بسم الله الرحمن الرحيم

ANATOMY

FINAL | Lecture 11

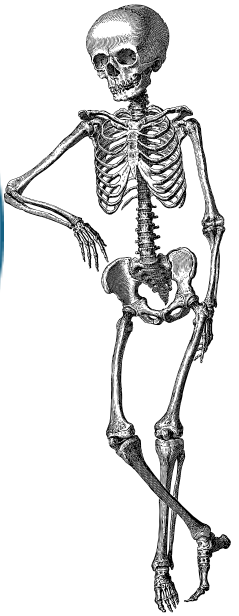
The Foot (pt.2)

Written by: Zaid Bassam
Saleh Alnaji

Reviewed by: Mahmoud Aljunaidi

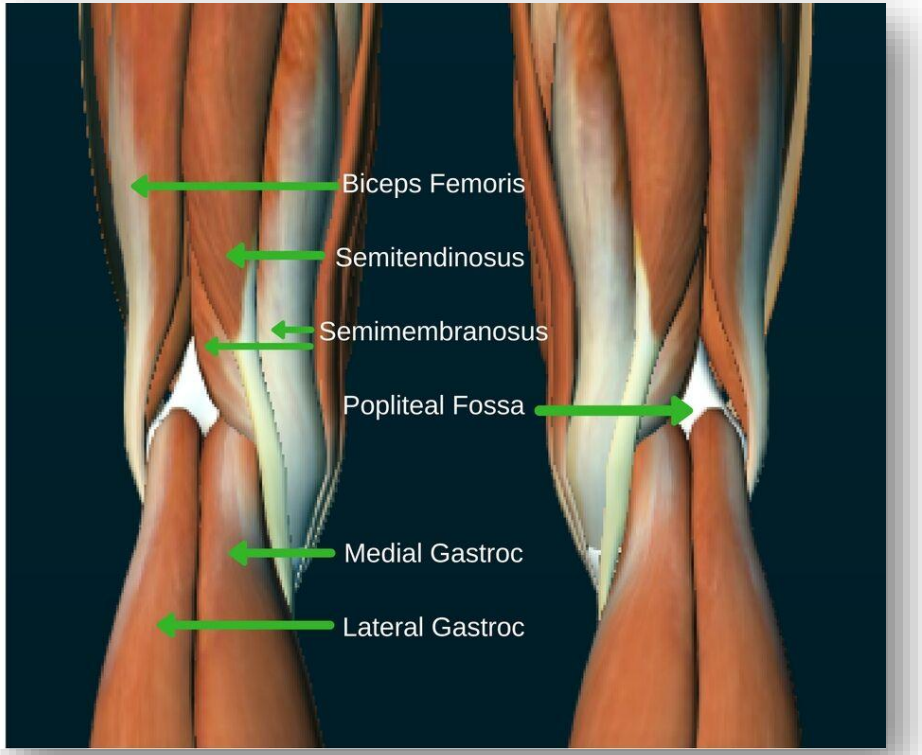
وَإِن تَتَوَلَّوْا يَسْتَبْدِلْ قَوْمًا غَيْرَكُمْ ثُمَّ لَا يَكُونُوا أَمْثَالَكُم

اللهم استعملنا ولا تستبدلنا



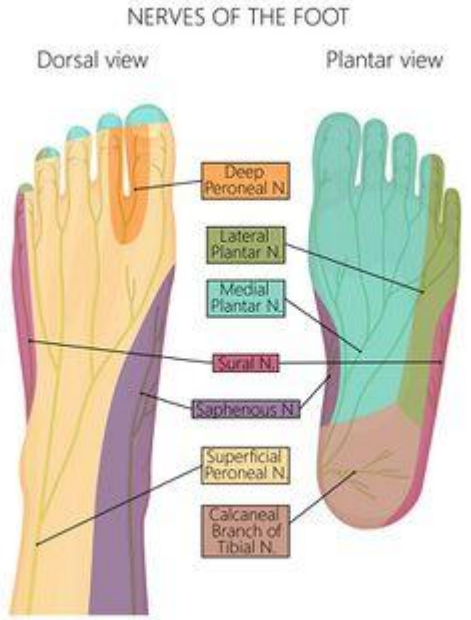
Color Code: Slides + Dr. doesn't mention | Slides + Dr. mentions | Extra from Dr.

Quiz on the previous lecture



The foot 2: The Dorsum

- The superficial peroneal nerve and the deep peroneal nerve are branches of the **common peroneal nerve.**
- The superficial peroneal nerve only provides sensory innervation and **does not** have any motor functions.
  - It is responsible for sensation on the dorsum of the foot, **except** for the area between the big toe and the second toe (**the first web space**), which is innervated by the **deep peroneal nerve**.
- The deep peroneal nerve (**mostly motor**) not only provides sensory innervation to the first web space but also gives motor innervation to the muscles in the anterior compartment of the leg.



Extra image, orange area is the first web space.

The Dorsum of the Foot

Skin

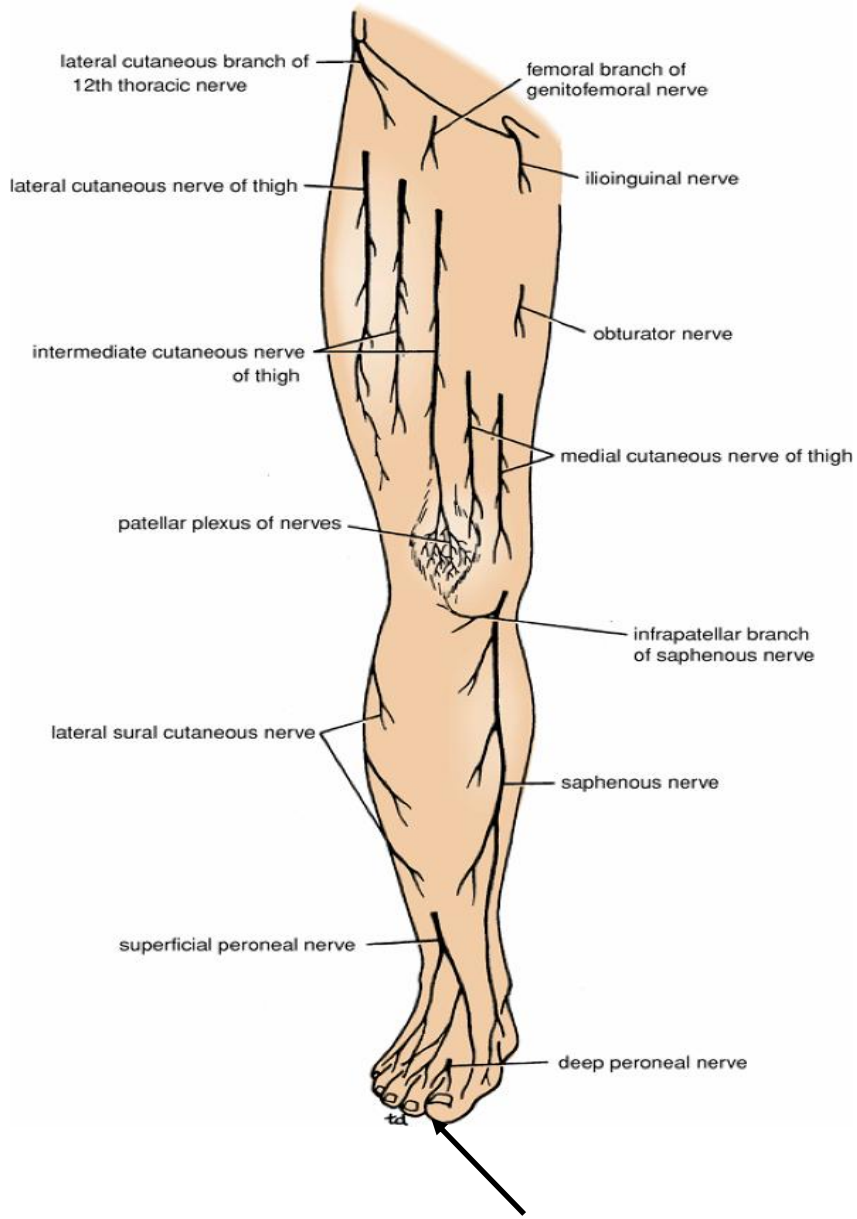
- The skin on the dorsum of the foot is thin, hairy, and freely mobile on the underlying tendons and bones.

- The sensory nerve supply to the skin on the dorsum of the foot is derived from **the superficial peroneal nerve, assisted by the deep peroneal, saphenous, and sural nerves.**

1- The superficial peroneal nerve

- emerges from between the peroneus brevis and the extensor digitorum longus muscle in the lower part of the leg

- It divides into medial and lateral cutaneous branches that supply the skin on the dorsum of the foot



The Dorsum of the Foot – cont.

2- The deep peroneal nerve supplies the skin of the adjacent sides of the big and second toes, aka the first web space.

3- The saphenous nerve

- The saphenous nerve is a branch of the femoral nerve.
- passes onto the dorsum of the foot in front of the medial malleolus.

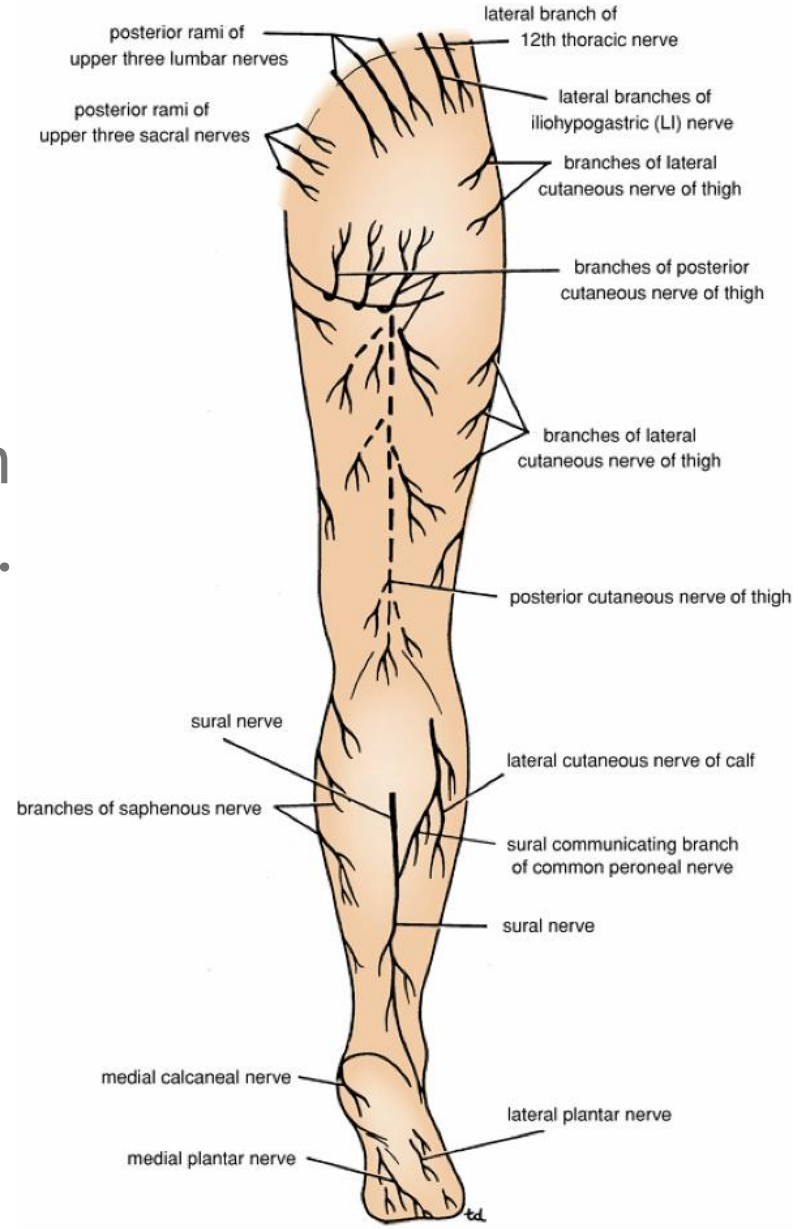
- It supplies the skin along the medial side of the foot as far forward as the head of the first metatarsal (big toe) – sensory innervation.

4- The sural nerve.

- The sural nerve, a branch of the **tibial nerve**, supplies sensation to the lateral side of the foot, extending to the little toe.
- Enters the foot behind the lateral malleolus and supplies the skin along the lateral margin of the foot and the lateral side of the little toe.

5- The nail beds and the skin covering the dorsal surfaces of the terminal phalanges are supplied by the **medial and lateral plantar nerves**.

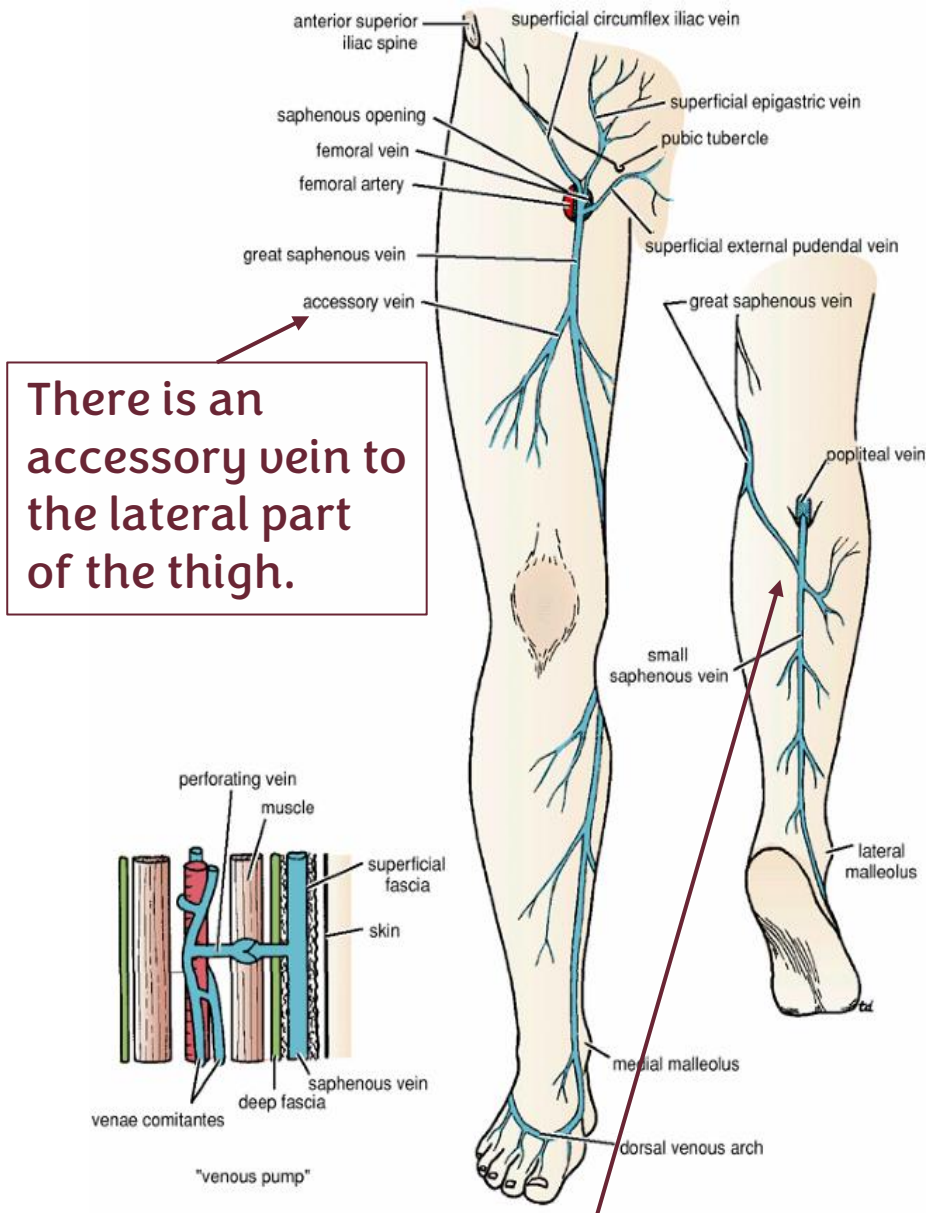
- Medial and lateral plantar nerves are branches from **tibial nerve** they cover the sole then come back to bed nails.



- **Dorsal Venous Arch (or Network)**

- The dorsal venous arch lies in the subcutaneous tissue over the heads of the metatarsal bones and drains on the medial side into **the great saphenous vein and on the lateral side into the small saphenous vein.**

- **The great saphenous vein** leaves the dorsum of the foot by ascending into the leg in front of the medial malleolus. Its further course is described on.

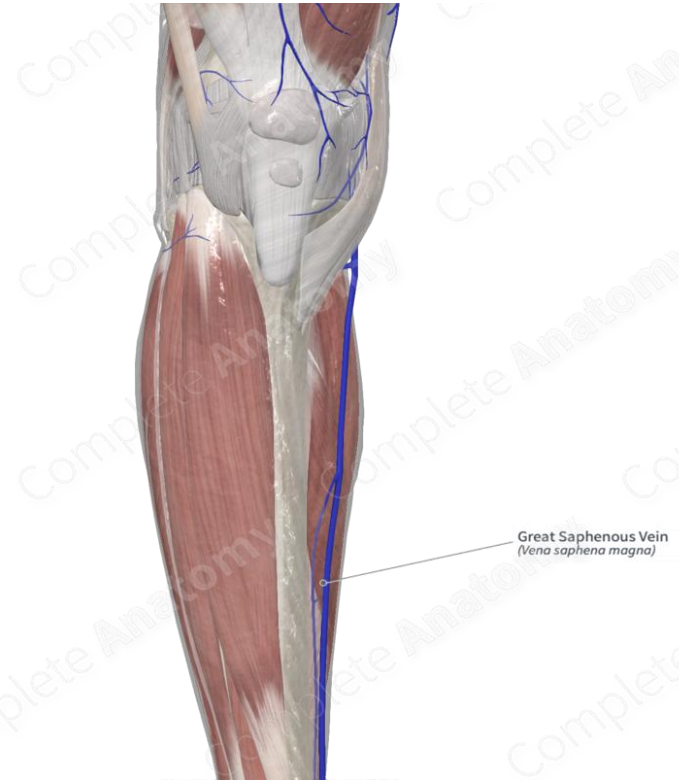


There is an accessory vein to the lateral part of the thigh.

There's a connection between great and small saphenous vein.

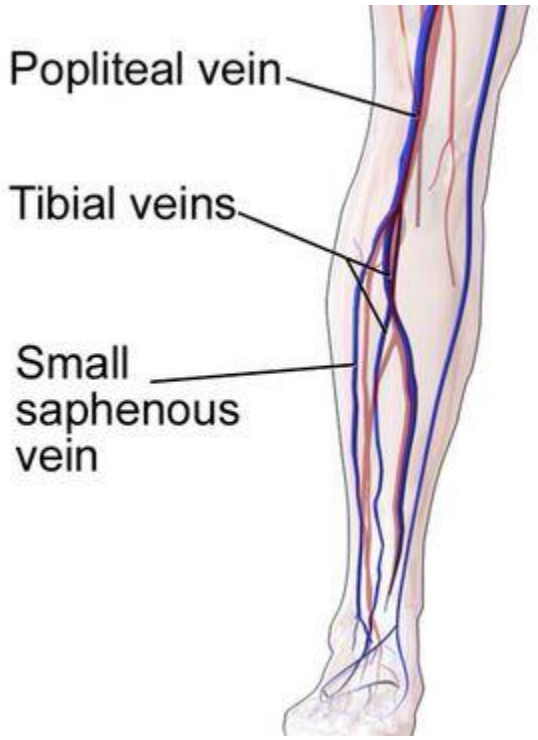
The great saphenous vein – Course.

The great saphenous vein runs in front of the medial malleolus, then continues along the medial side of the leg, passes behind the knee in the popliteal fossa, and then ascends into the thigh, where it ends by entering the saphenous opening. Along its course, it communicates with tributaries from other superficial veins, and finally drains into the **femoral vein**.



Dorsal Venous Arch – cont.

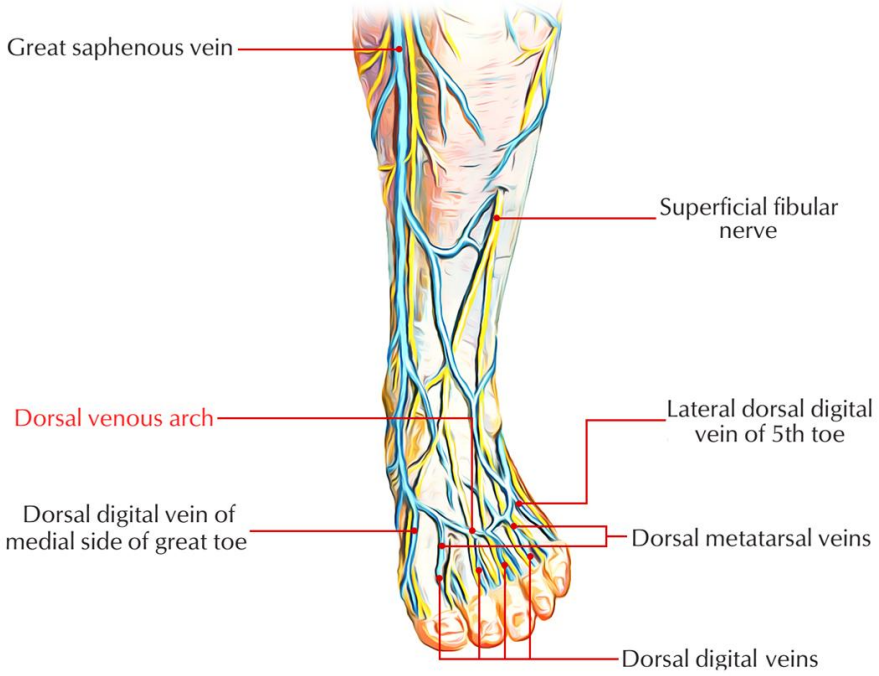
- **The small saphenous vein**
  - ascends into the leg behind the lateral malleolus. Its course in the back of the leg as it described before.
  - The small saphenous vein begins from the lateral side of the dorsal venous arch, then ascends behind the lateral malleolus, continues along the back of the leg, and then pierces the roof of the popliteal fossa, where it drains into the **popliteal vein**.
- The greater part of the blood from the whole foot drains into the arch via digital veins and **communicating veins** from the sole, which pass through the interosseous spaces.

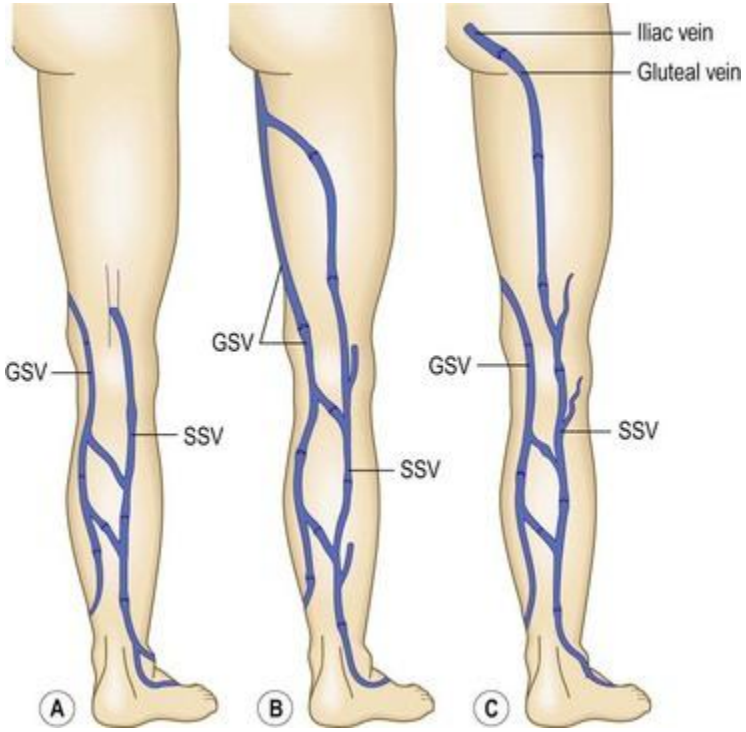


Extra image

The great saphenous vein is important in cardiac surgery.

Saphenous veins – Extra images.

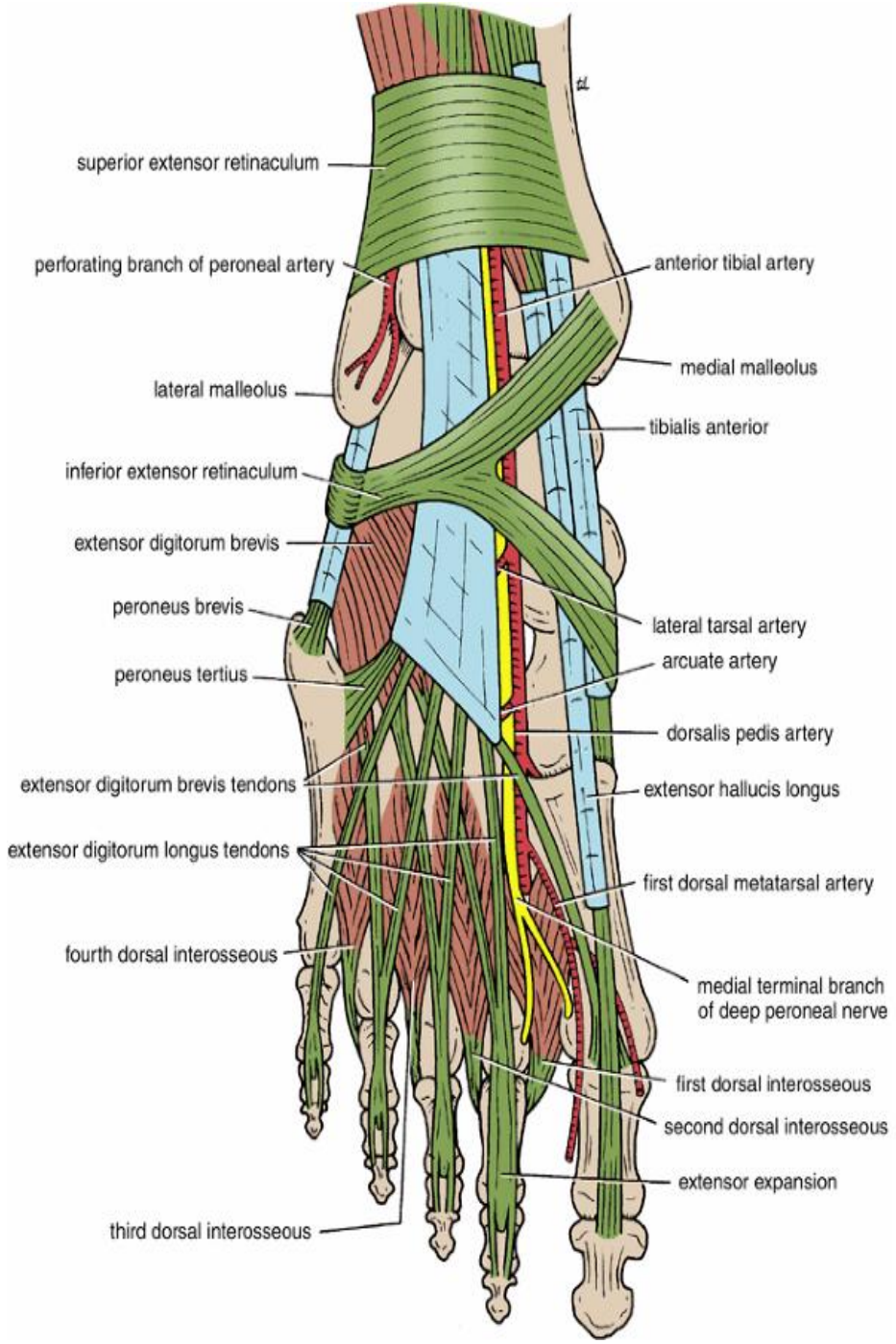




GSV = Great Saphenous Vein.
SSV = Small Saphenous Vein.

Muscles of the Dorsum of the Foot.

- The tendon of extensor digitorum longus passes beneath the superior extensor retinaculum and through the inferior extensor retinaculum, in company with the peroneus tertius muscle.
- The tendon divides into four, which fan out over the dorsum of the foot and pass to the lateral four toes.
- Opposite the metatarsophalangeal joints of the second, third, and fourth toes, each tendon is joined on its lateral side by a tendon of extensor digitorum brevis



Retinacula – The Foot.

- For the sake of stabilizing and fixating the tendons of muscles going to the foot, as they pass long distances, there are 5 retinacula they pass deep to:
  a. **In front of the foot.**
     - Superior extensor retinaculum.
     - Inferior extensor retinaculum (Y-shaped).
  b. **Behind the medial malleolus.**
     - Flexor retinaculum.
  c. **On the lateral side of peroneus tendon.**
     - Superior peroneal retinaculum.
     - Inferior peroneal retinaculum.

Dorsum of the Foot.

- **Peroneus Tertius** passes in front of the foot and enters the same synovial sheath as the **Extensor Digitorum Longus**.
- Extensor Digitorum **Longus** and **Brevis** exit from the dorsum of the foot and extend towards the lateral toes.
  - These muscles form the **Dorsal Expansion**, extending to the distal phalanges, explaining their role in fully extending the toes.

❖ Arterial Supply:

- The **Anterior Tibial** Artery gives off:
  - Lateral Tarsal Artery
- Anterior tibial artery continues as dorsalis pedis artery, which gives:
  - **Arcuate** Artery, that branches into:
    - Distal Artery branches.
  - **First Dorsal Metatarsal** Artery, which eventually supplies both sides of the big toe.

Dorsum of the Foot – Continued.

- Extensor Muscles: Responsible for **dorsiflexion**, which is the action of lifting the foot upwards.
- Mnemonic to Remember the Muscles, vessels, and nerves in the anterior compartment of the leg – deep to inf. Ext. Retinaculum: **(medial to lateral)**

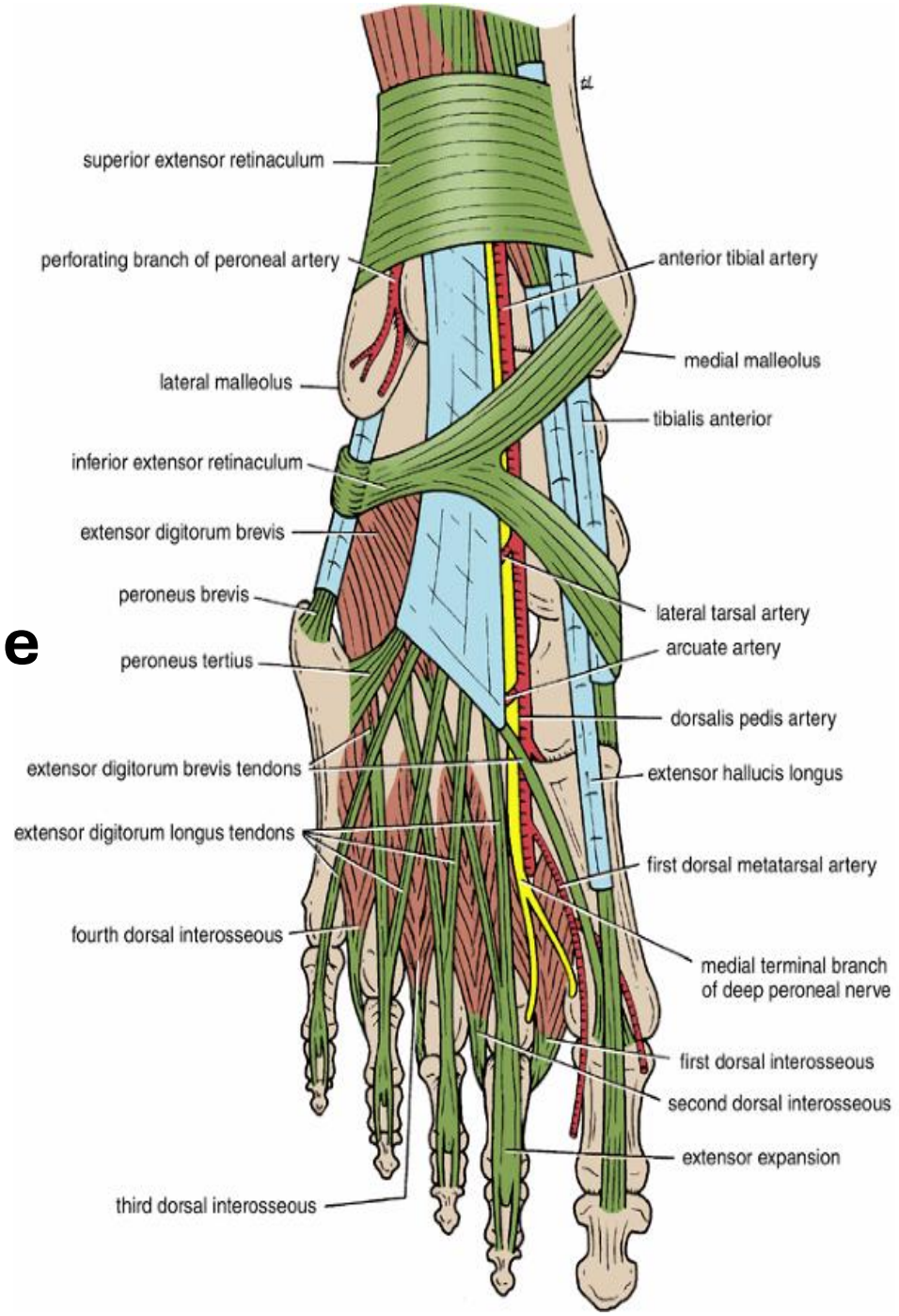
"Tom has very nice dogs and pigs"

- **T**om = **T**ibialis Anterior.
- **H**as = Extensor **H**allucis Longus (extends the big toe).
- **V**ery = Anterior tibial **V**essels.
- **N**ice = Deep peroneal **n**erve.
- **D**ogs = Extensor **D**igitorum longus and brevis (brevis to lateral).
- **P**igs = **P**eroneus Tertius.

- On the dorsal surface of each toe, the extensor tendon joins the fascial expansion called the extensor expansion.

- Near the proximal interphalangeal joint, the extensor expansion splits into **three parts: a central part, which is inserted into the base of the middle phalanx, and two lateral parts, which converge to be inserted into the base of the distal phalanx**

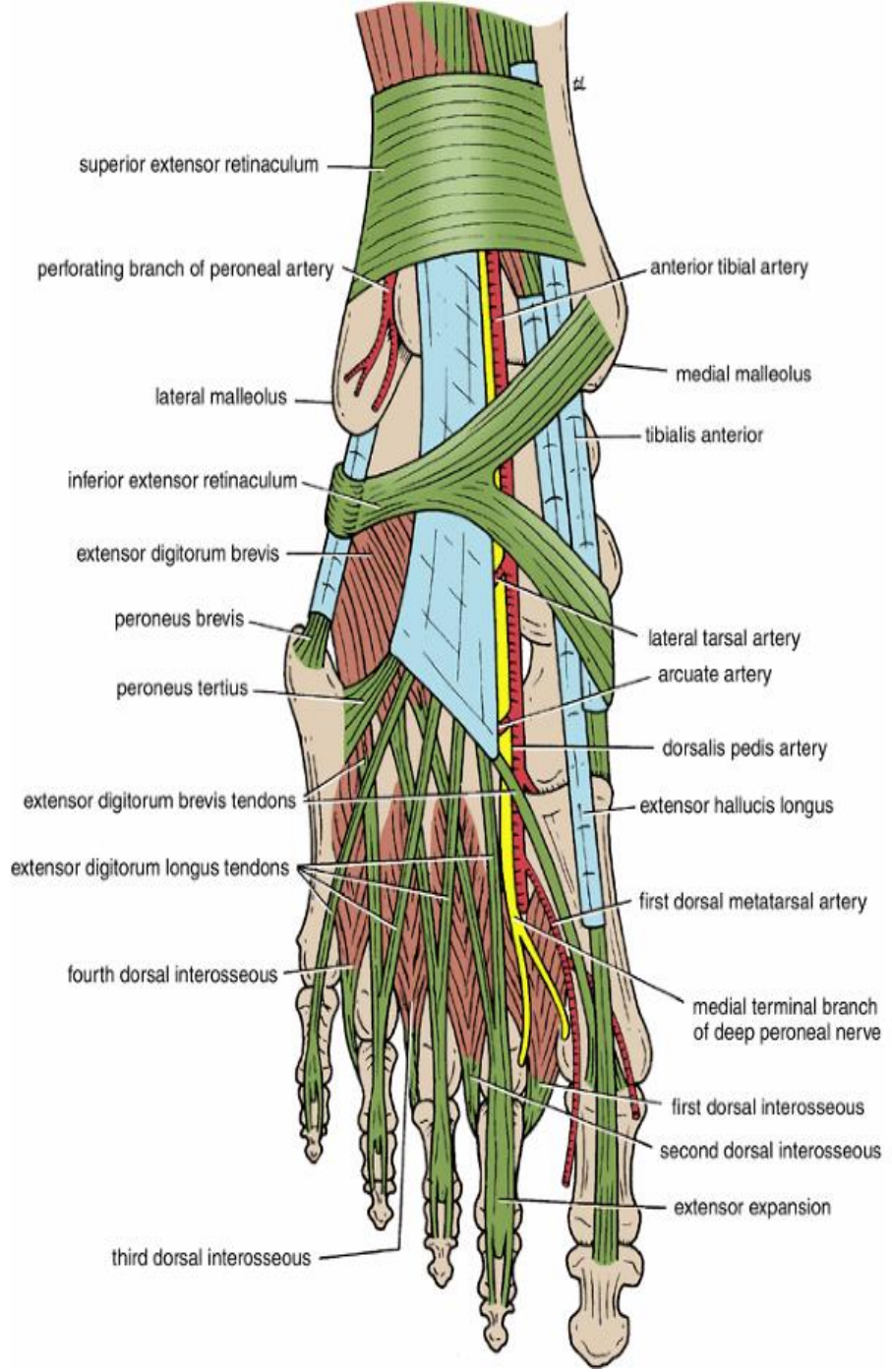
- **The dorsal expansion**, as in the fingers, receives the tendons of insertion of the interosseous and lumbrical muscles.



Synovial Sheath of the Tendon of Extensor Digitorum Longus

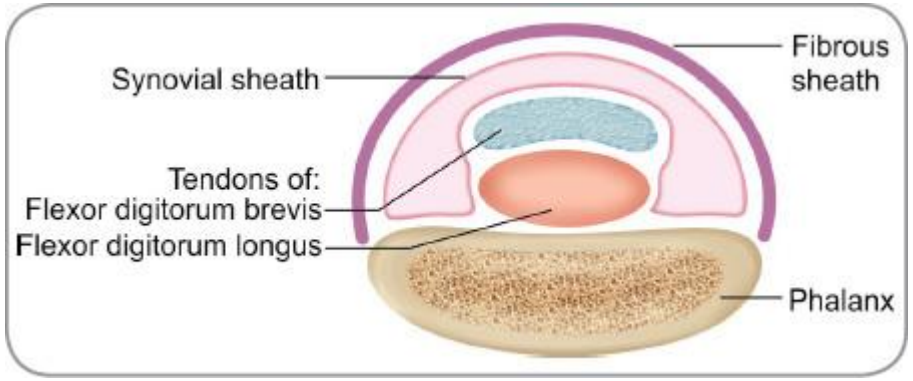
- The extensor digitorum longus and peroneus tertius tendons are surrounded by a common synovial sheath as they pass beneath the extensor retinacula

- The sheath extends proximally for a short distance above the malleoli and distally to the level of the base of the fifth metatarsal bone.



Synovial sheath and the surrounding layer

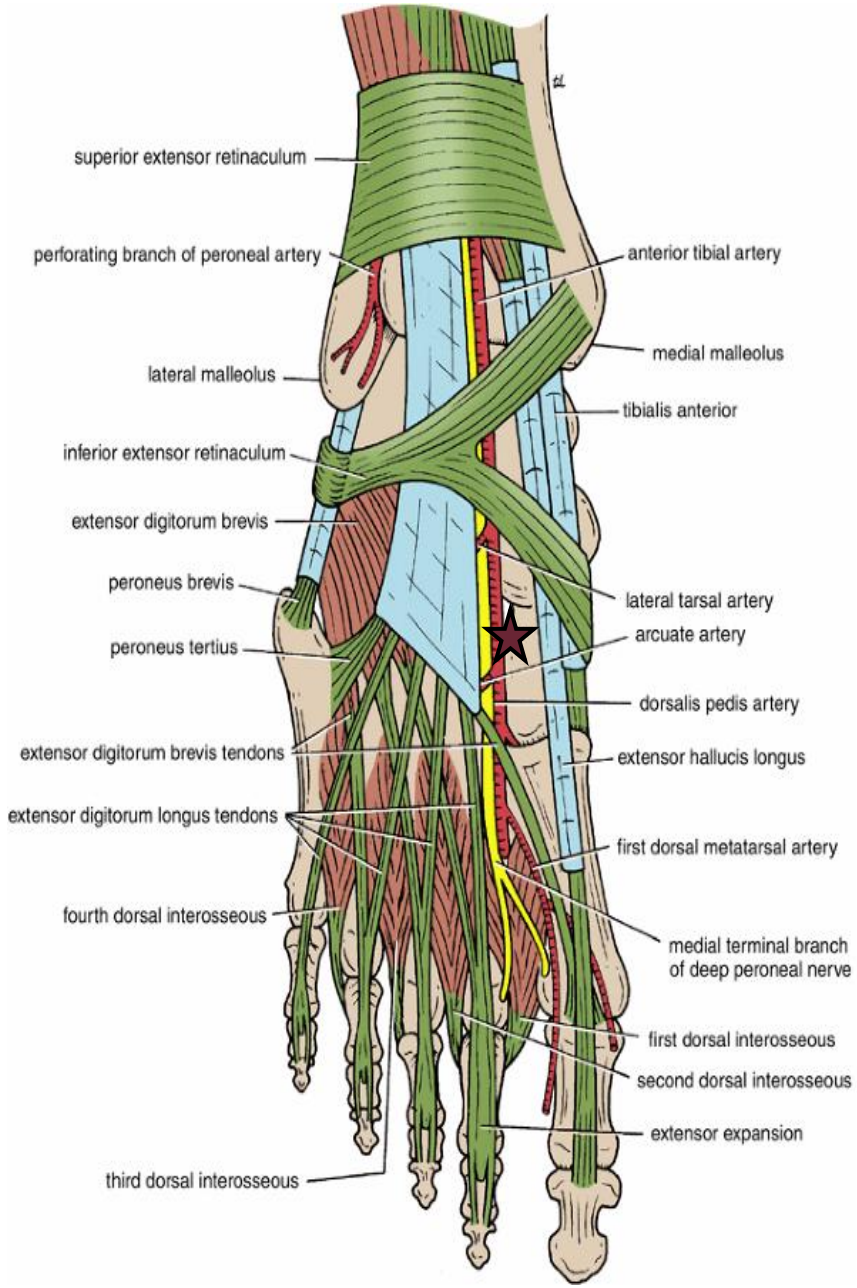
- The synovial sheath and fibrous sheath are around the tendons.
- The function of the synovial sheath is to **secrete synovial fluid**, for lubrication.
- The fibrous sheath is the outer layer, and its function is protection.
- The synovial sheath is inside the fibrous sheath.



Artery of the Dorsum of the Foot

Dorsalis Pedis Artery (the Dorsal Artery of the Foot)

- The dorsalis pedis artery begins in front of the ankle joint as a continuation of the anterior tibial artery
- It terminates by passing downward into the sole between the two heads of the first dorsal interosseous muscle, where it joins the lateral plantar artery and completes the plantar arch
- It is superficial in position and is crossed by the inferior extensor retinaculum and the first tendon of extensor digitorum brevis.



★ Here we can feel the pulse of the dorsalis pedis artery, which supplies the medial and lateral sides of the big toe, as it passes over the first and second metatarsal bones

Dorsalis pedis artery – cont.

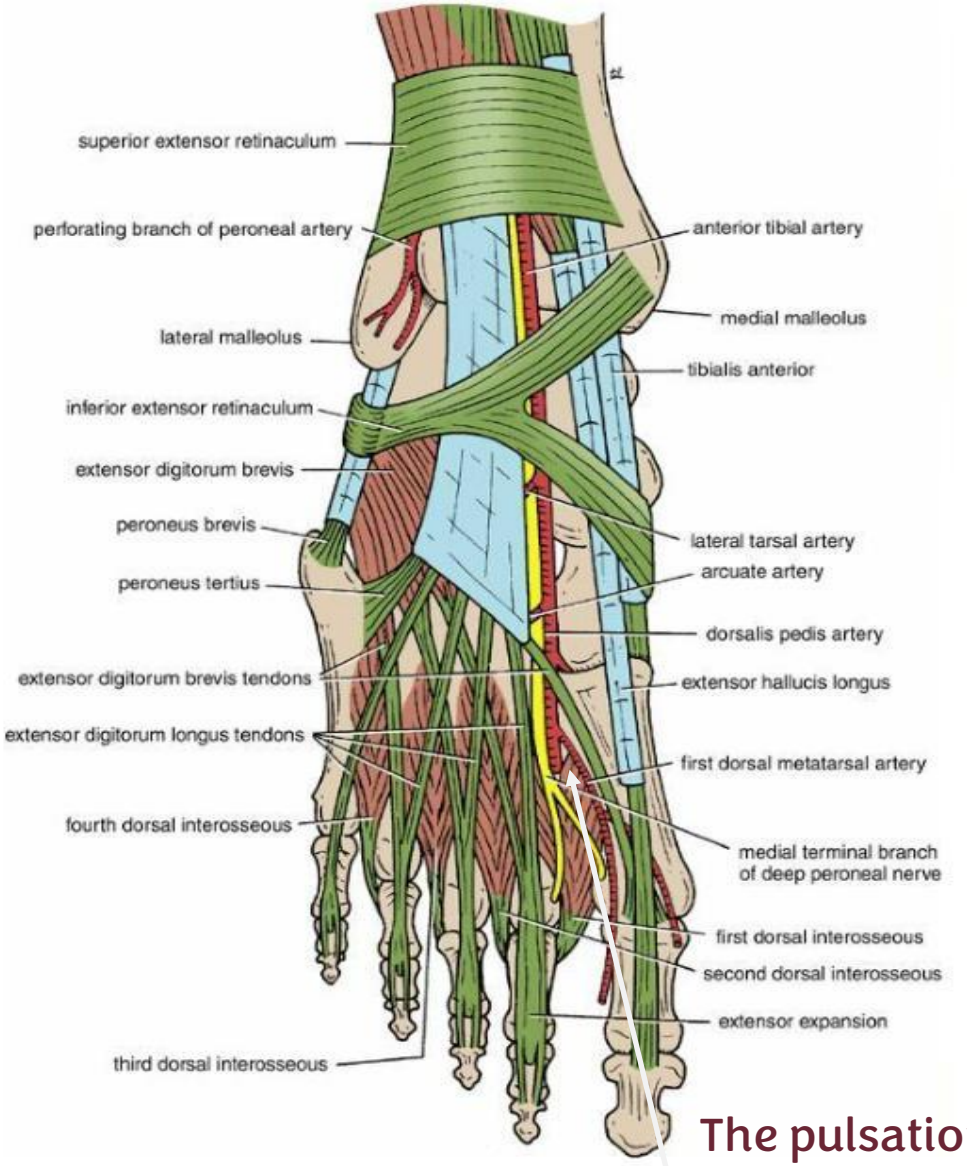
- On its lateral side lie the terminal part of the deep peroneal nerve and the extensor digitorum longus tendons.

- On the medial side lies the tendon of extensor hallucis longus

- Its pulsations can easily be felt.

Branches of dorsalis pedis artery:

- **Lateral tarsal artery**, which crosses the dorsum of the foot just below the ankle joint
- **Arcuate artery,** which runs laterally under the extensor tendons opposite the bases of the metatarsal bones
- It gives off **metatarsal branches to the toes.**
- **First dorsal metatarsal artery**, which supplies both sides of the big toe

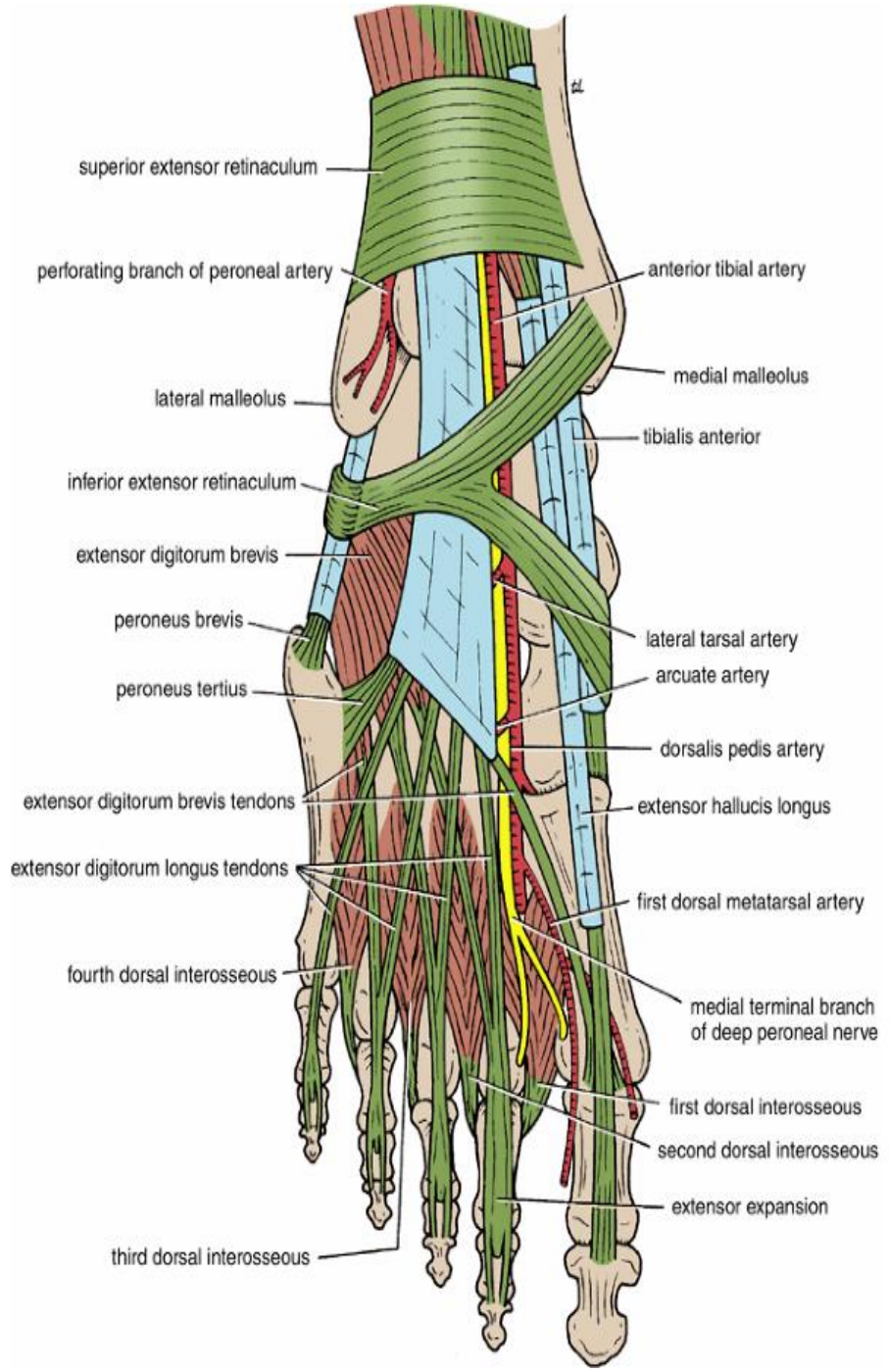


The pulsation is felt here between the hallucis and the first tendon of digitorum

Nerve Supply of the Dorsum of the Foot

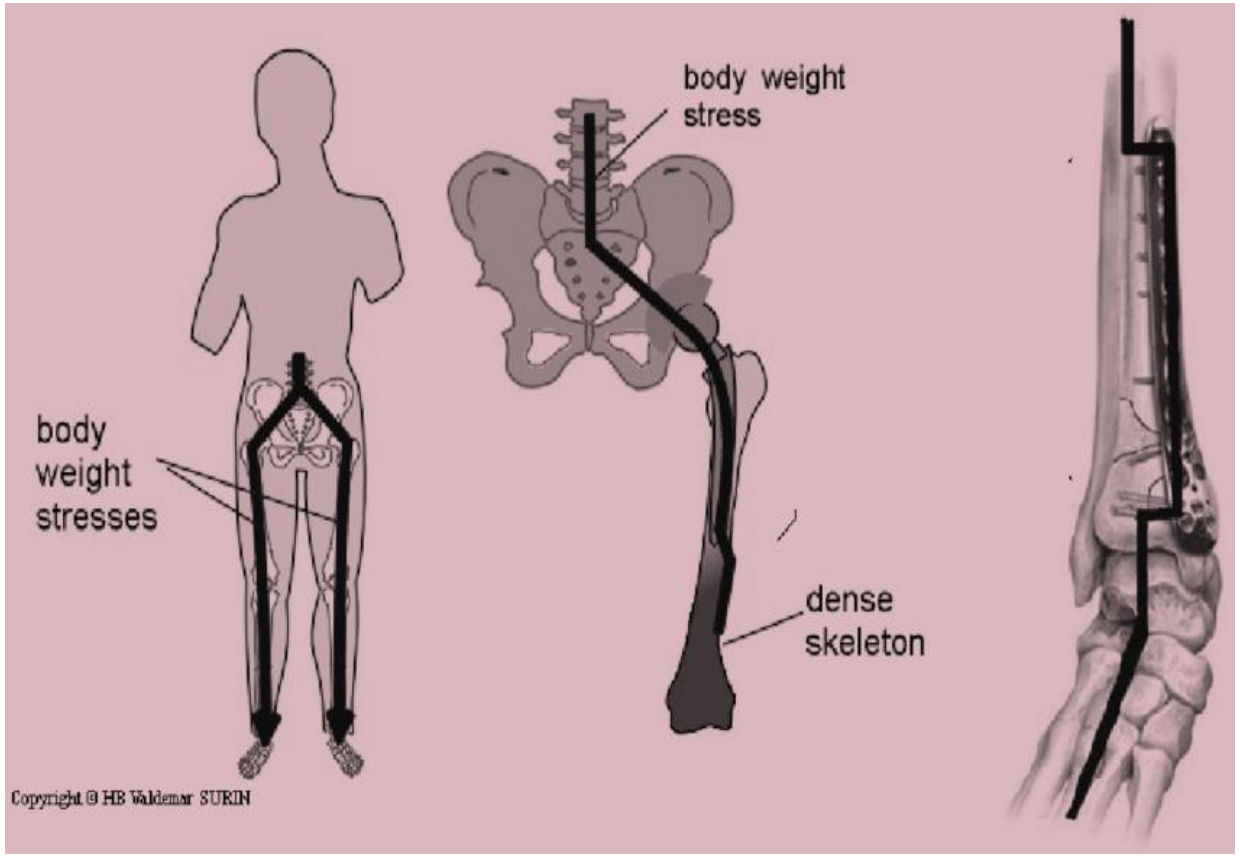
Deep Peroneal Nerve: Again, mainly motor for the muscles of the anterior compartment and sensory for the first cleft.

- The deep peroneal nerve enters the dorsum of the foot by passing deep to the extensor retinacula on the lateral side of the dorsalis pedis artery
- It divides into terminal, medial, and lateral branches.
- The medial branch supplies the skin/ sensation of the adjacent sides of the big and second toes (the first cleft).
- The lateral branch supplies the extensor digitorum brevis muscle.
- Both terminal branches give articular branches to the joints of the foot.

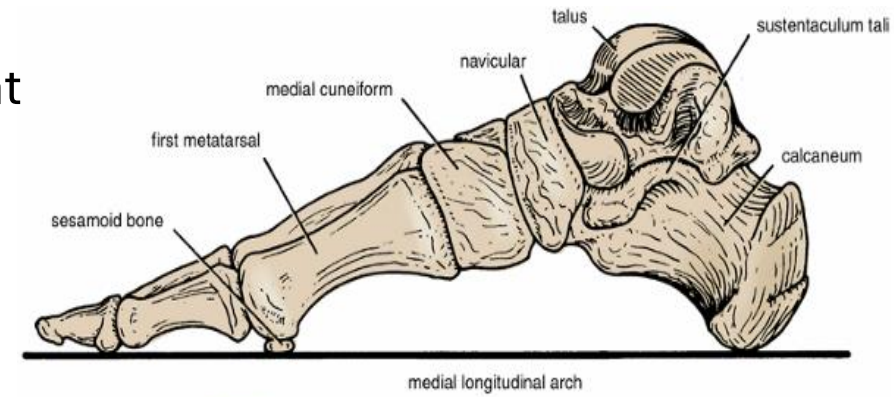


The Arches of the Foot

The weight of the upper limb is transmitted through the clavicle to the axial skeleton, then down through the vertebral column to the sacrum. From there, the weight is transferred to the hip bones via the sacroiliac joints and ligaments, then through the femur, tibia, and finally to the talus at the ankle joint. The foot arches then function to distribute and absorb this body weight efficiently during standing and movement.

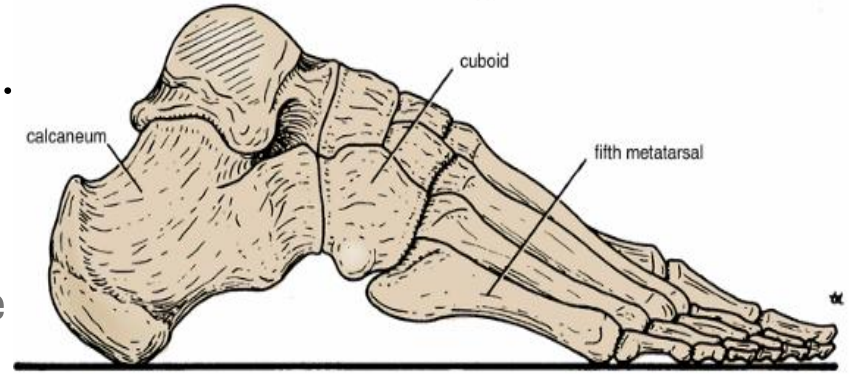


- **The Arches of the Foot** Made up of the tarsal and metatarsal bones.
- A segmented structure can hold up weight only if it is built in the form of an arch. The foot has three such arches, which are present at birth:



medial longitudinal arch

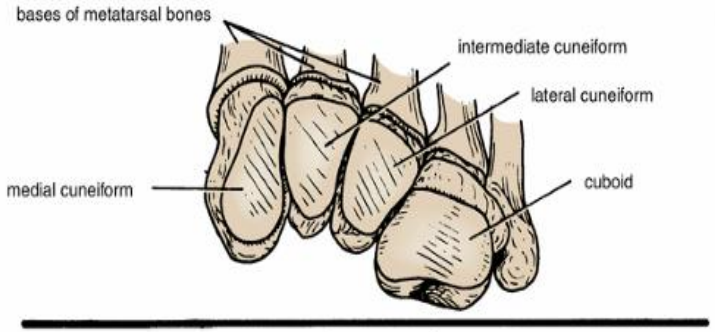
- **the medial longitudinal,** larger than the lateral.
- **lateral longitudinal.**
- **transverse arches**; between the medial and the lateral arches.



lateral longitudinal arch

- In the young child, the foot appears to be flat because of the presence of a large amount of subcutaneous fat on the sole of the foot.

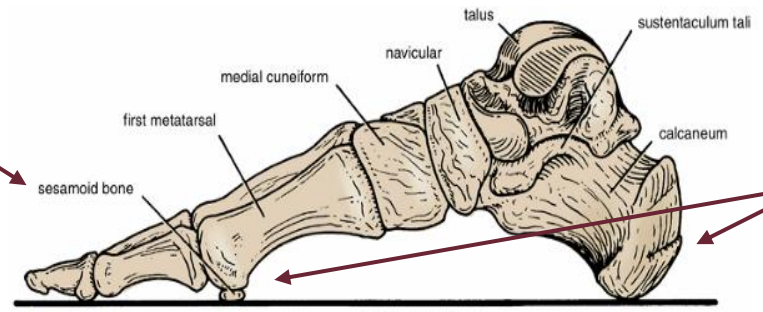
- On examination of the imprint of a wet foot on the floor made with the person in the standing position, one can see that the heel, the lateral margin of the foot, the pad under the metatarsal heads, and the pads of the distal phalanges are in contact with the ground



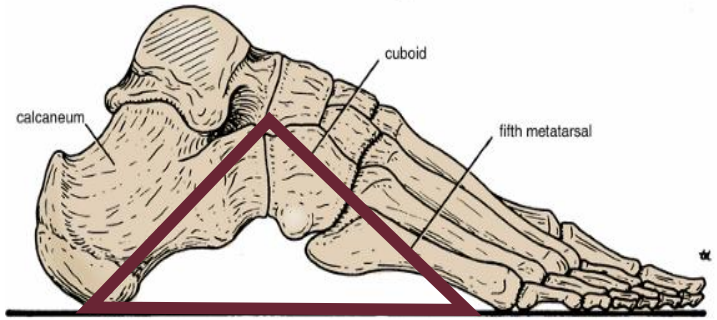
transverse arch

Foot Arches – further explanation.

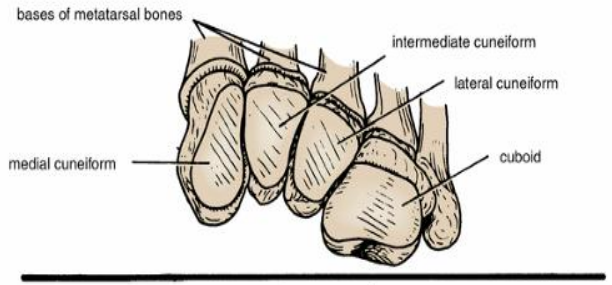
Sesamoid bone: is a small bone impeded in tendon; this sesamoid is impeded in the hallucis longus tendon .



medial longitudinal arch



lateral longitudinal arch



transverse arch

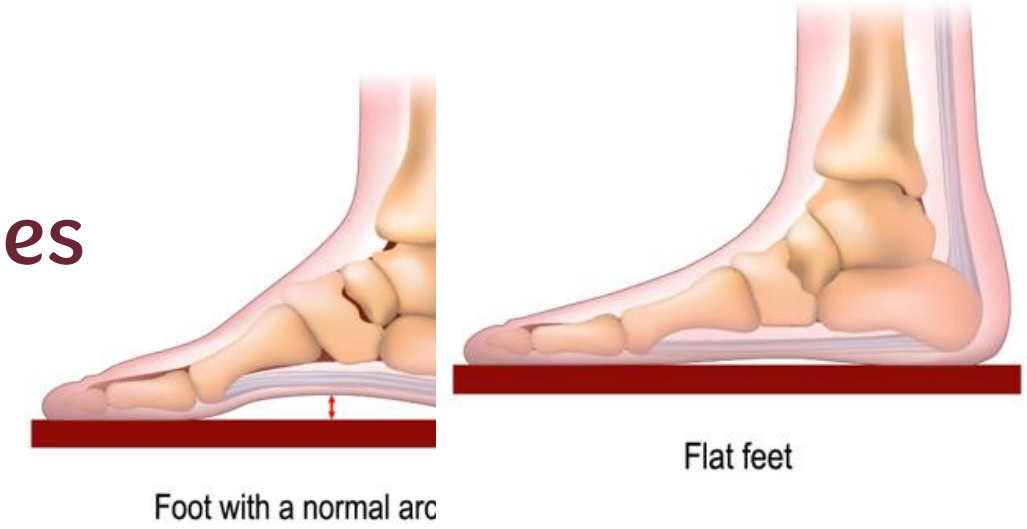
Half of the body wight is distributed to the left and the right side of the body. That, <u>each,</u> half is distributed to the anterior and posterior sides of the foot.

Applied Anatomy – Flat foot.

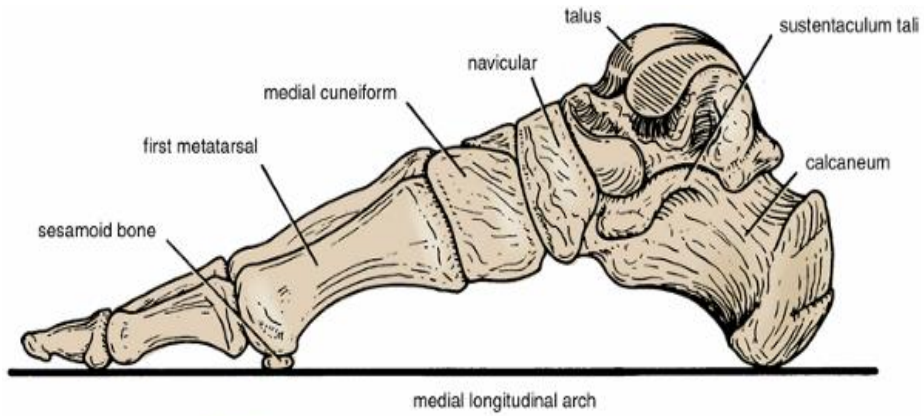
Patients with lost foot arches, experience flat foot.

Patients with flat foot suffer from severe pain while standing since the **weight isn't evacuated**.

A specially designed boots with arches inside the sole helps the patient's ligaments and bones take the arch shape.

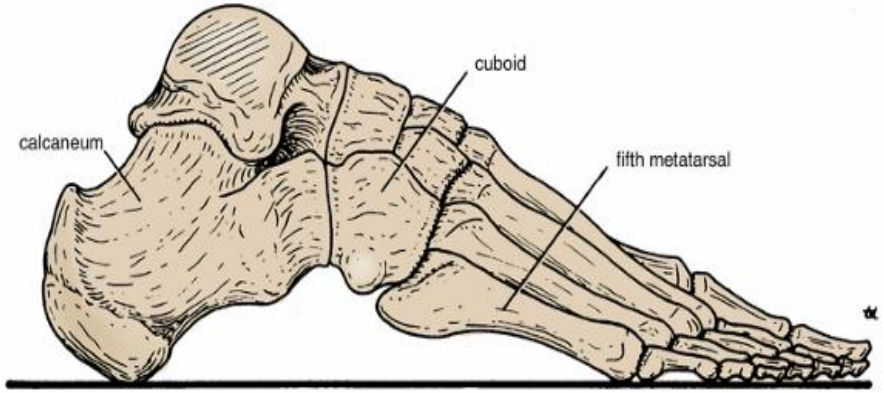


- The medial margin of the foot, from the heel to the first metatarsal head, is arched above the ground because of the important medial longitudinal arch.



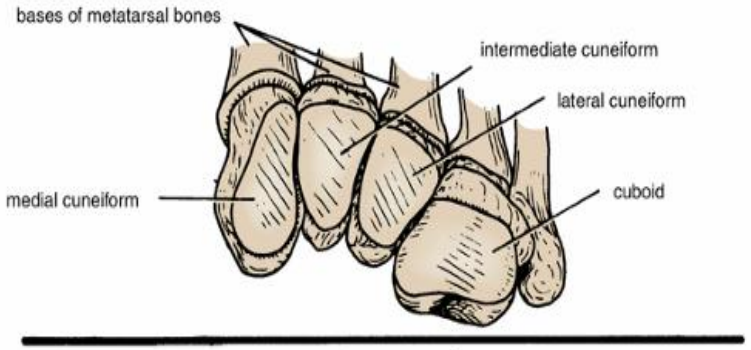
medial longitudinal arch

- The pressure exerted on the ground by the lateral margin of the foot is greatest at the heel and the fifth metatarsal head and least between these areas because of the presence of the low-lying lateral longitudinal arch.



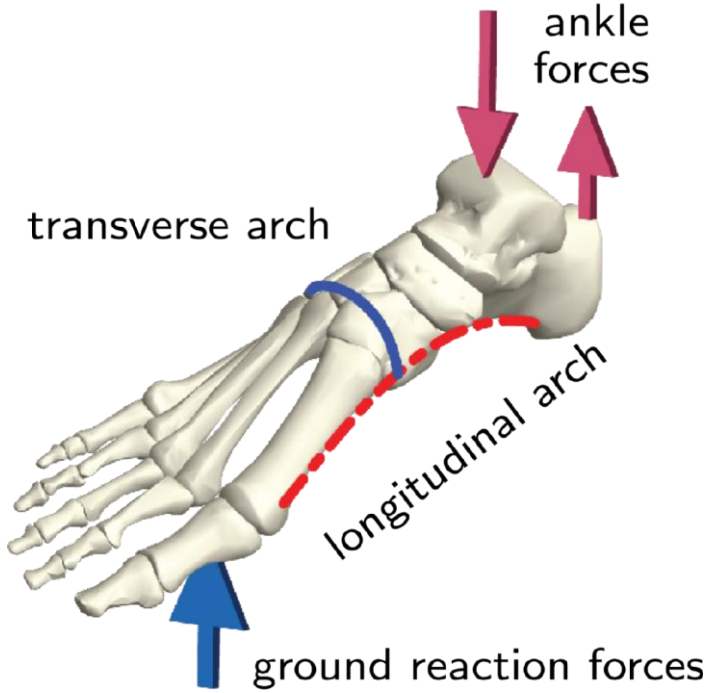
lateral longitudinal arch

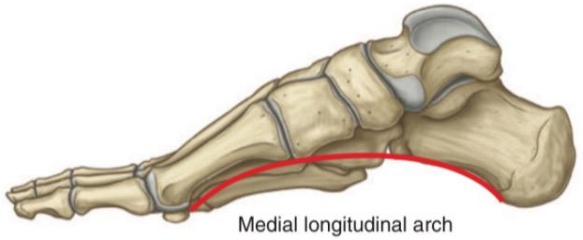
- The transverse arch involves the bases of the five metatarsals and the cuboid and cuneiform bones. This is, in fact, only half an arch, with its base on the lateral border of the foot and its summit on the foot's medial border. The foot has been likened to a half-dome, so that when the medial borders of the two feet are placed together, a complete dome is formed.

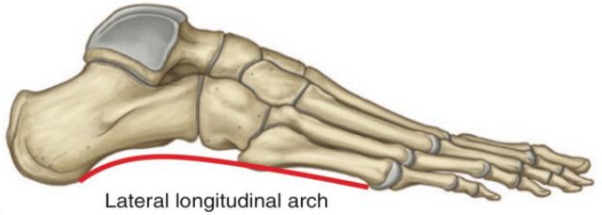


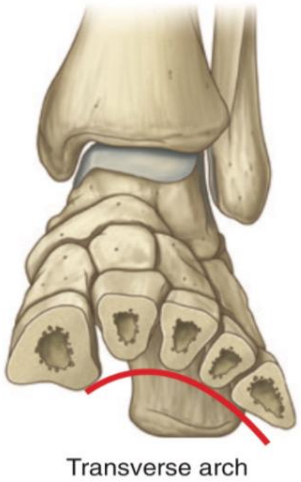
transverse arch

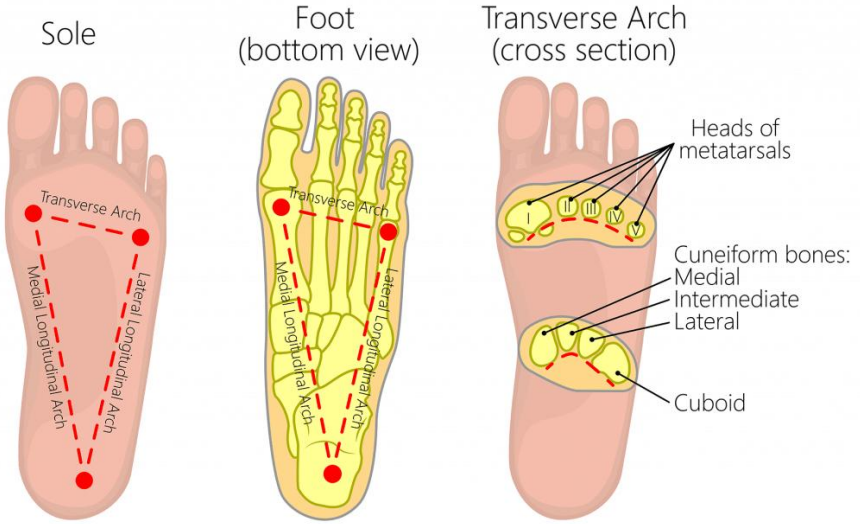
Foot Arches – Extra Images.











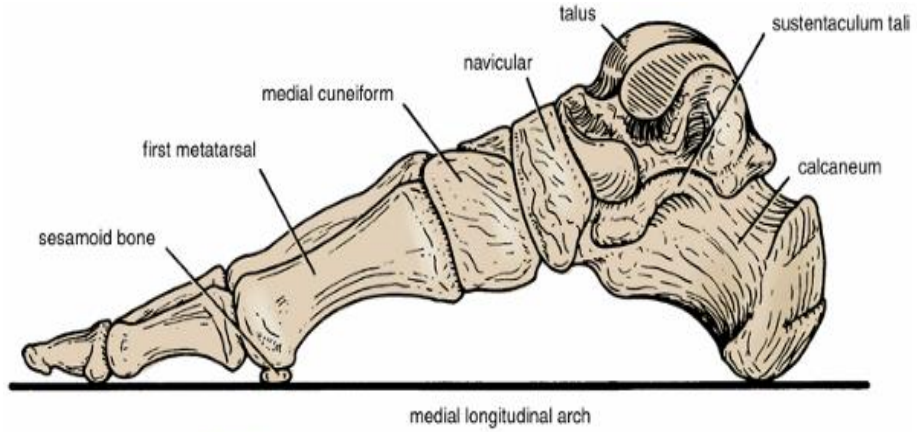
Function of the arch of the foot

- Distribution of the body weight on standing through a foot via the heel behind and six points of contact with the ground in front, namely, the two sesamoid bones under the head of the first metatarsal and the heads of the remaining four metatarsals.
- Supporting body weight
- Process of walking (lever) & running

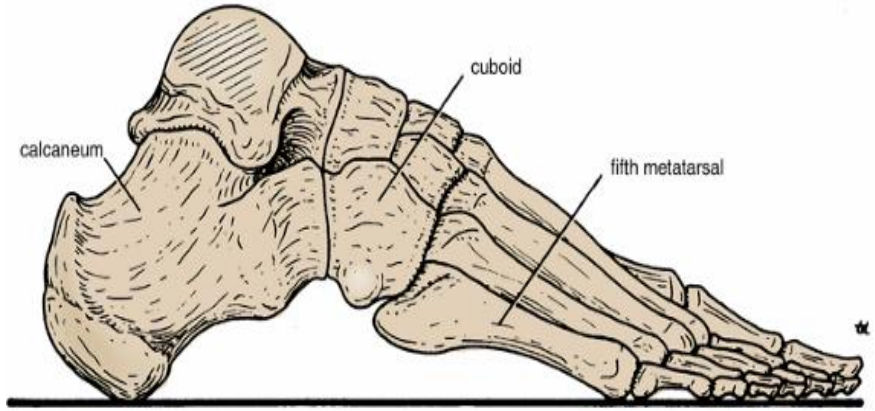
- **<u>The Bones of the Arches</u>**
- An examination of an articulated foot or a lateral radiograph of the foot shows the bones that form the arches.

Maintenance (support) of the arches

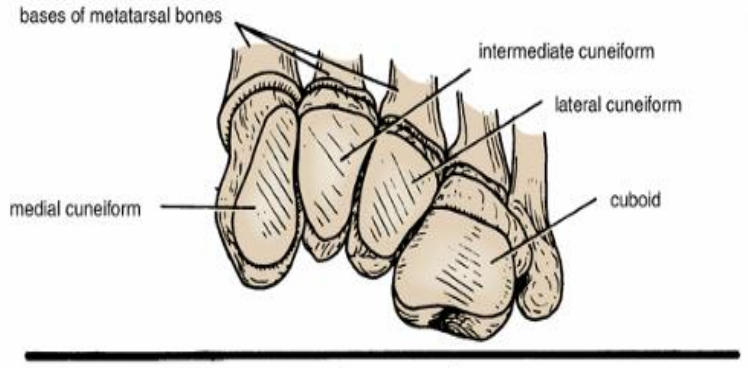
- shape of bones (wedege & keystone (center) like talus bone)
- Strong ligament→ tie the bone together
- Tone of the muscles → tie the pillers
- The tendons.



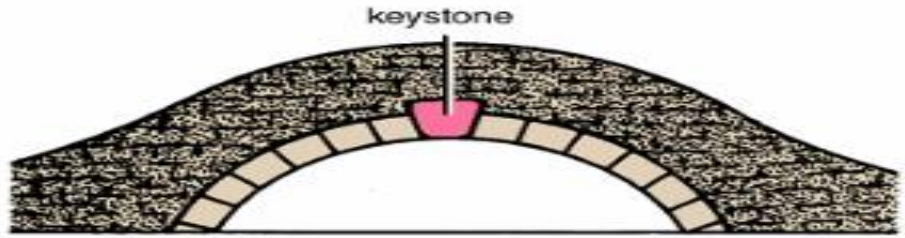
medial longitudinal arch



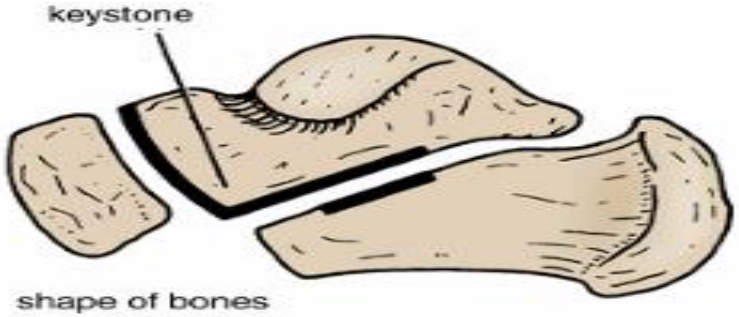
lateral longitudinal arch



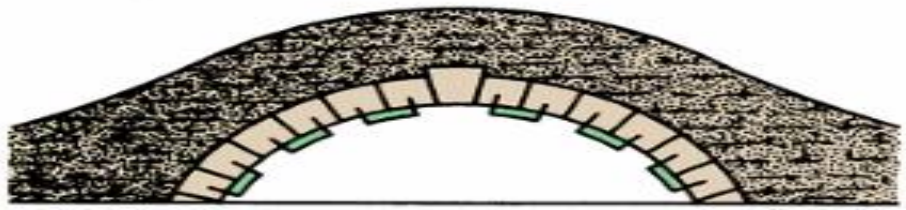
transverse arch



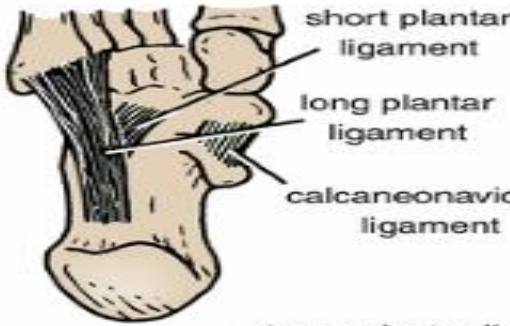
shape of stones



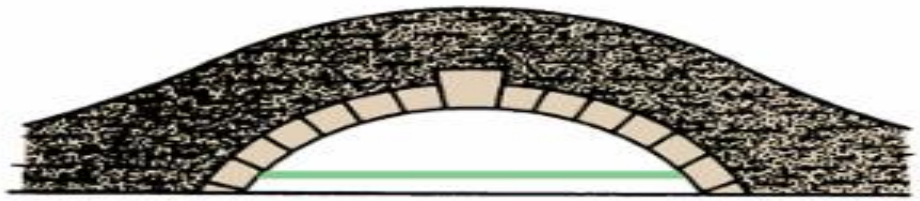
shape of bones



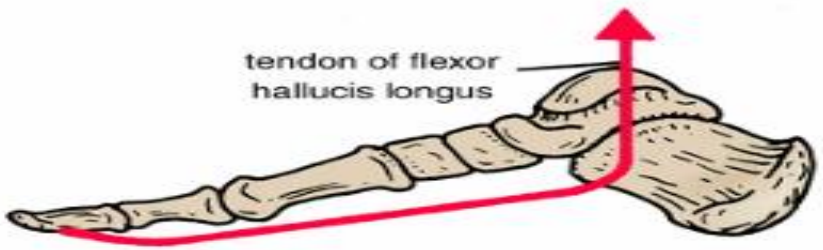
staples

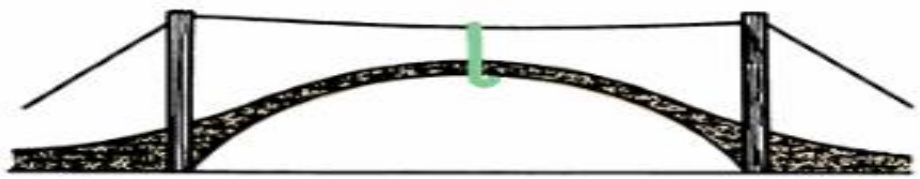


strong plantar ligaments

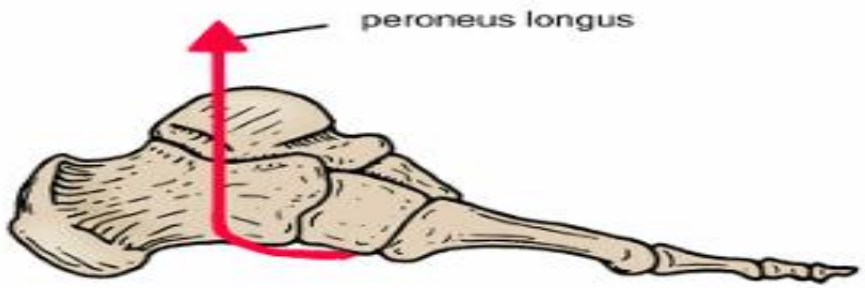


tie beam





suspension bridge



Medial longitudinal arch: This consists of :

- Key stone → the talus
- Posterior piller → the calcaneum
- Anterior piller → the navicular bone, the three cuneiform bones, and the first three metatarsal bones

Maintenance of the Medial Longitudinal Arch:

- Planter ligament, short muscle of the big toe(Abductor Hallucis, flexor Hallucis brevis, flexor Hallucis longus, medial flexor digitorum), tibialis Anterior and posterior, planter Aponuerosis & delotid ligament.
- In the medial arch, the most important tendons are the tendons of **hallucis longus** and **tibialis posterior**.

Lateral longitudinal arch:

- **Key stone** → lateral edge of talus & cuboid
- **Posterior Piller** → calcaneum
- **Anterior piller** → the cuboid, and the fourth and fifth metatarsal bones

Maintenance of the Lateral Longitudinal Arch

- Tying the ends of the arch together are the plantar aponeurosis, the abductor digiti minimi, and the lateral part of the flexor digitorum longus and brevis.
- **Suspending the arch from above are the peroneus longus and the brevis** (most important)

Transverse arch:

- This consists of the bases of the metatarsal bones and the cuboid and the three cuneiform bones

Maintenance of the Transverse Arch

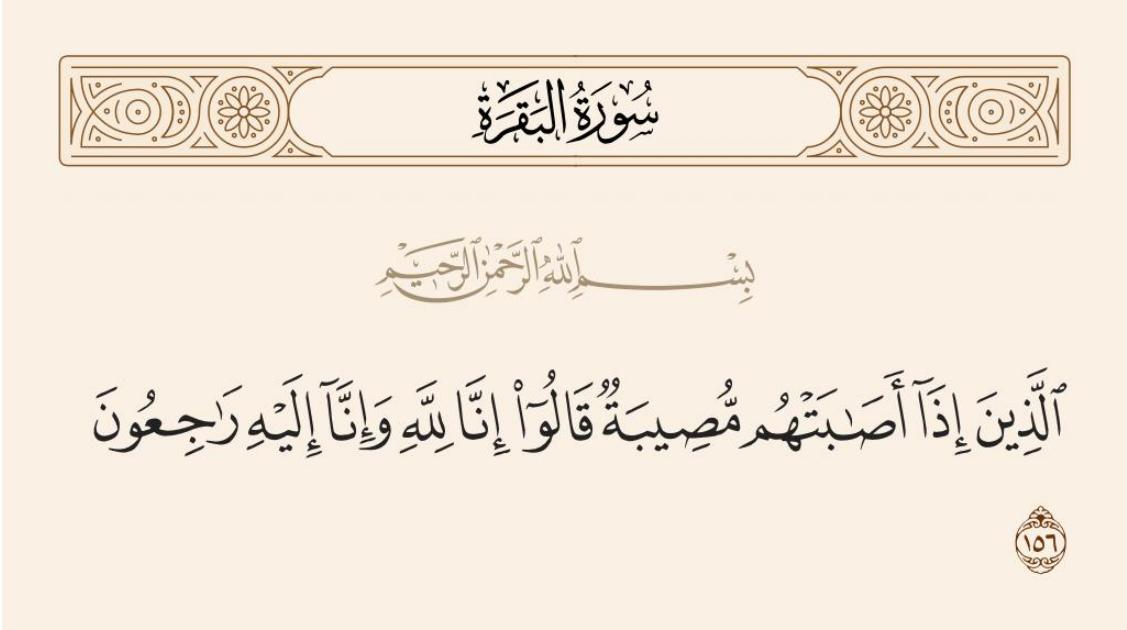
- The inferior edges of the bones are tied together by the deep transverse ligaments, the strong plantar ligaments, and the origins of the plantar muscles from the forepart of the foot; the dorsal interossei and the transverse head of the adductor hallucis are particularly important in this respect.
- Tying the ends of the arch together is **the peroneus longus tendon.**
- Suspending the arch from above are the peroneus longus tendon and the peroneus brevis.
- In the transverse arch, the most important tendons are the tendons of the **peroneus longus** and **brevis**. These tendons cross the foot from medial to lateral side.

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1	14	-	Arterial blood supply was corrected and better explained
	15	Very = deep peroneal Vessels.	Very = Anterior tibial Vessels.
V1 → V2			

رسالة من الفريق العلمي:



روي عن الإمام الشافعيّ انه قال: إنما العلم علمان: علم الدين، وعلم الدنيا، فالعلم الذي للدين هو: الفقه، والعلم الذي للدنيا هو: الطب

وروي عنه أيضًا: لا تسكننّ بلدًا لا يكون فيه عالم يفتيك عن دينك، ولا طبيبا ينبئك عن أمر بدنك.