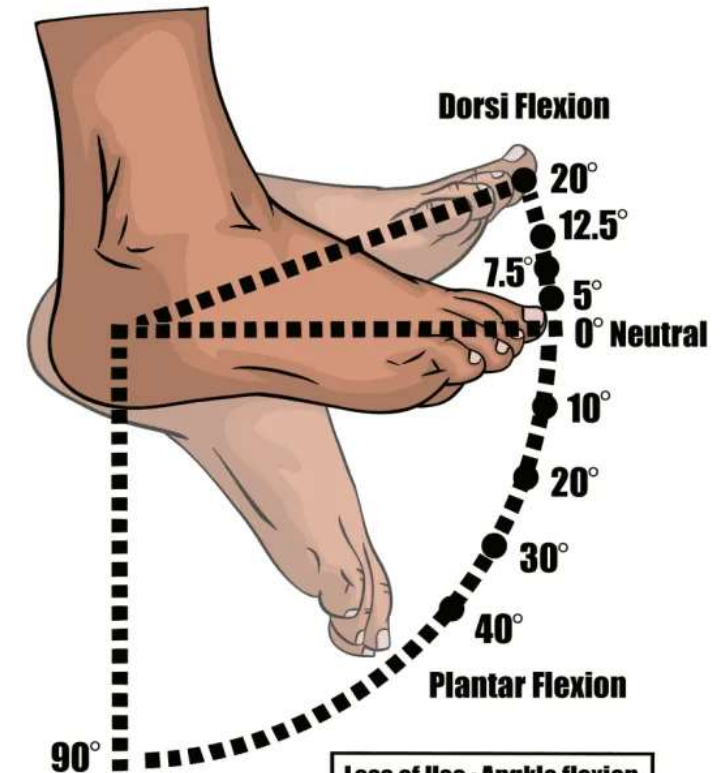
Posterior Compartment of Leg (Plantar flexor compartment)

- is the **largest** of the three leg compartments
- divided into **superficial** and **deep** muscle groups by the **transverse intermuscular septum**.
- The **tibial nerve** and **posterior tibial and fibular vessels** supply both parts of the posterior compartment but run in the deep group
- Muscles of the posterior compartment produce
 - ✓ **plantarflexion** at the **ankle**,
 - ✓ **inversion** at the **subtalar** and **transverse tarsal joints**
 - ✓ **flexion** of the toes.



Plantarflexion

- is a powerful movement (four times stronger than dorsiflexion)
- produced over a relatively **long range** (approximately **50°** from **neutral**).
- Plantarflexion is the major component of the forces generated during the push-off (**heel off** and **toe off**) parts of the **stance phase of walking** and **running**.



Loss of Use : Ankle flexion	
Dorsi	Plantar
20° = Full	40° = Full
12.5° = 7.5%	30° = 7.5%
7.5° = 15%	20° = 15%
5° = 25%	10° = 25%

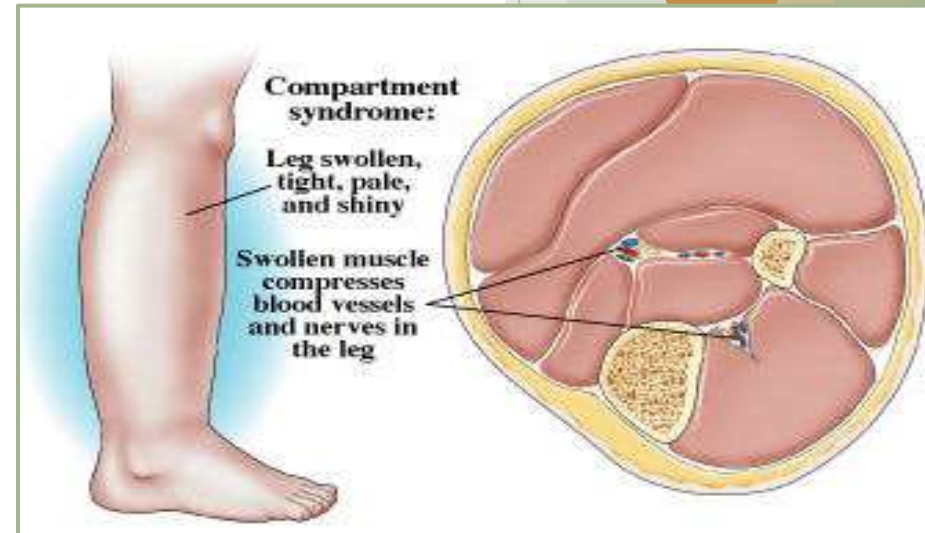
Compartment syndrome of the leg

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- The **larger superficial group** is the least confined compartmental area
- The smaller **deep subcompartment**, like the **anterior compartment**, is bounded by the two leg bones and the interosseous membrane that binds them together, plus the transverse intermuscular septum. Therefore, the **deep subcompartment** is quite **tightly confined**.

- the nerve and blood vessels supplying the entire posterior compartment and the sole of the foot pass through the deep subcompartment,
- when swelling occurs it leads to a **compartment syndrome** that has serious consequences, such as muscular necrosis (tissue death) and paralysis.

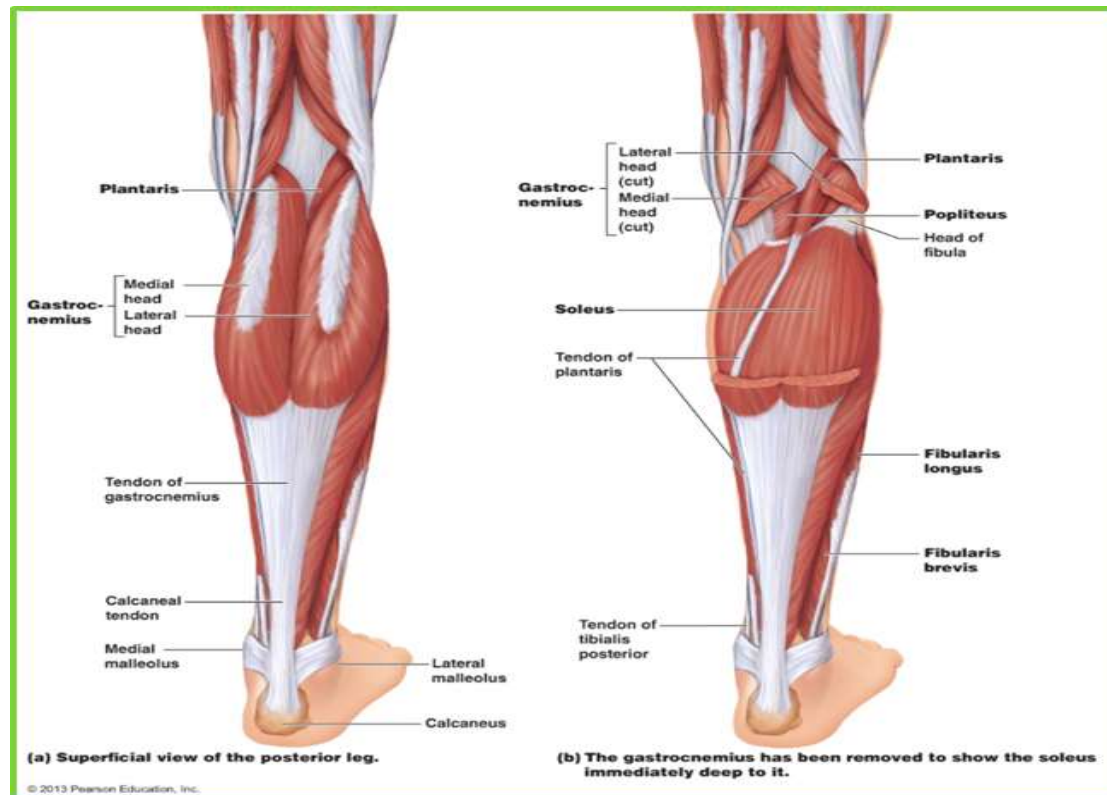


SUPERFICIAL MUSCLE GROUP IN POSTERIOR COMPARTMENT

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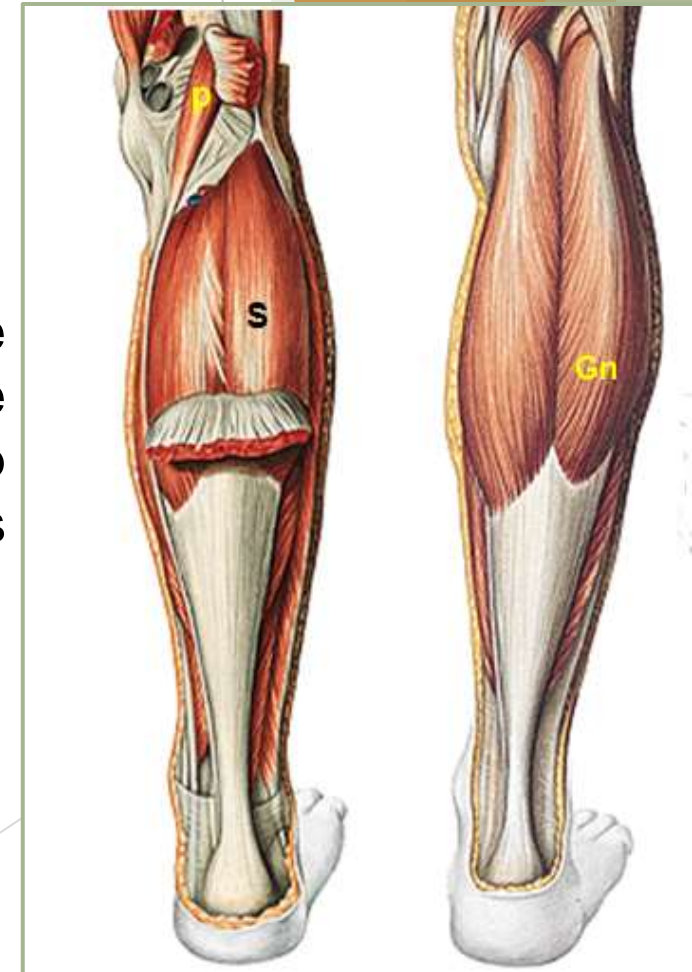
- The **gastrocnemius** and **soleus** share a common tendon, the **calcaneal tendon**
- This powerful muscular mass generates as much as **93%** of the **plantarflexion force**.





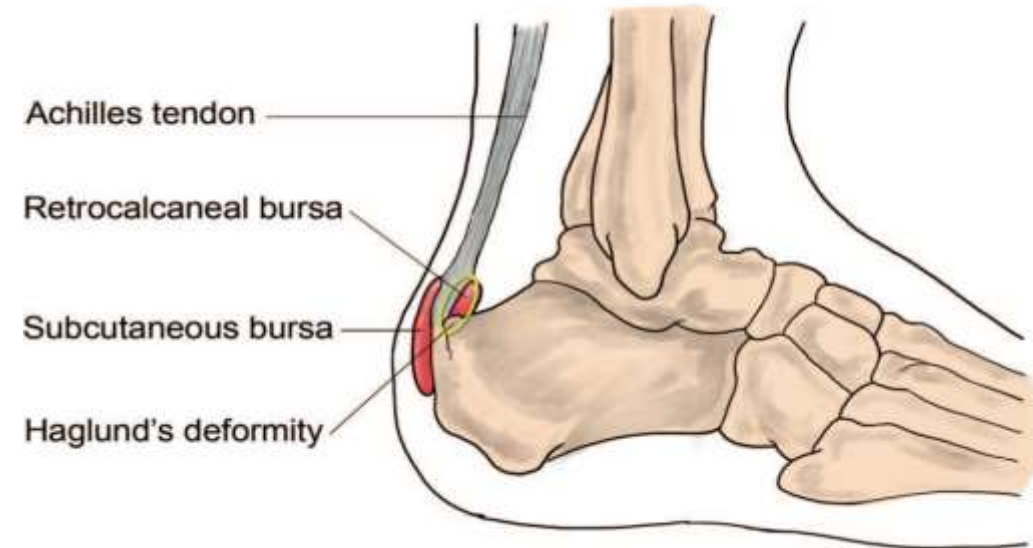
Calcaneal tendon

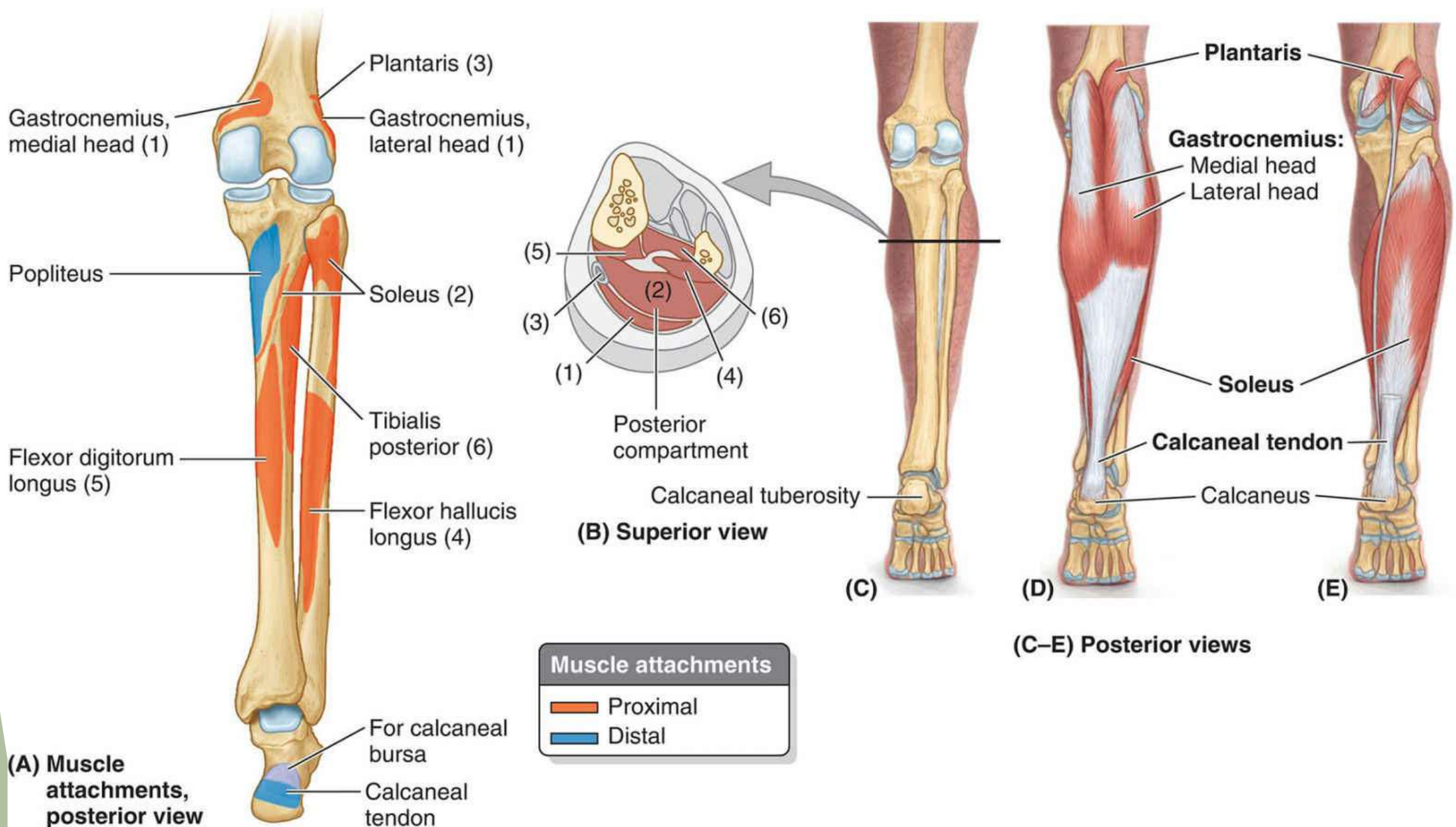
- ✓ is the thickest and strongest tendon in the body.
- ✓ approximately **15 cm in length**,
- it is a **continuation of the flat aponeurosis** formed halfway down the calf where the **bellies of the gastrocnemius** terminate. The aponeurosis receives fleshy fibers of the soleus directly on its deep surface proximally but thickens as the soleus fibers become tendinous inferiorly.
- it inserts centrally on the posterior surface of the calcaneal tuberosity.



Calcaneal bursitis

- results from inflammation of the **deep bursa** of the calcaneal tendon located between the calcaneal tendon and the superior part of the posterior surface of the calcaneus and / or inflammation of **subcutaneous bursa** located between the calcaneal tendon and skin
- causes pain posterior to the heel
- occurs quite commonly during **long-distance running, basketball, and tennis.**





Superficial (calf) muscles of posterior compartment of leg

Muscle	Origin	Insertion	N Supply	Action
Gastrocnemius	Lateral head: lateral aspect of lateral condyle of femur Medial head: popliteal surface of femur; superior to medial condyle	Posterior surface of calcaneus via calcaneal tendon	Tibial nerve (S1, S2)	✓ Plantarflexes ankle when knee is extended; ✓ raises heel during walking; ✓ flexes leg at knee joint
Soleus	Posterior aspect of head and superior quarter of posterior surface of fibula; soleal line and middle third of medial border of tibia; and tendinous arch extending between the bony attachments			✓ Plantarflexes ankle independent of position of knee; ✓ steadies leg on foot
Plantaris	Inferior end of lateral supracondylar line of femur; oblique popliteal ligament			✓ Weakly assists gastrocnemius in plantarflexing ankle

Actions of Superficial Group of Posterior leg muscles

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- Soleus and gastrocnemius are the **chief plantar flexors** of the foot, and gastrocnemius is also a **flexor of the knee**.
- The **soleus** is an **antigravity muscle**. In **standing** it contracts alternately with the extensor muscles of the leg to maintain balance. It is a very strong but relatively **slow plantar flexor** of the ankle joint,
 - One strolls with soleus
- The **gastrocnemius bellies** provide the necessary rapid contraction required for propulsion in fast walking, running and leaping.; one wins the long jump mainly with gastrocnemius. ; however, it cannot exert its full power on both joints at the same time. It is incapable of producing plantarflexion when the knee is fully flexed.
- the two muscles of the **triceps surae** are capable of acting alone, and often do so: "You **stroll** with the **soleus** but win the **long jump** with the **gastrocnemius**."
- Plantaris action is negligible as compared to other two muscles





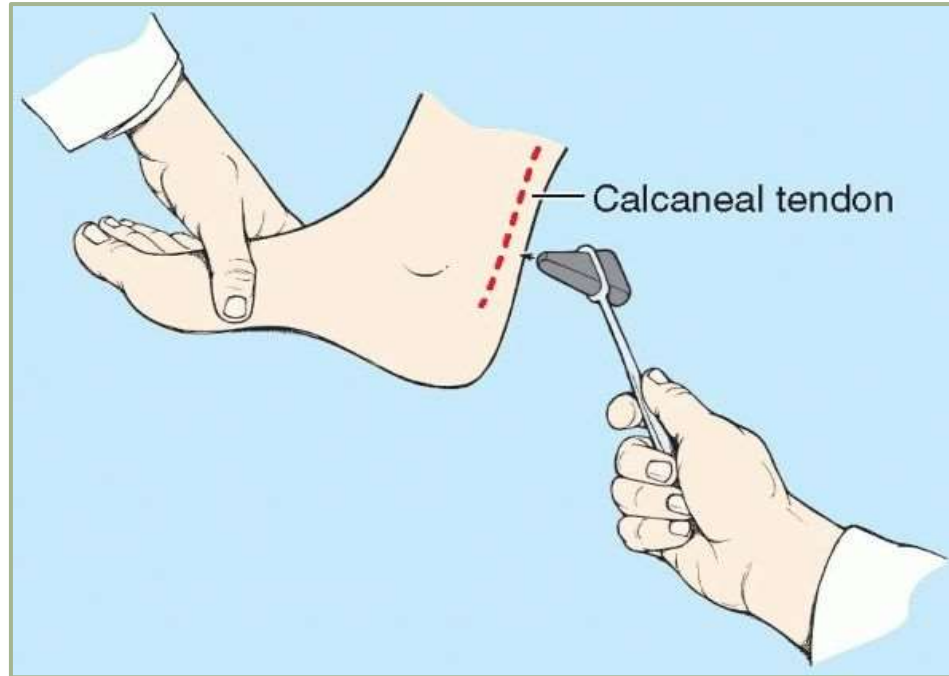
Testing of the triceps surae

- the foot is plantarflexed against resistance (e.g., by “standing on the toes,” in which case body weight [gravity] provides resistance).
- If normal, the **calcaneal tendon** and triceps surae can be seen and palpated.

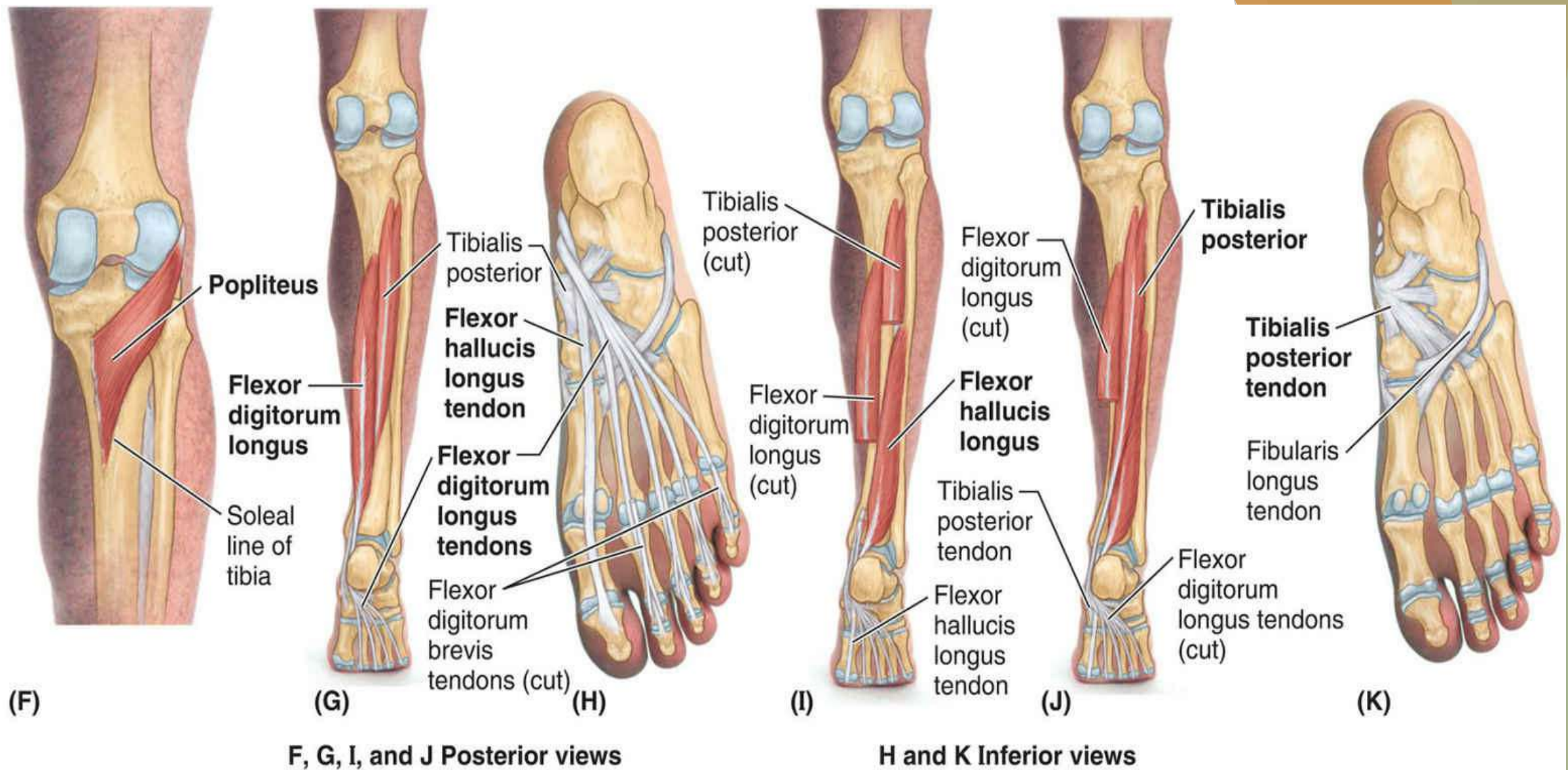


Calcaneal Tendon Reflex

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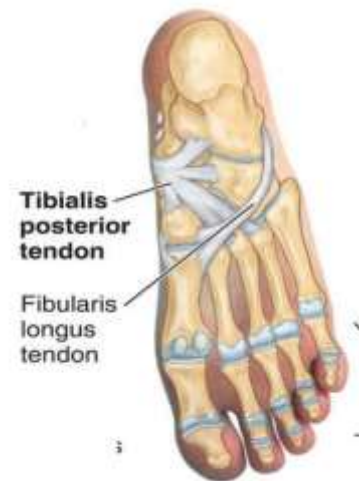
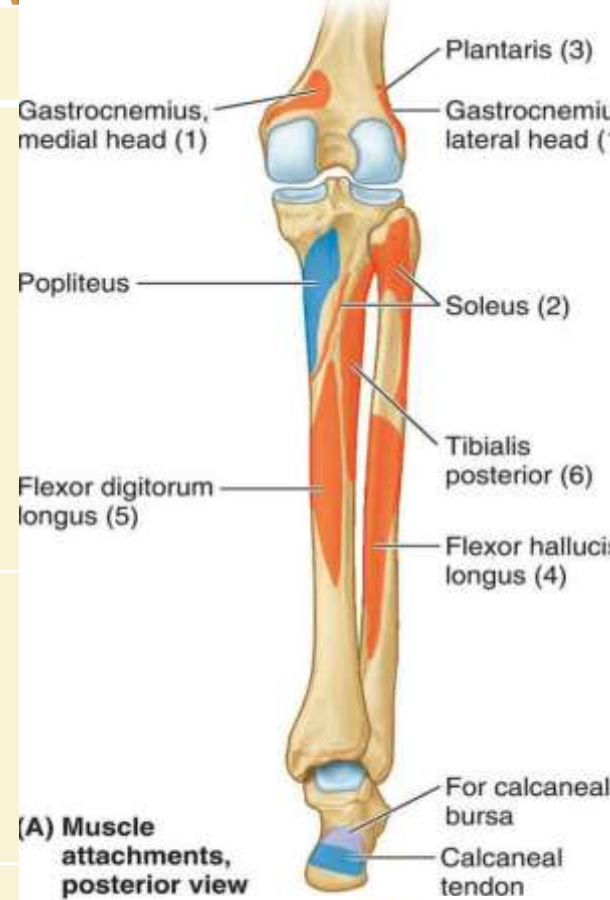


- The ankle jerk reflex, or triceps surae reflex
- The calcaneal tendon reflex tests **the S1 and S2** nerve roots. If the S1 **nerve root is injured** or compressed, the **ankle reflex is virtually absent**.



Deep muscles of Posterior Compartment of Leg

Muscle	Origin	Insertion	N Supply	Action
Flexor hallucis longus	<ul style="list-style-type: none"> ✓ Inferior two thirds of posterior surface of fibula; ✓ inferior part of interosseous membrane 	Base of distal phalanx of great toe (hallux)	Tibial nerve (L5, S1 and S2)	Flexes great toe at all joints;
Flexor digitorum longus	<ul style="list-style-type: none"> ✓ Posterior surface of the tibia medial to tibialis posterior from just below the soleal line 	Bases of distal phalanges of lateral four digits		Flexes lateral four digits;
Tibialis posterior	<ul style="list-style-type: none"> ✓ arises from the interosseous membrane and the adjoining surface of both bones of the leg below the origin of soleus. 	Tuberosity of navicular, cuneiform, cuboid, and sustentaculum tali of calcaneus; bases of 2nd, 3rd, and 4th metatarsals	Tibial nerve (L4, L5)	Plantarflexes ankle; inverts foot Support the foot arch

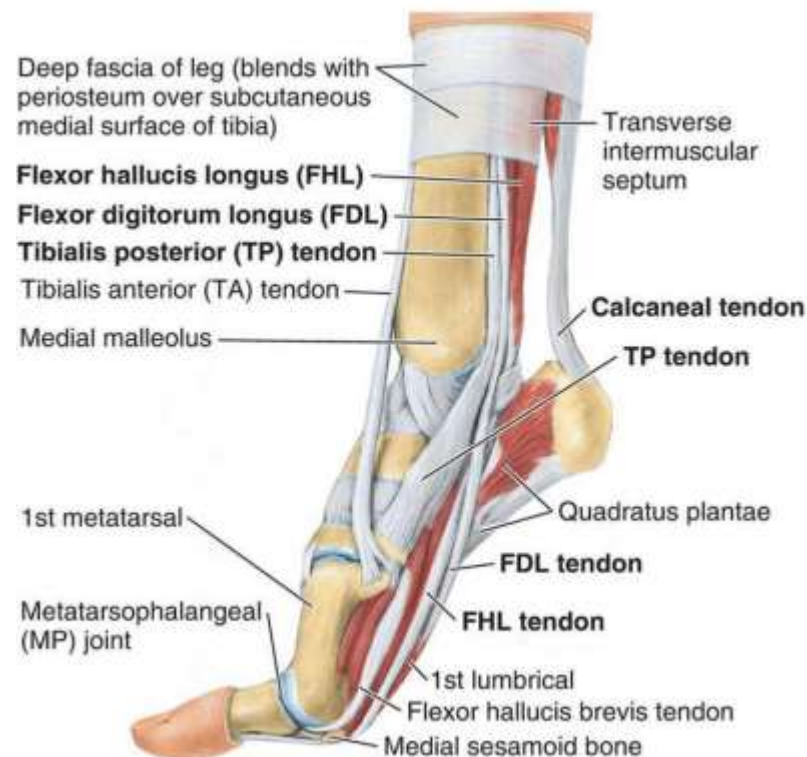


Flexor Hallucis Longus

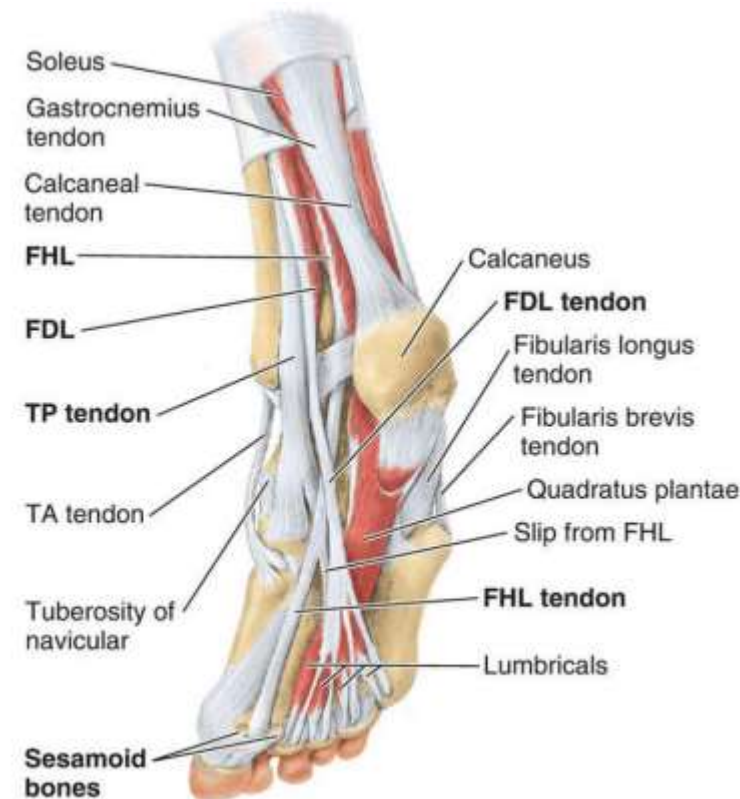
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- is a **powerful flexor** of all of the **joints of the great toe**
- The tendon of the FHL
 - ✓ passes posterior to the **distal end of the tibia**
 - ✓ occupies a **shallow groove on the posterior surface of the talus**, which is continuous with the groove on **the plantar surface of the sustentaculum tali**
 - ✓ crosses deep to the **tendon of the flexor digitorum longus** in the sole of the foot.



(A) Medial view

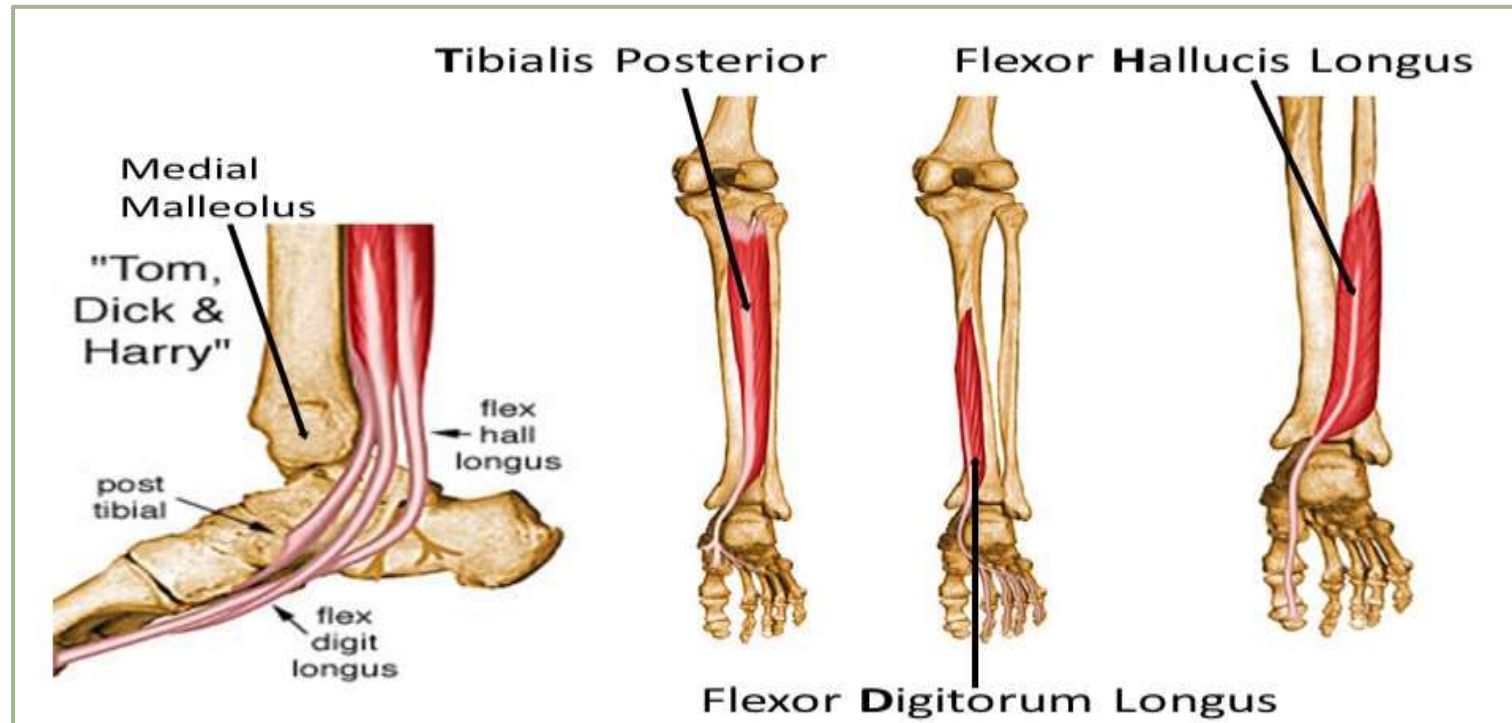


(B) Postero-inferior view



Flexor Digitorum Longus

- is smaller than the FHL, even though it moves four digits
- It passes diagonally into the sole of the foot, superficial to the tendon of the FHL.
- FDL tendon divides into four tendons, which in turn pass to the **distal phalanges of the lateral four digits.**

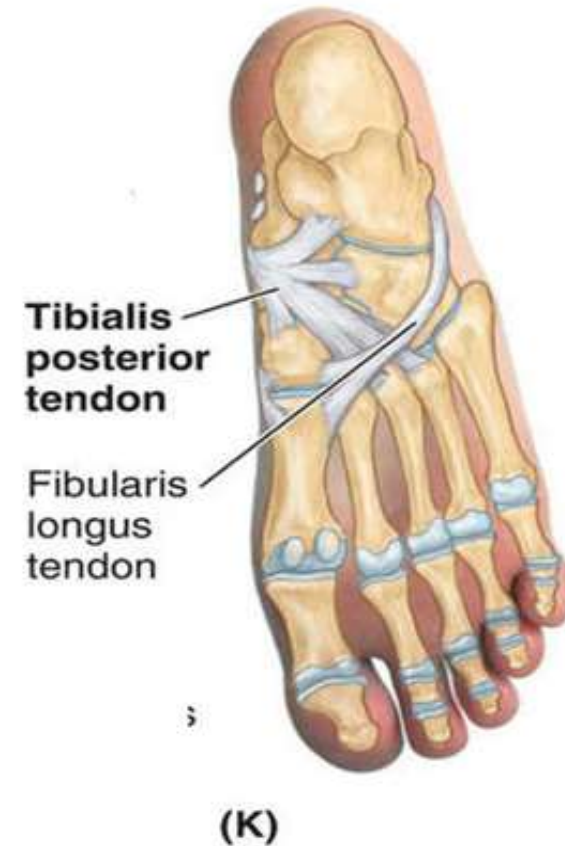
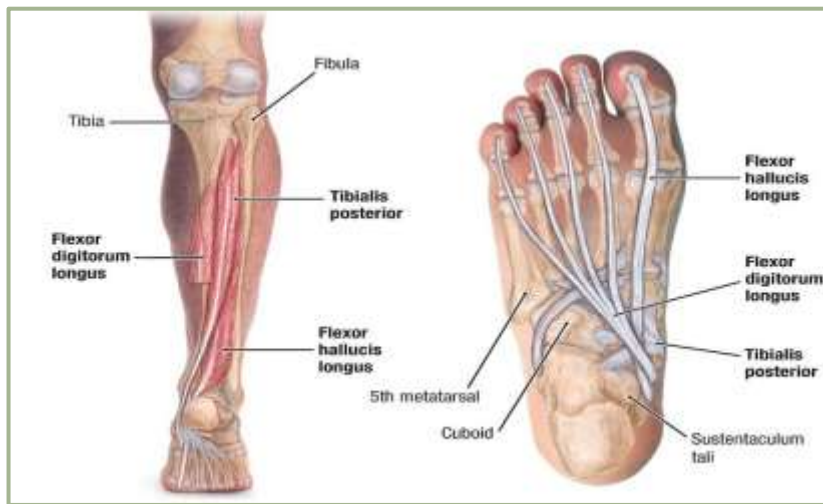


Tibialis Posterior

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- ❑ the deepest (most anterior) muscle in the posterior compartment, lies between the FDL and the FHL in the same plane as the tibia and fibula within the deep group



- ❑ Tibialis posterior tendon after passing deep to the flexor R inserted by slips as follows:
 - Main part in the navicular tuberosity
 - Plantar portion is inserted into the cuboid, cuneiforms & bases of 2 , 3 & 4 metatarsals



FHL

- the distal phalanx of the great toe is flexed against resistance;
- if normal, the tendon can be seen and palpated on the plantar aspect of the great toe as it crosses the joints of the toe

Testing

FDL

- the distal phalanges of the lateral four toes are flexed against resistance;
- if they are acting normally, the tendons of the toes can be seen and palpated.

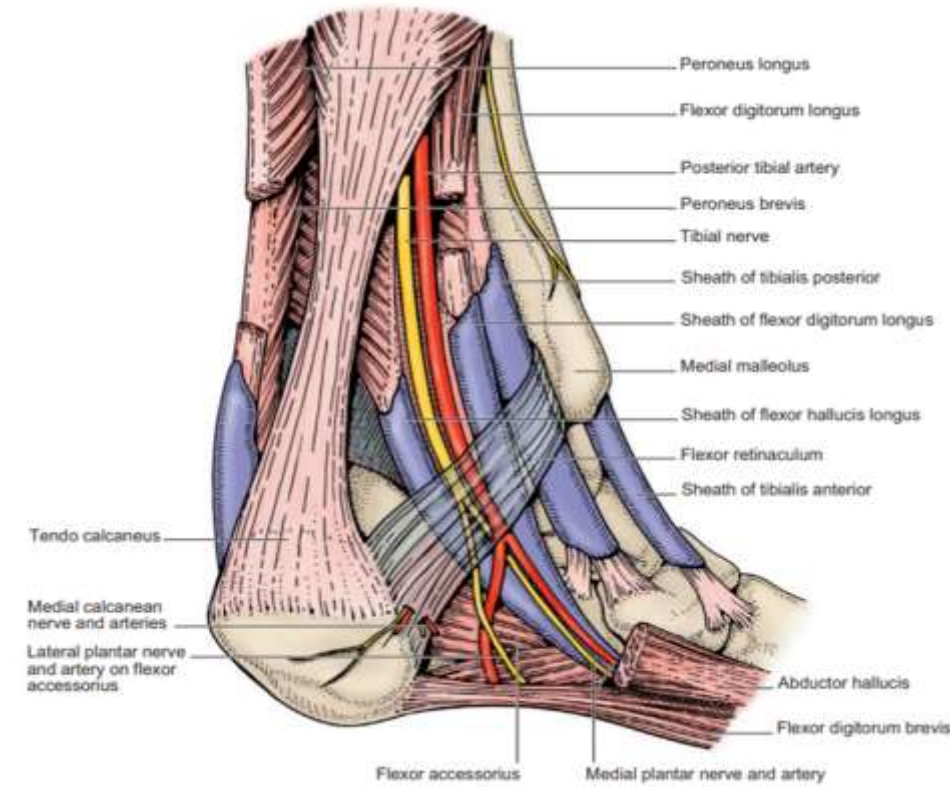
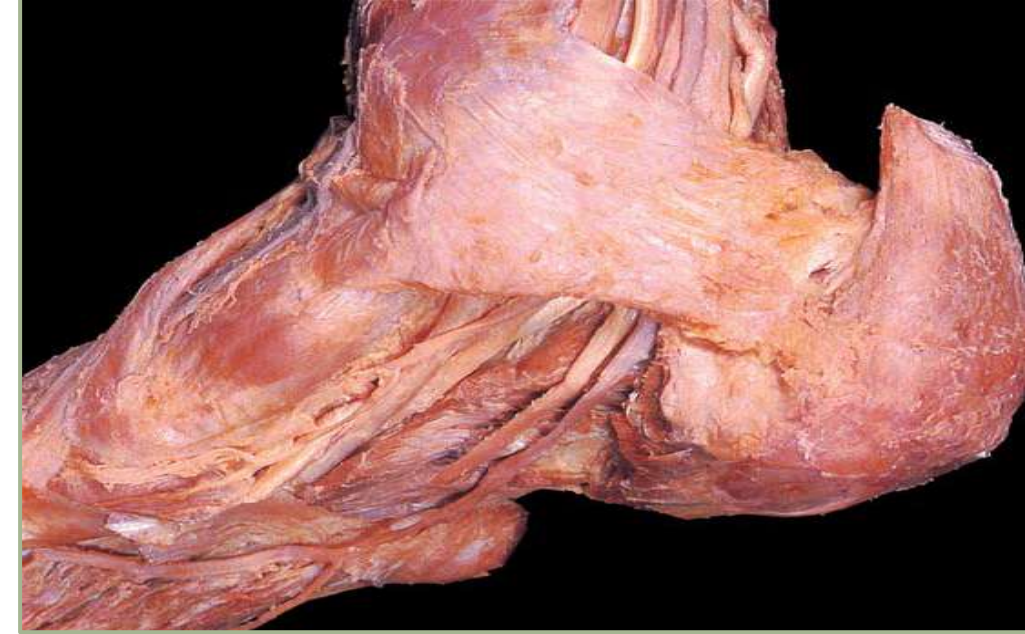
TP

- the foot is inverted against resistance with the foot in slight plantarflexion;
- if normal, the tendon can be seen and palpated posterior to the medial malleolus

Flexor Retinaculum

- Stretches between the calcaneus & medial malleolus
- Tendons of deep group pass underneath it
- The retinaculum is subdivided deeply, forming **separate compartments** for each tendon of the deep muscle group, as well as for the tibial nerve and posterior tibial artery as they bend around the medial malleolus

Structures deep to the FR (The tarsal tunnel)

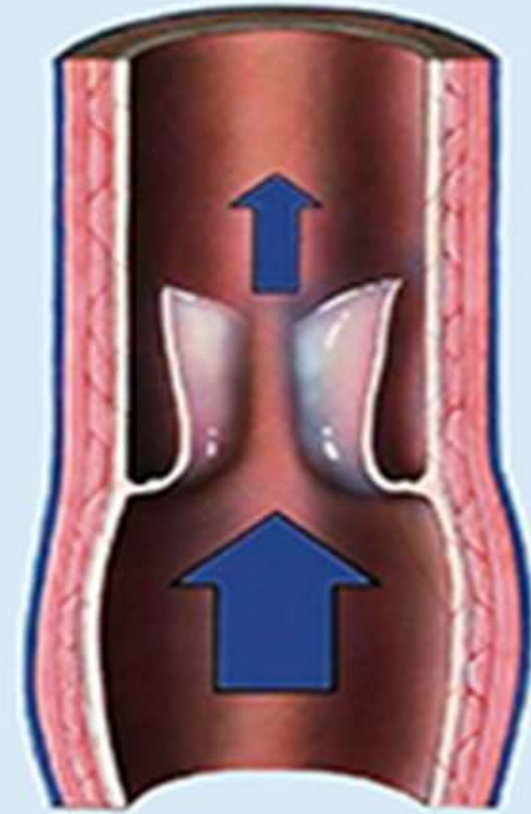
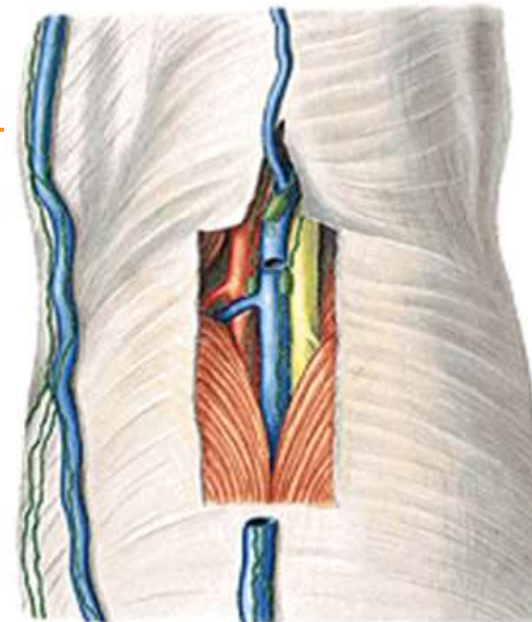
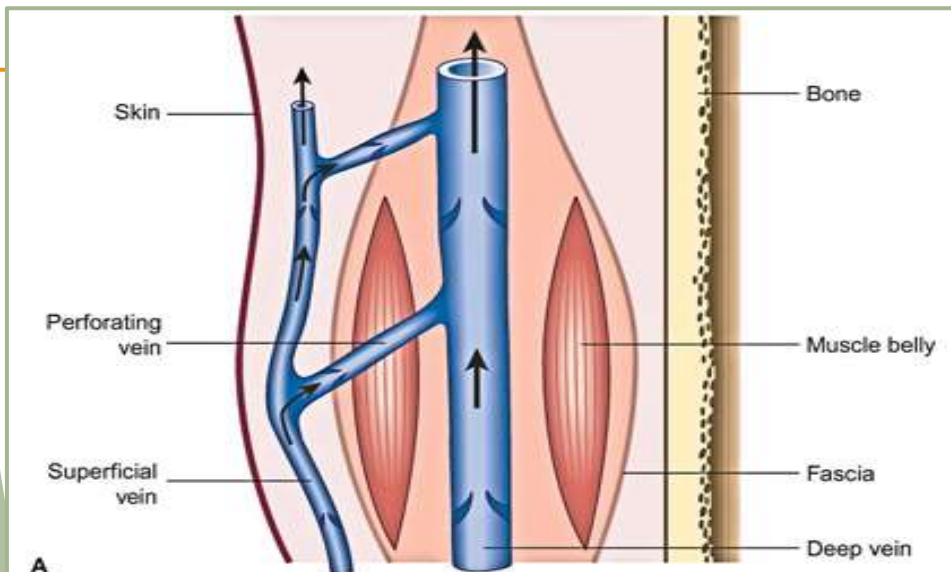


Veins of the leg

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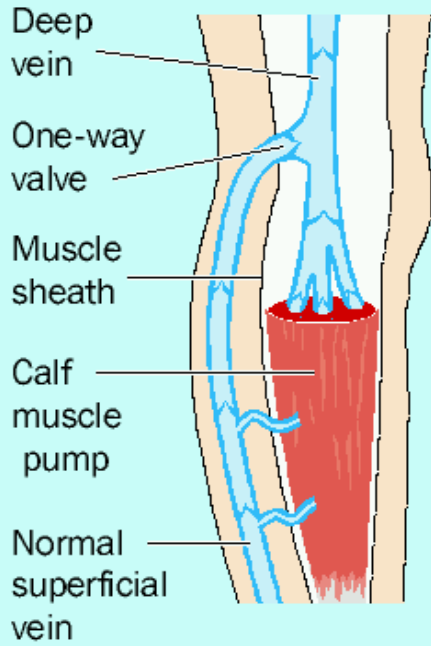


- The deep veins carry 90% or more of the blood from the legs toward the heart
- They are aided by muscle contraction
- Superficial veins have the same type of valves as deep veins, but they are not surrounded by muscle.
- Much of the blood that flows through the superficial veins is diverted into the deep veins by **connecting (perforating) veins**
- Valves in the connecting veins allow blood to flow from the superficial veins into the deep veins but not vice versa.
- perforating veins pass through the deep fascia at an oblique angle so that when muscles contract and the pressure increases inside the deep fascia, the perforating veins are compressed.

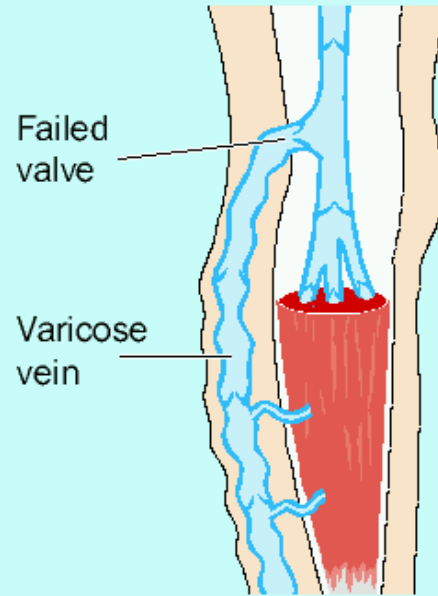




Normal veins



Varicose veins



Deep venous thrombosis

**Destruction of valves of the
connecting veins**

Varicose veins





Prolonged venous blood stagnation

Increase venous pressure

Blood extruded to interstitial tissues

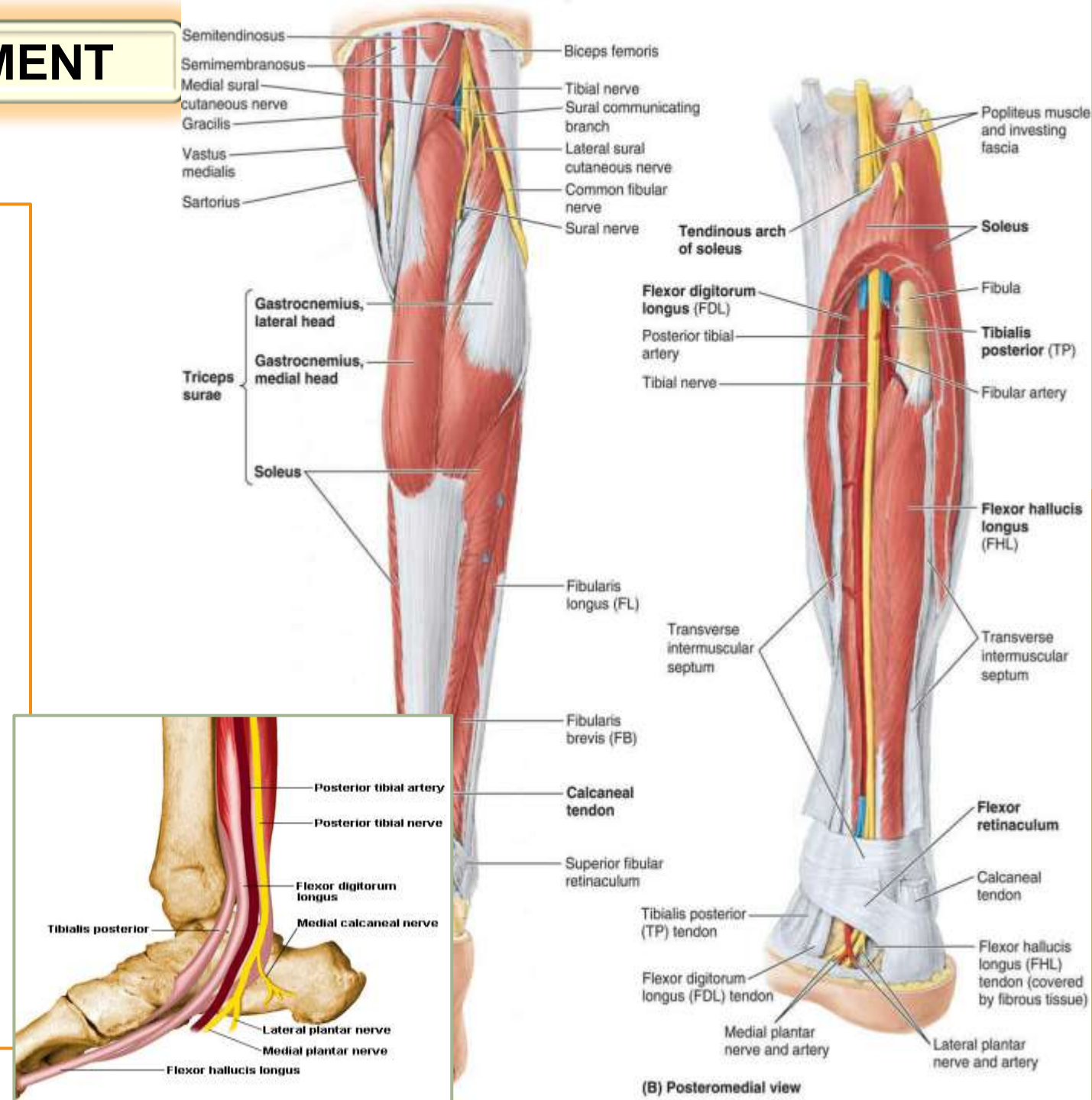
- Skin pigmentation & ulceration
- (Varicose ulcers)



NERVES IN POSTERIOR COMPARTMENT

Tibial nerve (L4, L5, and S1-S3)

- It runs vertically through the popliteal fossa with the popliteal artery, passing between the heads of the gastrocnemius,
- Tibial nerve & popliteal artery exiting the fossa by passing deep to the **tendinous arch of the soleus**
- **At the ankle**, the nerve lies between the tendons of the FHL and the FDL.
- Posteroinferior to the **medial malleolus**, the tibial nerve divides into the **medial and lateral plantar nerves**

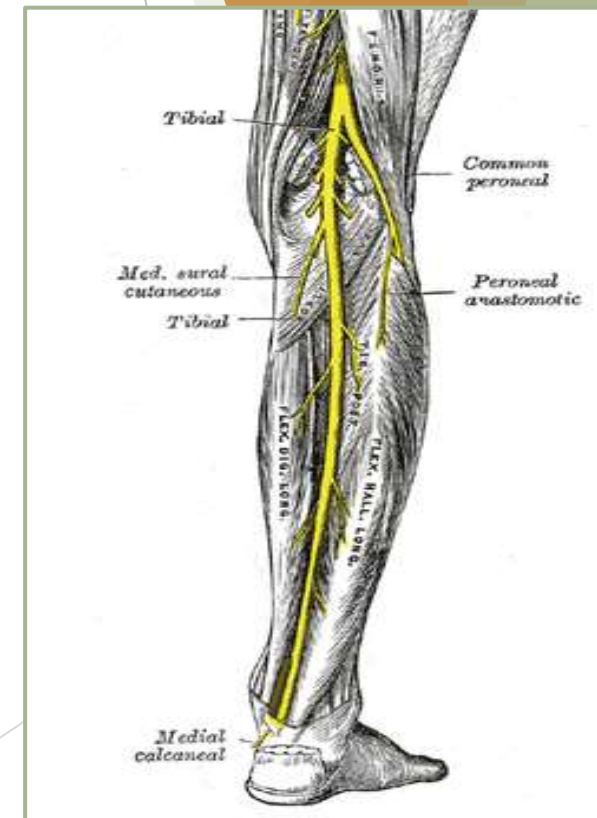
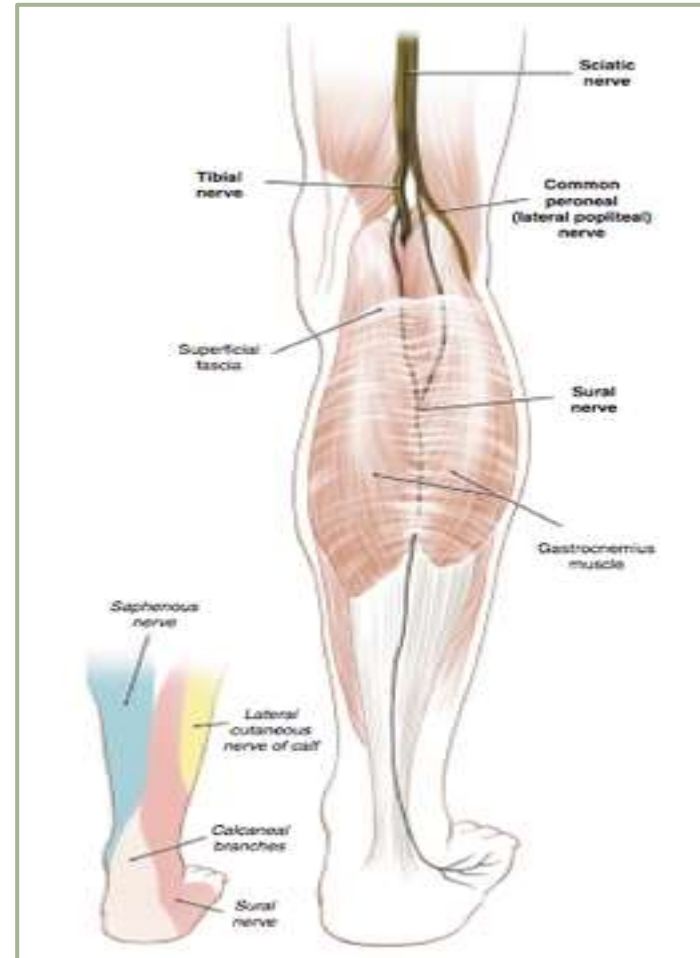


Branches of the Tibial nerve

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- **Muscular Branches**: to all muscles in the posterior compartment of the leg
- **Articular branches** supply the knee joint
- **Cutaneous branches**
 - ✓ **Medial sural cutaneous nerve**, is usually joined by the sural communicating branch of the common fibular nerve to form the **sural nerve**.
 - ✓ **Medial calcaneal branches** supply the skin of the heel.

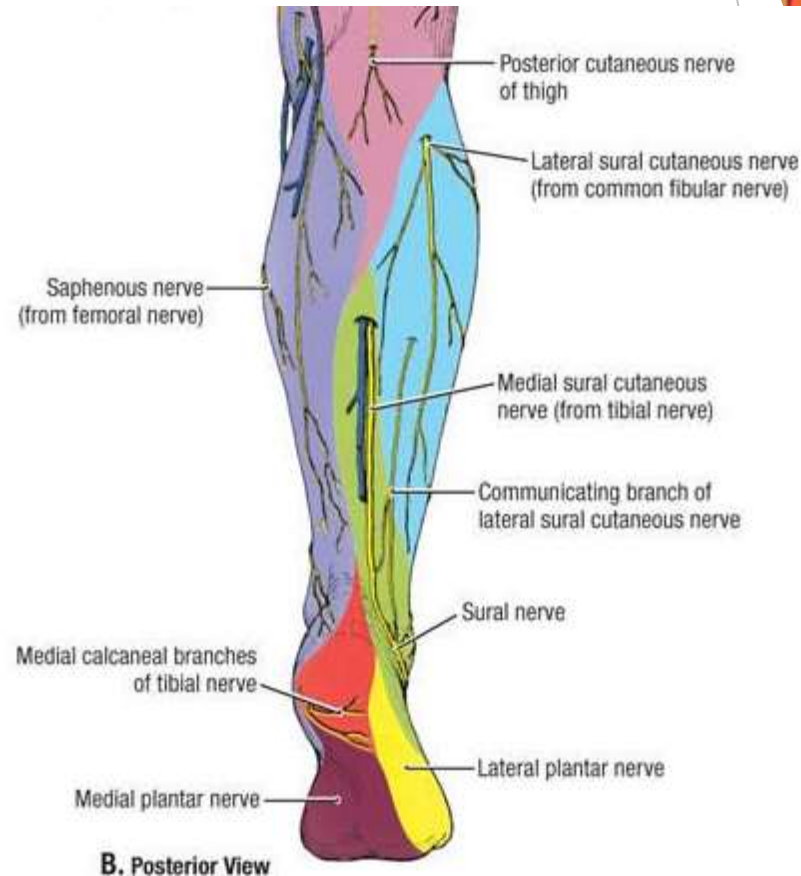


Cutaneous innervation

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Sural nerve

- Descends between heads of gastrocnemius
- becomes superficial at middle of leg;
- descends with small saphenous vein
- passes inferior to lateral malleolus to lateral side of foot



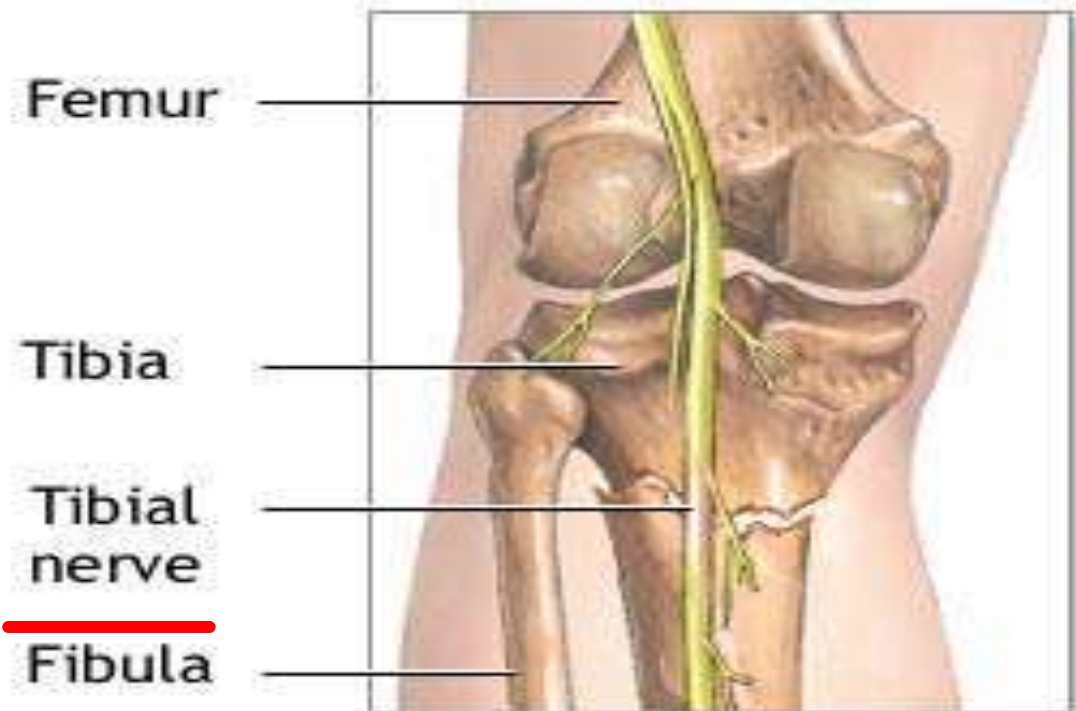
- It supplies the **skin of the lateral and posterior part of the inferior third of the leg and the lateral side of the foot**



Tibial Nerve Injury (depends on the level)

- Motor disturbances in the ankle & knee
- Paralysis of all foot muscles
(inability to walk!)

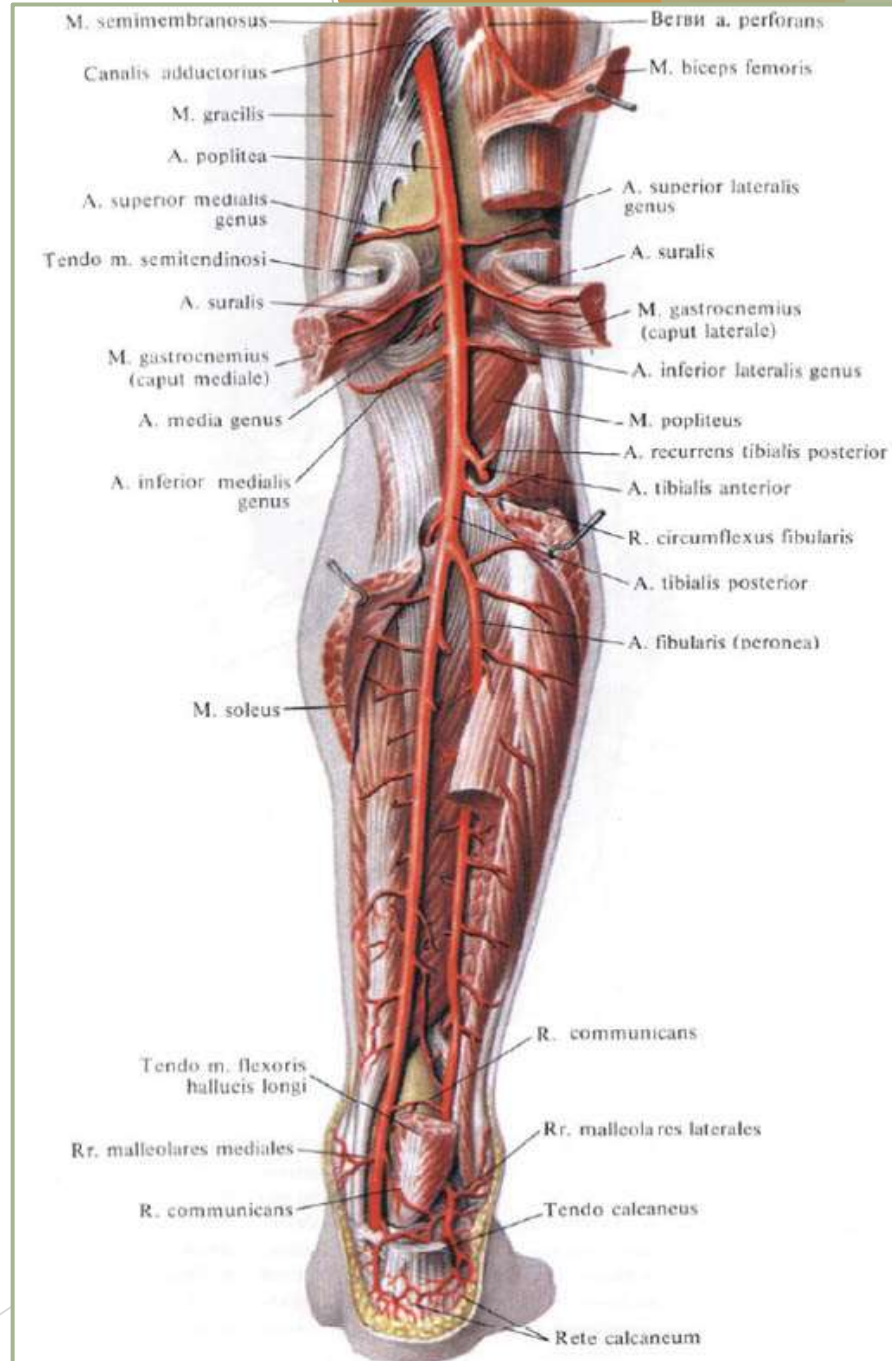
Sensory disturbances on the sole



ARTERIES IN POSTERIOR COMPARTMENT

Posterior tibial artery

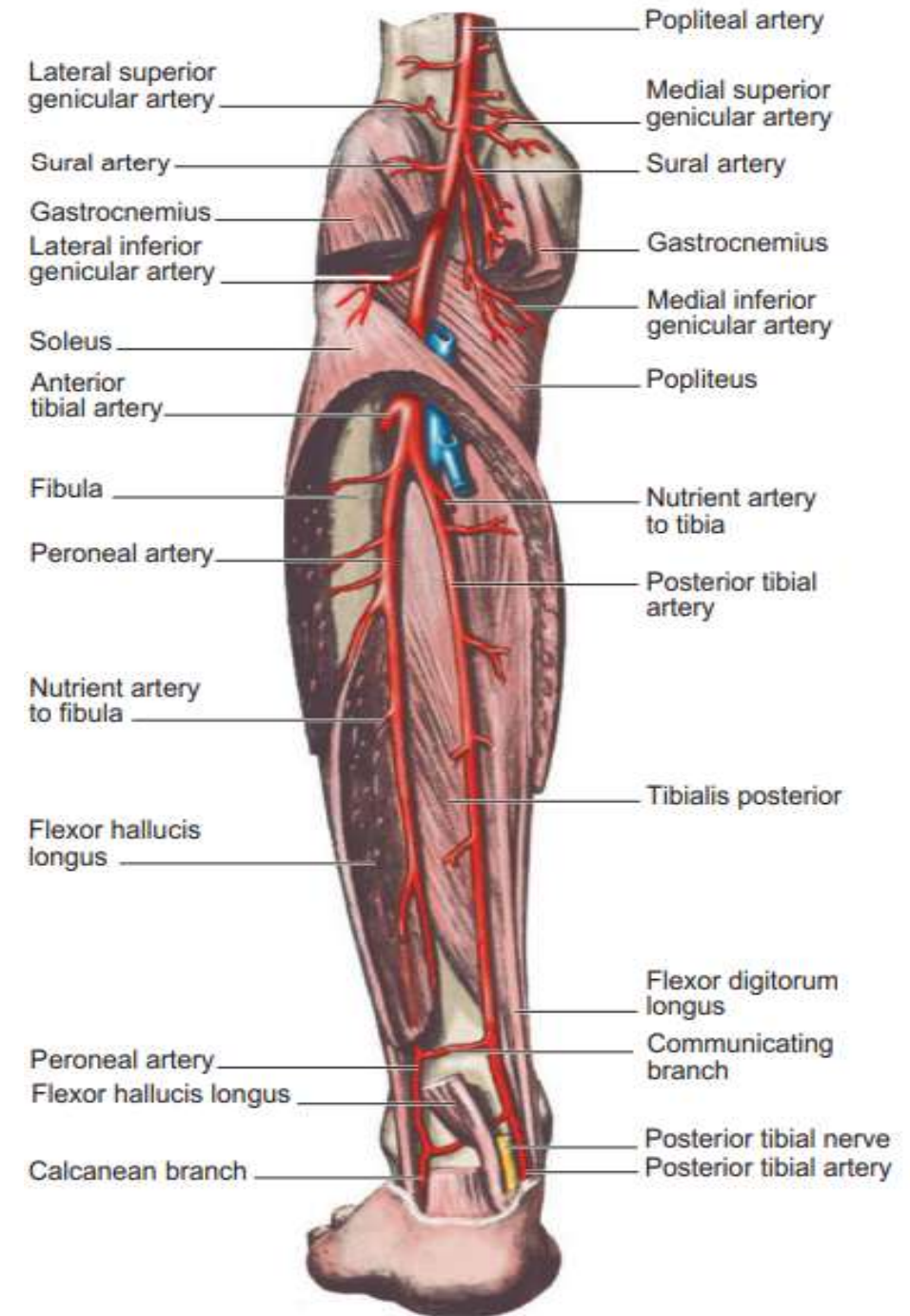
- It begins at the distal border of the popliteus as the popliteal artery passes deep to the tendinous arch of the soleus and simultaneously bifurcates into its terminal branches.
- **Close to its origin**, the posterior tibial artery gives rise to its largest branch, **the fibular” peroneal” artery**
- It runs down on tibialis posterior, between flexor digitorum longus and flexor hallucis longus.
- It ends under the flexor retinaculum by dividing into medial and lateral plantar arteries.
- During its descent, the **posterior tibial artery** is accompanied by the **tibial nerve** and **veins**.



Branches of posterior tibial artery

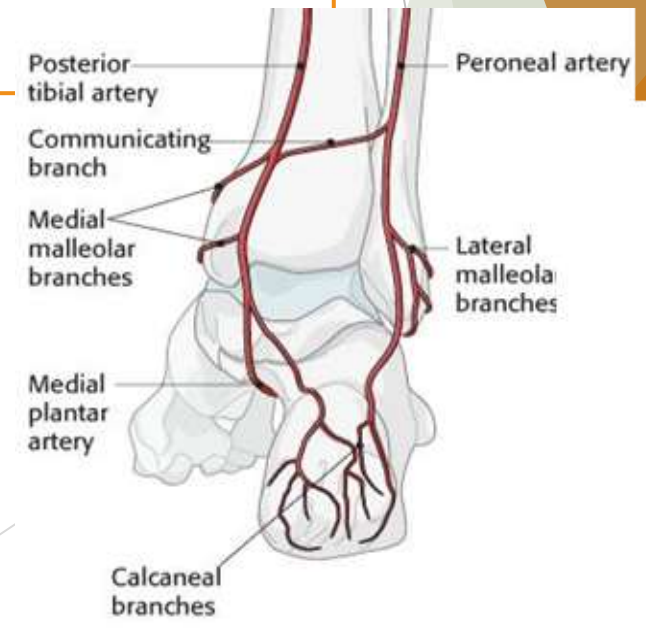
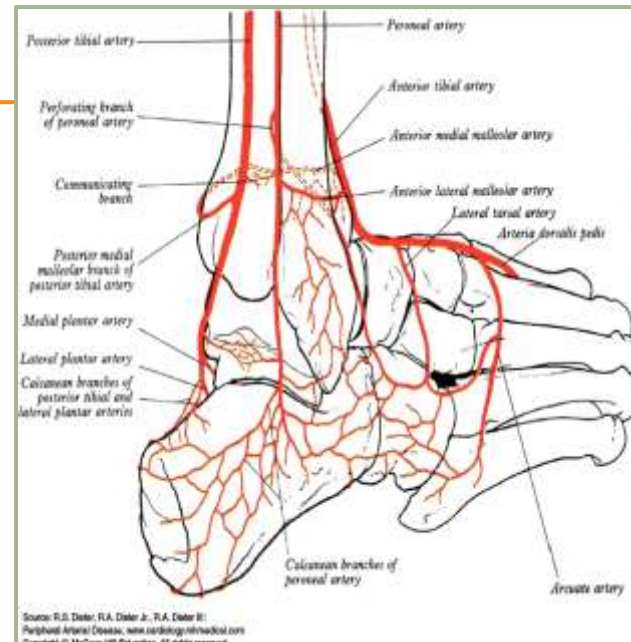
1. Fibular (peroneal) artery

- The principal source of blood to the lateral compartment
- Given from the posterior tibial artery 2 cm below its origin and it runs lateral and parallel to it within the same subcompartment
- Descends in the posterior compartment of the leg in the substance of FHL



Branches of the fibular artery

- **Muscular branches** to the **popliteus** and **other muscles** in both the **posterior** and the **lateral compartments of the leg**.
- **Nutrient artery of the fibula**
- **perforating branch** pierces the interosseous membrane and passes to the dorsum of the foot, where it anastomoses with the arcuate artery.
- **Lateral calcaneal branches** supply the heel,
- **Lateral malleolar branch** joins other malleolar branches to form a periarticular arterial anastomosis of the ankle.



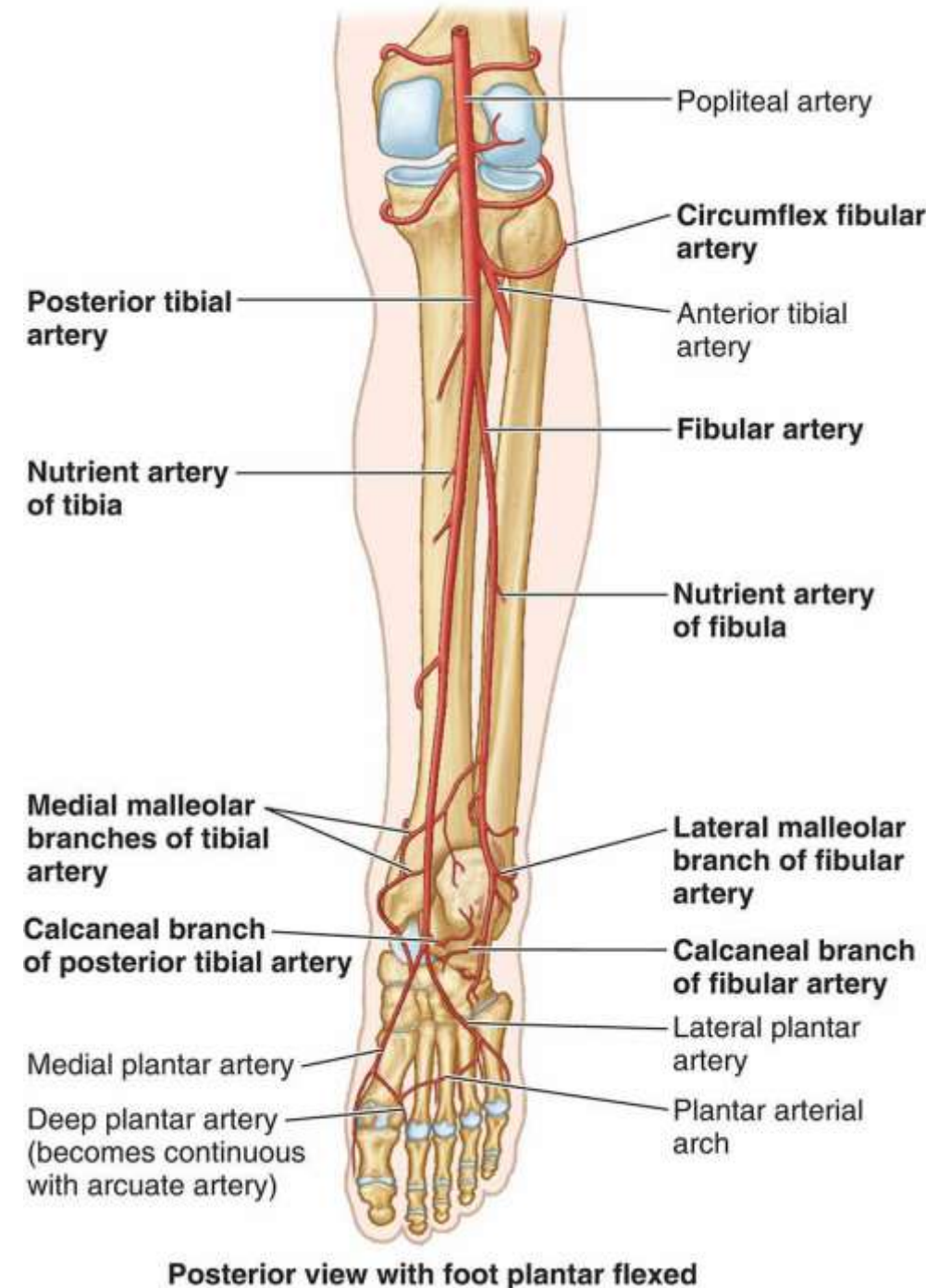
Branches of posterior Tibial Artery

2. Circumflex fibular artery; arises from the origin of the anterior or posterior tibial artery at the knee and passes laterally around **fibular neck** to join the arterial anastomosis around the knee.

3. Posterior tibial recurrent artery; to the anastomosis around the knee

4. Muscular arteries

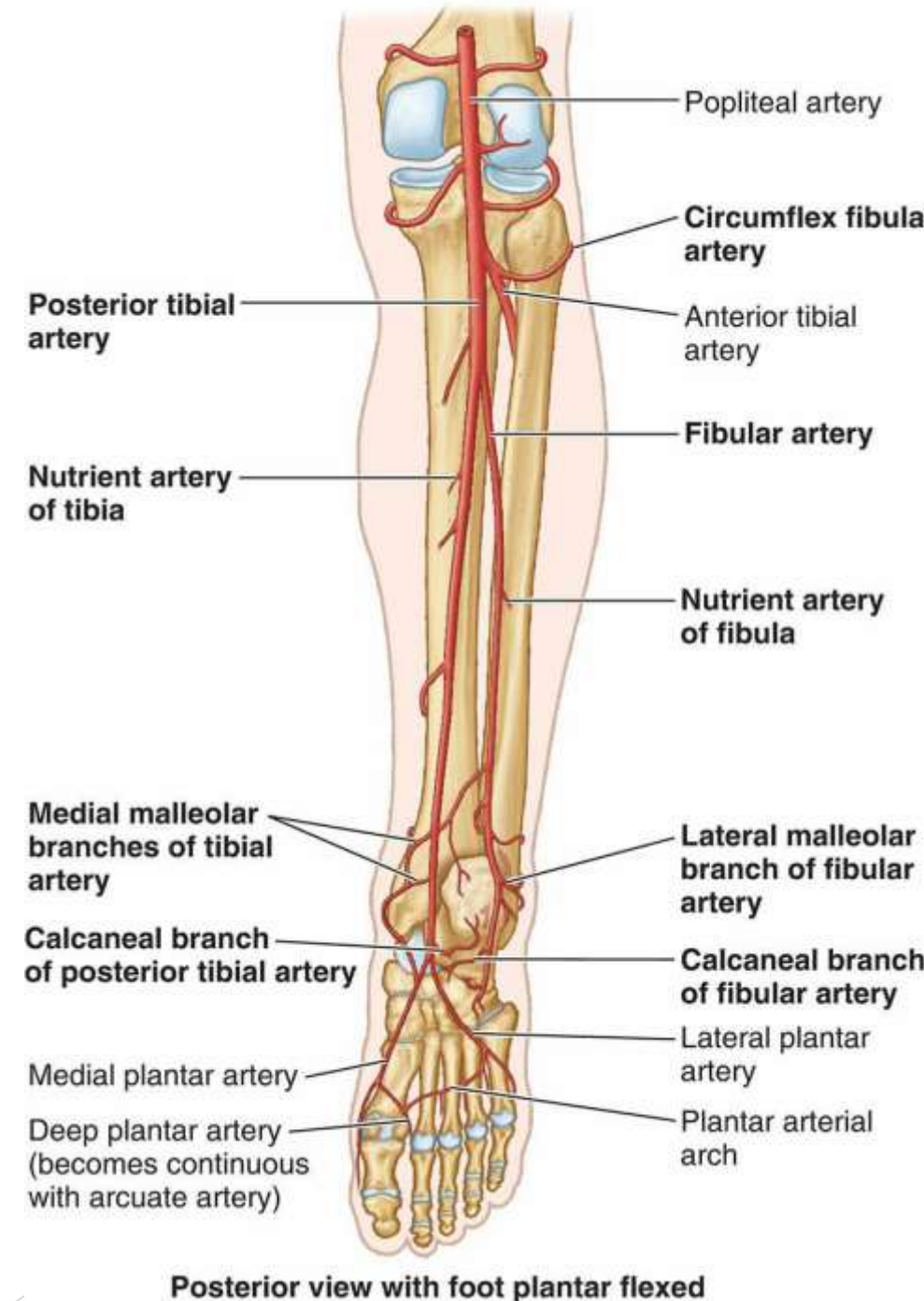
5. Perforating arteries; 5 in number, perforate the deep fascia to supply superficial structures & skin



6-Nutrient artery to the tibia: one of the largest of the nutrient arteries, arises from the **posterior tibial artery** near its origin . It pierces tibialis posterior and runs downwards to enter the bone just distal to the soleal line

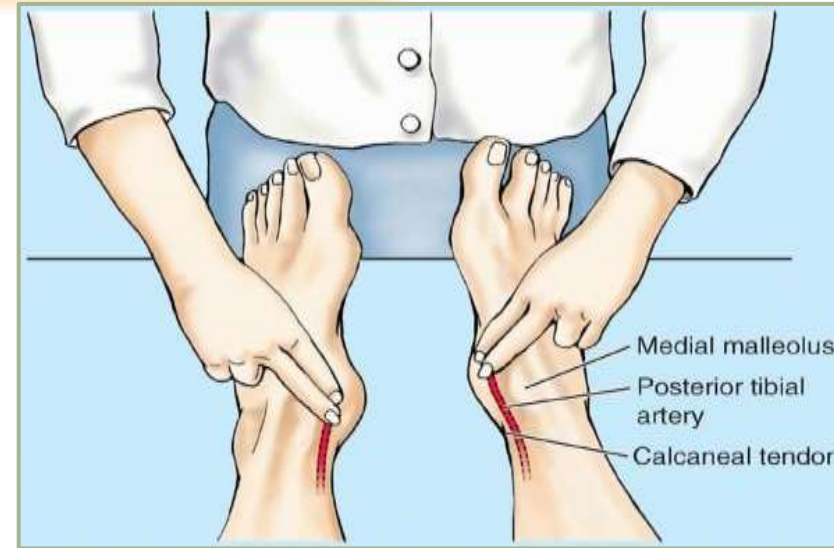
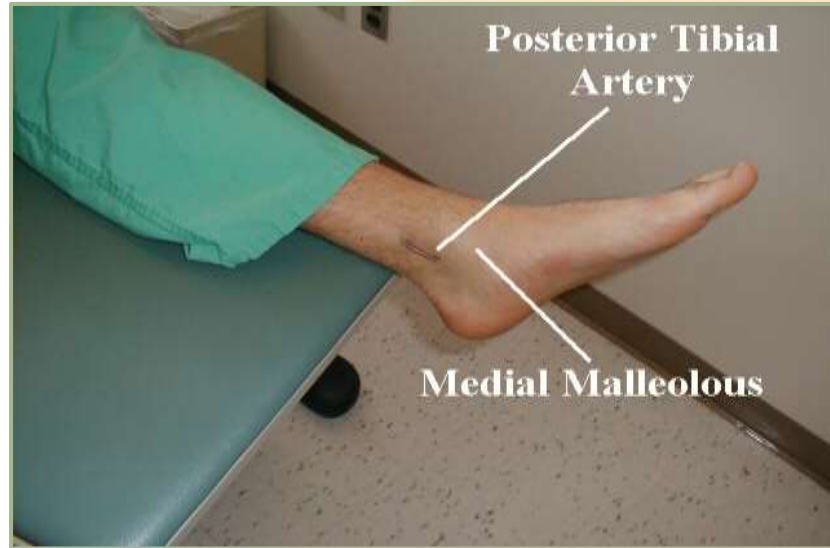
7- Medial malleolar branches ; to the malleolar network

8- Medial calcaneal branches; to the skin of the heel & adjacent areas



Posterior Tibial Pulse

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- can usually be palpated between the posterior surface of the **medial malleolus** and the medial border of **the calcaneal tendon**
- Because the posterior tibial artery passes deep to the flexor retinaculum, it is important when palpating this pulse to have the person **invert the foot** to relax the retinaculum.
- Both arteries are examined simultaneously for equality of force.

absence of posterior tibial pulses is a sign of **occlusive peripheral arterial disease** in people older than 60 years.

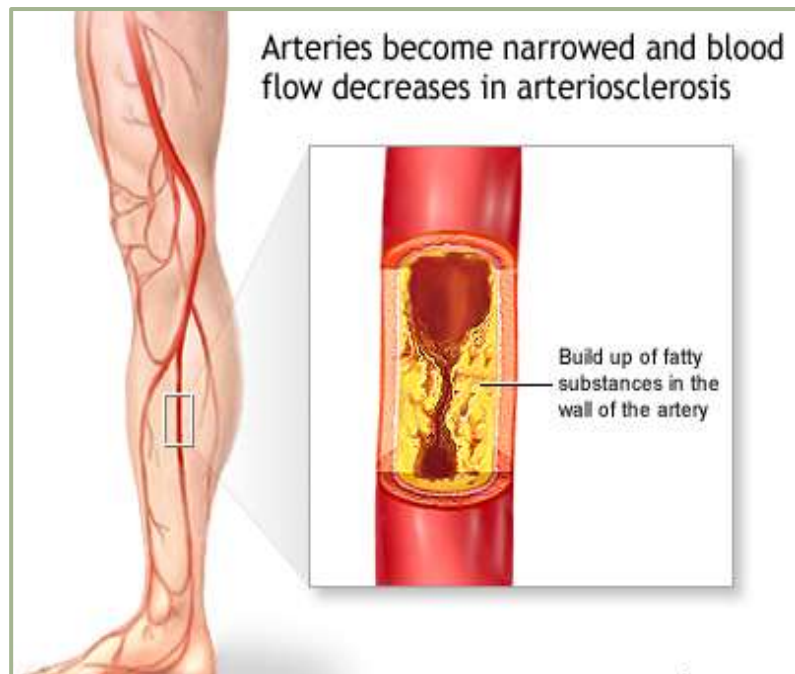


The leg may manifest peripheral vascular disease

Intermittent claudication

- ❖ results from **ischemia of the leg muscles** caused by **narrowing** or **occlusion of the leg arteries**.

- ❖ characterized by leg pain and cramps,
- ❖ develops during walking and disappears after rest.





*Thank
you*

