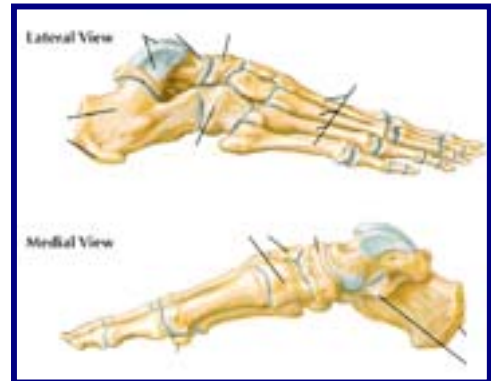


Objective 1)

Identify the osseous components of the distal tibia and fibula, the tarsal, metatarsal and phalangeal bones of the lower limb. Demonstrate the major joints involved in dorsiflexion and plantar flexion of the foot at the ankle, and inversion and eversion of the foot and major ligaments supporting these joints.

- A). Distal Tibia: smaller than proximal end
 - i. Inferior articular surface for articulation with talus and fibular notch for fibular articulation
 - ii. Medial malleolus: inferiorly directed projection from the medial side of the distal end of the tibia
 - iii. Groove for tibialis posterior and flexor digitorum longus tendons
- B). Distal Fibula:
 - i. Lateral malleolus: enlarged distal portion of fibula that is more prominent, more posteriorly placed, and 1 cm more distal than the medial malleolus → helps hold talus in socket
 - ii. *Interosseous membrane: holds shafts of fibula and tibia together
- C). Tarsus:
 - i. Calcaneus: (heel bone and strongest bone in foot)
 - 1. Articulates with talus superiorly and cuboid anteriorly
 - 2. Talar shelf on superior medial side to support head of talus → sustentaculum tali; also provides passage for flexor hallucis longus tendon
 - 3. Fibular trochlea on lateral side → oblique ridge that has groove for fibularis longus under it
 - 4. Calcaneal tuberosity → posterior prominence with medial, lateral, and anterior tubercles → tendo calcaneus attaches and has groove for flexor hallucis longus
 - ii. Talus: (ankle bone)
 - 1. Has head, neck, and body
 - 2. Trochlea is superior surface of body and articulates with tibia and fibula to transmit weight
 - 3. Sits on 2/3 of calcaneus and articulates with navicular anteriorly
 - iii. Navicular: (“little ship”)
 - 1. Sits b/ head of talus and cuneiforms
 - 2. Navicular tuberosity of medial side → can cause foot pain



- iv. Cuboid: (most lateral bone of distal tarsus)
 1. Tuberosity of cuboid
 2. Groove for tendon of fibularis longus on lateral and plantar surfaces
 - v. Cuneiforms: (“wedge-shaped”)
 1. 3 of them → medial (1st), intermediate (2nd), lateral (3rd)
 2. All 3 articulate with navicular and appropriate metatarsal
 3. Lateral cuneiform articulates with cuboid too
- D). Metatarsus:
- i. 5 metatarsus and go medial to lateral (1st-5th)
 - ii. Each has base (proximal) that articulate with cuneiforms or cuboid, shaft, head (distal) that articulates with proximal phalanges
 - iii. 1st metatarsal shortest and stoutest and has sesamoid bones
 - iv. 2nd metatarsal longest
 - v. 5th metatarsal has large tuberosity that extends over the margin of the cuboid
- E). Phalanges:
- i. 14 total phalanges
 - ii. Great toe (1st digit) has two → proximal and distal
 - iii. Lateral 4 digits have 3 → proximal, middle, distal
 - iv. Each had base (proximal), shaft, head (distal)
 - v. Phalanges of 1st digit short, broad, and strong
- F). Ankle Joint: a.k.a. talocrural articulation; hinge type joint
- i. Movements: dorsiflexion (anterior compartment muscles) and plantarflexion (posterior compartment muscles)
 1. Ankle more stable during dorsiflexion than plantarflexion
 - ii. Location: b/ distal ends of tibia and fibula and superior part of talus
 1. Inferior ends of tibia and fibula w/ inferior transverse ligament form mortise (deep socket) for trochlea of talus
 2. Medial surface of lateral malleolus, lateral surface of medial malleolus, and inferior surface of tibia articulate with talus
 - iii. Articular capsule: fibrous capsule thin anteriorly and posteriorly but has ligaments on side and attaches to malleoli and talus; synovial membrane lines capsule and ascends b/ tibia and fibula
 - iv. Ligaments:
 1. Interosseous ligament: holds tibia and fibula together during dorsiflexion
 2. Lateral ligament: holds joint together laterally and has 3 parts
 - a. Anterior talofibular ligament: flat, weak band that extends anteriomedially from lateral malleolus to neck of talus
 - b. Posterior talofibular ligament: thick, strong band running horizontally and medially and posteriorly from malleolar fossa of fibula to lateral tubercle of talus
 - c. Calcaneofibular ligament: a round cord that passes posteroinferiorly from tip of lateral malleolus to lateral tubercle of talus
 3. Medial (deltoid) ligament: reinforces capsule medially and attaches proximally to the medial malleolus and fans out from it to attach distally to talus, calcaneus, and navicular
 - a. Makes up tibionavicular ligament, anterior and posterior tibiofibular ligaments (also been called tibiotalar) and tibiocalcaneal ligaments

- G). Subtalar Joint: plane type joint
- i. Joint in which inferior talus articulates with superior calcaneus
 - ii. Movements: inversion and eversion
 - iii. Joint capsule: attaches to margins of articular surfaces
 - iv. Ligaments:
 1. Medial, lateral, and posterior talocalcaneal ligaments support capsule
 2. Interosseous talocalcaneal ligament binds bones together
- H). Calcaneocuboid Joint: plane type joint
- i. Joint in which anterior end of calcaneus articulates with posterior surface of cuboid
 - ii. Movements: inversion and eversion
 - iii. Joint capsule: fibrous capsule enclose joint
 - iv. Ligaments: all support capsule
 1. Dorsal calcaneocuboid ligament
 2. Plantar calcaneocuboid ligament
 3. Long plantar ligament
- I). *Talocalcaneonavicular joint: b/ talus, calcaneus, and navicular bones
- i. Movements: gliding that contributes to inversion and eversion
 - ii. Ligaments: Plantar calcaneonavicular (spring) ligament

Objective 2)

Identify the muscles, nerves and blood supply of each of the fascial compartments of the leg and their extensions into the foot.

- J). Anterior compartment of leg: extensor compartment
- i. All muscles innervated by deep fibular (peroneal) nerve
 1. One of two terminal branches of common fibular nerve and arises b/ fibularis longus muscle and fibular neck, enters compartment, and accompanies the anterior tibial artery
 2. Extends in to foot to supply extensor digitorum brevis and extensor hallucis brevis and skin b/ 1st and 2nd toes
 - ii. Anterior tibial artery is the blood supply for this compartment
 1. Smaller terminal branch of popliteal artery. Begins at inferior border of popliteus, passes anteriorly through gap in superior part of interosseous membrane, runs along leg b/ tibialis anterior and extensor digitorum longus, and ends at malleoli
 2. Becomes dorsal artery of foot
 - iii. Muscles:
 1. Tibialis anterior:
 - a. From lateral condyle and superior half of lateral surface of tibia and interosseous membrane to medial and inferior surfaces of medial cuneiform and base of 1st metatarsal
 - b. Action: dorsiflexes and inverts foot
 2. Extensor hallucis longus:
 - a. From middle part of anterior surface of fibula and interosseous membrane to dorsal aspect of distal phalanx of great toe (hallux)
 - b. Action: extends great toe and dorsiflexes ankle
 3. Extensor digitorum longus:

- a. From lateral condyle and superior 3/4 of anterior surface of interosseous membrane to middle and distal phalanges of lateral 4 digits
 - b. Action: extends lateral 4 digits and dorsiflexes ankle
 - 4. Fibularis tertius:
 - a. From inferior 1/3 of anterior surface of fibula and interosseous membrane to dorsum of base of 5th metatarsal
 - b. Action: dorsiflexes ankle and aid in eversion of foot
- K). Lateral compartment of leg:
 - i. All muscles innervated by superficial fibular nerve
 - 1. One of two terminal branches of common fibular nerve
 - 2. Supplies skin on distal part of anterior surface of leg and nearly all of dorsum of foot
 - ii. Lateral compartment had no artery. Receives its blood from perforating branches of anterior tibial artery superiorly and perforating branches of fibular artery inferiorly
 - iii. Muscles:
 - 1. Fibularis longus:
 - a. From head and superior 2/3 of lateral surface of fibula to base of 1st metatarsal and medial cuneiform
 - b. Action: everts foot and weakly plantarflexes it
 - 2. Fibularis brevis:
 - a. From inferior 2/3 of lateral surface of fibula to dorsal surface of tuberosity on lateral side of base of 5th metatarsal
 - b. Action: everts foot and weakly plantarflexes it
- L). Posterior compartment of leg:
 - i. All muscles innervated by the tibial nerve.
 - 1. Larger of two terminal branches of sciatic nerve. Leaves popliteal fossa b/ heads of gastrocnemius and runs down leg until posteroinferior to of medial malleolus and divides into medial and lateral plantar nerves.
 - 2. Branch of tibial nerve, medial sural cutaneous nerve, unites with communicating fibular nerve to form sural nerve, which supplies skin on lateral and posterior part of inferior 1/3 leg and lateral foot.
 - ii. The posterior tibial artery and its biggest branch the fibular artery supply the posterior compartment.
 - 1. The posterior tibial artery is the larger branch of the popliteal artery and is the main supply of blood to the foot as the medial and lateral plantar arteries. It has the tibial nerve and vein accompanying it. It also gives a nutrient artery to the tibia.
 - 2. The fibular artery provides a nutrient artery to the fibula, the muscles of the lateral and posterior compartments, and a circumflex fibular artery to the genicular anastomosis.
 - iii. Superficial muscles:
 - 1. Gastrocnemius:
 - a. From lateral aspect of lateral condyle of femur (lateral head) and popliteal surface of femur superior to medial condyle (medial head) to posterior surface of calcaneus via calcaneal tendon

- b. Action: plantarflexes ankle, raises heel during walking, and flexes knee at joint
 - 2. Soleus:
 - a. From posterior aspect of head of fibula, superior ¼ of posterior surface of fibula, soleal line, and medial border of tibia to posterior surface of calcaneus via calcaneal tendon
 - b. Action: plantarflexes ankle and steadies leg on foot
 - 3. Plantaris:
 - a. From inferior end of lateral supracondylar line of femur and oblique popliteal ligament to posterior surface of calcaneus via calcaneal tendon
 - b. Action: weakly assists gastrocnemius in plantarflexing ankle and flexing knee
- iv. Deep muscles:
- 1. Popliteus:
 - a. From lateral surface of lateral condyle of femur and lateral meniscus to posterior surface of tibia superior to soleal line
 - b. Action: weakly flexes knee and unlocks it
 - 2. Flexor hallucis longus:
 - a. From inferior 2/3 of posterior surface of fibula and inferior part of interosseous membrane to base of distal phalanx of great toe
 - b. Action: flexes great toe at all joints and plantarflexes ankle; supports medial longitudinal arch of foot
 - 3. Flexor digitorum longus:
 - a. From medial part of posterior surface of tibia and inferior to soleal line and by broad tendon of fibula to bases of distal phalanges of lateral 4 digits
 - b. Action: flexes lateral 4 digits and plantarflexes ankle; supports longitudinal arches of foot
 - 4. Tibialis posterior:
 - a. From interosseous membrane, posterior surface of tibia inferior to soleal line, and posterior surface of fibula to tuberosity of navicular, cuneiform, and cuboid and bases of 2nd, 3rd, and 4th metatarsals
 - b. Action: plantarflexes ankle and inverts foot

Objective 3)

Identify the longitudinal and transverse arches of the foot, and their major sources of support (bony, ligamentous, and tendon [muscle]).

- M). Longitudinal arch: composed of medial and lateral longitudinal arches
- i. Medial longitudinal arch: higher and more important
 - 1. Composed of calcaneus, talus, navicular, three cuneiforms, and three metatarsals w/ the talar head being the keystone of the arch
 - 2. The tibialis anterior attaches to the 1st metatarsal and medial cuneiform to help strengthen the arch
 - 3. The fibularis longus tendon, which passes lateral to medial, also helps strengthen the arch
 - ii. Lateral longitudinal arch: flatter and rests on ground when standing

1. Composed of calcaneus, cuboid, and lateral two metatarsals
- N). Transverse arch: runs from side to side
- i. Formed by cuboid, cuneiforms, and bases of metatarsals.
 - ii. Medial and lateral longitudinal arches serves as pillars for transverse arch.
 - iii. The tendon of the fibularis longus crossing the sole of the foot obliquely helps to maintain the curvature of the transverse arch.
- O). Integrity of bony arches maintained by the:
- i. Shape of the interlocking bones
 - ii. Action of muscles through their tonus and bracing action of their tendons
 - iii. Strength of the plantar ligaments, especially the plantar calcaneonavicular (spring) ligament, and the long and short plantar ligaments
 1. Bears greatest stress and most important in maintaining the arches
 - iv. Plantar aponeurosis
 1. Bears greatest stress and most important in maintaining the arches



Objective 4)

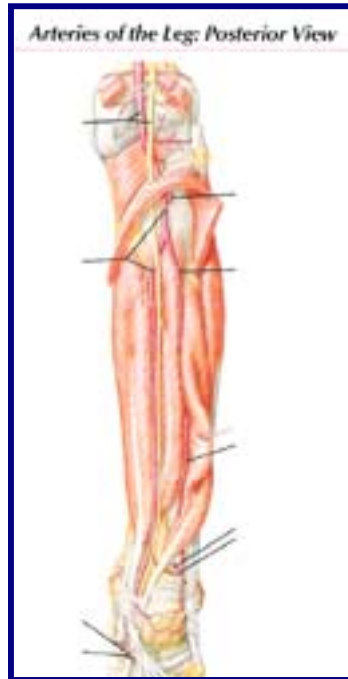
Predict the motor and sensory deficits in the leg and foot, which could result from damage to the sciatic nerve or to the femoral nerve.

- P). Damage to the sciatic nerve:
- i. Before the condyles of the femur, the sciatic nerve terminates into two branches, the tibial nerve (medial) and the common fibular nerve (lateral).
 - ii. Damage from loss of tibial nerve:
 1. Motor:
 - a. Paralysis of flexor muscles (posterior compartment of leg) and the intrinsic muscles in the sole of the foot.
 - b. Loss of plantarflexion of ankle and flexion of toes.
 - c. Some loss of flexion @ knee due to loss of gastrocnemius, plantaris, and popliteus (may be hard to unlock joint)
 2. Sensory:
 - a. Loss of sensation of skin on the middle part of the posterior leg via **medial sural cutaneous nerve**
 - b. Loss of sensation of skin on lateral ankle (malleolus) and lateral aspect of foot including lateral heel via



Objective 5)

Follow the course of the vascular supply of the leg and foot and its known vascular connections. Indicate possible alternate pathways for arterial blood supply to the leg and foot, if a major vessel is blocked.



- R). Leg from the popliteal artery →
- i. Anterior tibial artery: smaller terminal branch and supplies the anterior compartment of the leg
 1. Has anterior tibial recurrent artery, which anastomoses with knee
 2. Has lateral and medial malleolar arteries coming off to supply malleoli
 - ii. Posterior tibial artery: larger terminal branch and supplies posterior and lateral compartments of the leg
 1. Fibular artery: branch off of posterior tibial artery that supplies posterior compartment and lateral compartment through perforating branches
 2. Has circumflex fibular branch going back to anastomoses of knee
 3. Has nutrient artery to tibia
 - iii. Sural arteries: arise in the popliteal fossa and pass to gastrocnemius, plantaris, and soleus to supply them
 - iv. Possible alternate pathways:
 1. If the popliteal artery is blocked below knee, blood can flow through anastomoses of knee through circumflex fibular branch of posterior tibial artery into posterior tibial artery and down the leg.
 2. If the popliteal artery is blocked below knee, blood can flow through anastomoses of knee through anterior tibial recurrent artery into anterior tibial artery and down the leg.

S). Foot

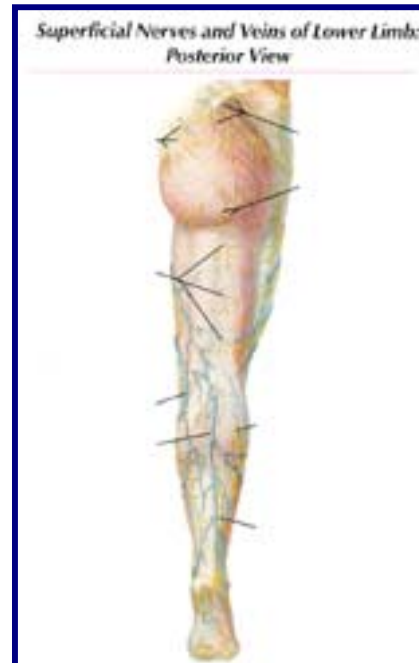
- i. From the anterior tibial artery →
 1. Dorsal artery of the foot (dorsalis pedis): continuation of anterior tibial artery distal to inferior extensor retinaculum that supplies dorsum of foot to the 1st interosseous space
 - a. Lateral tarsal artery: side branch of dorsal artery of foot that runs laterally towards metatarsals
 - b. Medial tarsal artery
 - c. Arcuate artery: a terminal branch of the dorsal artery of the foot that across the bases of the 1st 4 metatarsals deep to the extensor tendons
 - i. 2nd to 4th metatarsal arteries: branch off of arcuate artery and run b/ 2nd-4th metatarsals and each divides into two dorsal digital arteries (pass along sides of adjoining toes)
 - d. Deep plantar artery: passes to sole of foot to join plantar arch
 - i. 1st metatarsal artery: branch off of deep plantar artery and run b/ 1st and 2nd metatarsals and divides into two dorsal digital arteries (pass along sides of adjoining toes)

From the posterior tibial artery →

2. Medial plantar artery: continuation of posterior tibial artery that runs up the medial foot and extends to supply the hallux
3. Lateral plantar artery: continuation of posterior tibial artery that runs up the lateral foot with superficial and deep branches and terminates into deep plantar arch
 - a. Deep plantar arch: continuation of lateral plantar artery that begins at the base of the 5th metatarsal and is completed by the deep plantar artery medially
 - i. Perforating arteries: off of deep plantar arch and pass to dorsum of foot to arcuate artery
 - ii. Plantar metatarsal arteries: four total and branch of deep plantar arch to supply toes
 1. Plantar digital arteries: branch off plantar metatarsal arteries to supply toes
- ii. Possible alternate pathways:
 1. If anterior tibial artery blocked before it turns into the dorsal artery of the foot, a perforating branch of the fibular artery passes into the lateral malleolar artery and into the lateral tarsal artery.
 2. If the dorsal artery of the foot is blocked before it terminates, the lateral tarsal artery anastomoses with the arcuate artery, which will bring blood to the arcuate and deep plantar arteries.
 3. If the metatarsal arteries are cut off from their dorsal supply, they are connected to the deep plantar arch by perforating arteries.
 4. If the lateral plantar artery is blocked just before it terminates into the deep plantar arch, the deep plantar arch can get blood from the deep plantar artery.

Objective 6)

Identify the major deep and superficial veins draining the lower extremity and the connections between the two. Trace the course of lymphatic drainage of the lower limb, indicating the locations of major aggregations of lymph nodes (whether or not they are present in your cadaver).



T). Superficial venous drainage:

- i. Dorsal digital veins → dorsal metatarsal veins, which join to form the dorsal venous arch in the subcutaneous tissue → medially to great saphenous vein and laterally to small saphenous vein
 1. Small saphenous vein with perforating veins connecting to deep veins → popliteal vein
 2. Great saphenous vein with perforating veins connecting to deep veins → femoral vein
- ii. Superficial plantar veins → plantar venous network → medial and lateral marginal veins → great and small saphenous veins

U). Deep venous drainage:

- i. Dorsal digital veins (that communicates to deep veins) → dorsal metatarsal veins (that communicates to deep veins) → dorsal venous arch (that communicates to deep veins) → deep veins of dorsal venous arch → anterior tibial vein (actually 2 interconnecting accompanying veins) → popliteal vein → femoral vein
- ii. Plantar digital veins, which communicate with dorsal digital veins → plantar venous arch → posterior tibial vein or fibular vein, which goes into the posterior tibial vein (both are actually 2 interconnecting accompanying veins) → popliteal vein → femoral vein

V). Lymph drainage:

- i. Superficial lymph drainage: Superficial lymphatic vessels form subcutaneous plexuses in foot with majority in sole of foot
 1. Medial superficial lymphatics (larger and more numerous than lateral ones) → converge on great saphenous vein and run up to superficial inguinal lymph nodes → deep inguinal lymph nodes or external iliac lymph nodes → external iliac lymph nodes → common iliac lymph nodes → lateral aortic lymph nodes
 2. Lateral superficial lymphatics → accompany small saphenous vein → popliteal lymph nodes → deep inguinal lymph nodes → external iliac lymph nodes → common iliac lymph nodes → lateral aortic lymph nodes
- ii. Deep lymphatic drainage follows major veins (anterior and posterior tibial, fibular, popliteal, femoral); go to popliteal lymph nodes → deep inguinal lymph nodes → external iliac lymph nodes → common iliac lymph nodes → lateral aortic lymph nodes

W). Lymph nodes:

- i. Popliteal lymph nodes: In back of the knee in popliteal fossa and receive lymph from deep lymphatics and lateral superficial lymphatics. Send lymph to deep inguinal lymph nodes.
- ii. Superficial inguinal lymph nodes: Along inguinal ligament or at termination of great saphenous vein and receive lymph from superficial lymphatics. Send lymph to deep inguinal or external iliac lymph nodes.
- iii. Deep inguinal lymph nodes: Under deep fascia along medial side of femoral vein and receive lymph from deep lymphatics and superficial inguinal lymph nodes. Send lymph to external iliac lymph nodes.
- iv. External iliac lymph nodes: Along external iliac vein and receive lymph from superficial and deep inguinal lymph nodes. Send lymph to common iliac lymph nodes.