

# Anatomy of the lower limb

## Posterior compartment of the leg & retinacula around the ankle

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The superficial fascia on the back of the leg has no special feature, it contains 2 superficial veins:

- Small saphenous vein which runs in the middle of the posterior leg and terminates by piercing the deep fascia over the popliteal fossa, accompanied by sural nerve inferiorly & posterior cutaneous nerve of the thigh superiorly.
- Great saphenous vein, that appears on the medial side of the posterior aspect of the knee & upper part of back of the leg. In the leg & foot the saphenous nerve accompanies it.

And 7 cutaneous nerves.

The deep fascia on the posterior aspect of the leg is thin above, but thickened near the ankle to form the flexor retinaculum on the medial side of the ankle

### Cutaneous innervation

7 cutaneous nerves supply the skin on the posterior aspect of the leg:

- Along the medial one third of the back of the leg: uppermost part of the medial one third is supplied by the **medial cutaneous nerve of thigh** & the greater lower region supplied by the **saphenous nerve** down to the medial malleolus and the medial border of the foot up to the ball of the big toe.
- Middle one third: upper half is supplied by the **posterior cutaneous nerve of the thigh** while the lower half is supplied by the **sural nerve** (a branch from tibial nerve).
- Lateral one third: its uppermost third is supplied by the lateral cutaneous nerve of the calf (a branch of common peroneal nerve), middle part by the sural communicating nerve (branch from common peroneal nerve that joins the sural nerve 2 inches above the lateral malleolus), and the lowermost part of the lateral third is supplied by the sural nerve.

### Muscles of the posterior compartment of the leg

- The muscles of the posterior leg is divided into two layers by a thin intermuscular septum; superficial & deep layers.
- All the muscles of the posterior compartment of the leg are supplied by the **tibial nerve**, muscles in the posterior layer are supplied by branches given in the popliteal fossa. The other muscles in the deep layer are supplied by branches given in the posterior leg.
- The lateral head of gastrocnemius usually contains a small sesamoid bone called the **fabella**.
- **Gastrocnemius** and **soleus** are sometimes referred to as **triceps surae**. The two are powerful plantar flexors acting around the fulcrum of the heads of the metatarsals; especially the first metatarsal; to raise the weight of the body on the toes. Soleus maintains plantar flexion when the foot is raised off the ground because in this position the knee is flexed and gastrocnemius loses its effect as a plantar flexor.

- **Plantaris** has a small belly and a long slender tendon. It adds very little to the power of triceps surae. It may be concerned with **proprioception** (joint position sensation) in human.
- **Flexor hallucis longus** is much larger than flexor digitorum longus and lies lateral to it. It plays an important role of the terminal "push-off" in walking and running

MUSCLES OF THE POSTERIOR COMPARTMENT OF THE LEG				
	Muscle	Origin	Insertion	Action
Superficial layer	<b>Gastrocnemius</b>	Lateral head from the lateral femoral condyle & medial head from the medial femoral condyle	Posterior surface of calcaneum via tendocalcaneus	Ankle plantar flexion Knee flexion
	<b>Plantaris</b>	Lateral supracondylar ridge of the femur	Lateral supracondylar ridge of the femur	Lateral supracondylar ridge of the femur
	<b>Soleus</b>	Soleal line & shafts of the tibia & fibula	Posterior surface of calcaneum via tendocalcaneus	Ankle plantar flexion
Deep layer	<b>Popliteus</b>	Lateral surface of lateral femoral condyle (within the knee joint capsule)	Posterior surface of the tibial shaft above the soleal line	Knee flexion Knee joint unlocking
	<b>Flexor digitorum longus</b>	Posterior surface of tibial shaft	Bases of the distal phalanges of the lateral 4 toe	Ankle plantar flexion Flexion of lateral 4 toes Maintains longitudinal foot arches
	<b>Flexor hallucis longus</b>	Posterior surface of fibular shaft	Base of distal phalanx of big toe	Ankle plantar flexion Flexion of big toe Maintains medial longitudinal foot arch
	<b>Tibialis posterior</b>	Posterior surfaces of tibia & fibula & interosseous membrane	Navicular tuberosity & adjacent bone	Ankle plantar flexion Subtalar inversion Maintains medial longitudinal foot arch

## Posterior tibial artery

### Course

This is the larger terminal branch of the popliteal artery. It begins at the lower border of popliteus muscle and ends deep to the flexor retinaculum by dividing into medial and lateral plantar arteries.

It descends anterior to gastrocnemius and soleus muscle and the deep transverse fascial septum of the leg. It lies posterior to tibialis posterior above and to the tibial shaft below. As it reaches the lower part of the leg, it becomes more superficial and is covered only by skin and fascia to pass posterior to the medial malleolus deep to the flexor retinaculum where it divides into its terminal branches.

## Relations

- **Anteriorly**; tibialis posterior muscle (above) and the tibia (below).
- **Posteriorly**; transverse fascial septum, soleus, gastrocnemius, fascia and skin.
- **Laterally**; tibial nerve and flexor hallucis longus muscle.
- **Medially**; flexor digitorum longus muscle.

## Branches

1. Circumflex fibular (peroneal): curves around the neck of fibula supplying adjacent muscles & skin.
2. Peroneal artery
3. Nutrient artery to the tibia enters below the soleal line
4. Muscular branches to the muscles of the posterior leg
5. Communicating branch joins with similar branches of peroneal artery above the ankle.
6. Medial malleolar branch: passes toward the medial malleolus
7. Calcaneal branch: pierces the flexor retinaculum and supplies the soft tissue of the heel.
8. Terminal branches: are medial and lateral plantar arteries of the sole of the foot.

## Peroneal artery

This is the largest branch of the posterior tibial artery beginning near its origin just distal to the lower border of popliteus muscle. It descends along the back of the fibula either deep to or within the substance of flexor hallucis longus muscle. It ends at the ankle joint by giving the lateral malleolar and lateral calcaneal branches and anastomosing with the posterior tibial artery behind the ankle.

### Branches

Muscular branches supply the adjacent muscles and pierce the lateral intermuscular septum to the lateral compartment of the leg.

1. Nutrient artery of the fibula.
2. A perforating branch perforates the interosseous membrane just above the distal tibiofibular joint to anastomose with the lateral tarsal branch of the dorsalis pedis artery.
3. The lateral malleolar artery.
4. The lateral calcaneal artery

## Tibial nerve

This nerve descends with the posterior tibial artery deep to gastrocnemius and soleus on the back of tibialis posterior and the tibia. It lies first medial then crosses posterior and finally becomes lateral to the artery. Then it passes posterior to the medial malleolus and deep to the flexor retinaculum between the tendons of flexor digitorum longus and flexor hallucis longus where it divides into medial and lateral plantar branches.

### Branches

1. Muscular branches supply tibialis posterior, flexor digitorum longus, flexor hallucis longus and the deep part of soleus.
2. The medial calcaneal nerve supplies the skin of the heel.
3. Articular branches supply the ankle joint.
4. The medial and lateral plantar nerves pass to the sole of the foot.

# Retinacula around the ankle joint

## Flexor retinaculum

It is a rectangular thickening of the deep fascia extends from the posterior aspect of the medial malleolus to the medial tubercle of the calcaneus. Proximally it is continuous with the deep fascial septum of the leg that covers the deep flexors. Distally, it is continuous with the deep fascia of the sole.

Structures that pass deep to the flexor retinaculum posterior to the medial malleolus, from medial to lateral, are;

- Tibialis posterior tendon
- Flexor digitorum longus tendon
- Posterior tibial artery and its venae comitantes
- Tibial nerve
- Flexor hallucis longus tendon

The great saphenous vein runs superficially anterior to the retinaculum.

## Extensor retinacula

There are two extensor retinacula; superior & inferior extensor retinacula.

### The superior extensor retinaculum

This is a rectangular broad band of deep fascia that extends from the lower part of the anterior border of the tibia to the triangular subcutaneous area of the fibula. At its tibial attachment, it splits into two layers through which the tendon of tibialis anterior passes.

### The inferior extensor retinaculum

This is a Y-shaped band whose stem is attached to the upper surface of the anterior part of the calcaneum. Medially, the upper limb of the band is attached to the medial malleolus while the lower limb continues and is fused with the deep fascia of the foot inferomedially. The band is split into two layers by the tendons of tibialis anterior, extensor digitorum longus, extensor hallucis longus and peroneus tertius. The two layers enclose the tendons and separate them from each other by fibrous septa. The tendons of these muscles are also enclosed by synovial sheaths as they pass deep to the retinaculum.

Structure which pass deep or posterior to the extensor retinacula, from medial to lateral, are;

- Tibialis anterior tendon
- Extensor hallucis longus tendon
- Anterior tibial artery (superior retinaculum) / Dorsalis pedis artery (inferior retinaculum)
- Deep peroneal nerve
- Extensor digitorum longus tendon
- Peroneus tertius tendon

## Peroneal retinacula (superior and inferior peroneal retinacula)

### The superior peroneal retinaculum

This extends from the lateral malleolus to the lateral surface of the calcaneum.

### **The inferior peroneal retinaculum**

This is attached to the calcaneum at 3 points; above the tendon of peroneus brevis, below the tendon of peroneus longus and between the two tendons to the peroneal tubercle. Therefore, the retinaculum forms 2 arches; each arch binds one of the peronei to the calcaneus.

The tendons of peroneus longus and brevis share a common synovial sheath as they pass deep to the superior peroneal retinaculum but the sheath divides into two parts as the tendons separate to pass deep to the arches of the inferior peroneal retinaculum with peroneus brevis tendon being superior. The sural nerve and the small saphenous vein pass superficial to the peroneal retinacula.