

# Anatomy of the lower limb

## Popliteal fossa

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The popliteal fossa is a diamond-shaped hollow on the back of the knee joint. It becomes prominent when the knee is extended. This fossa is an important anatomical region because it provides passage for main vessels and nerves from the thigh to the leg.

### **Boundaries:**

- Supero-medially: semitendinosus & semimembranosus
- Supero-laterally: biceps femoris
- Infero-medially: medial head of gastrocnemius
- Infero-laterally: lateral head of gastrocnemius & plantaris

**Floor (or anterior wall):** it is formed from above downward by:

- The popliteal surface of the femur
- Posterior part of knee joint capsule & oblique popliteal ligament
- Fascia covering the popliteus muscle
- The proximal part of the popliteal surface of the tibia

**Roof (or posterior wall):** It is formed from the strong popliteal fascia. The superficial fascia over the roof contains:

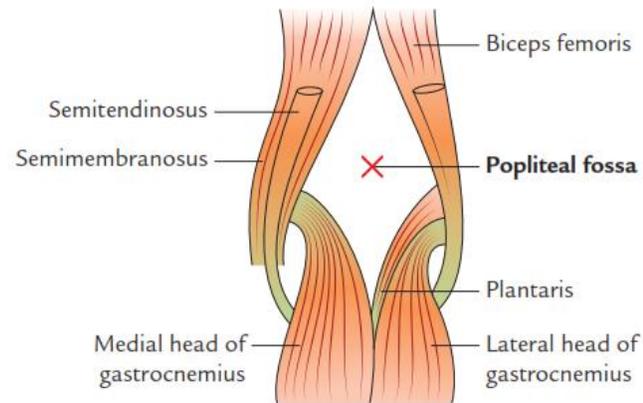
- (a) Short saphenous vein, and
- (b) Three cutaneous nerves:
  - i. Terminal part of the posterior cutaneous nerve of thigh
  - ii. Posterior division of the medial cutaneous nerve of thigh
  - iii. sural communicating nerve. The roof is pierced by all these structures except the posterior division of medial cutaneous nerve of the thigh.

**Contents** of the popliteal fossa:

1. Tibial nerve and its branches.
2. Common peroneal nerve and its branches.
3. Popliteal artery and its branches.
4. Popliteal vein and its tributaries.
5. Popliteal lymph nodes.
6. Popliteal pad of fat.
7. Posterior cutaneous nerve of the thigh
8. Genicular branch of the obturator nerve

## Tibial nerve

The tibial nerve and the common peroneal nerve originate proximal to the popliteal fossa as the two major branches of the sciatic nerve. Both are the most superficial of the neurovascular structures in the popliteal fossa. The tibial nerve is *larger branch* & enters the popliteal fossa and descends vertically through the fossa lateral, then posterior and finally medial to the popliteal artery.

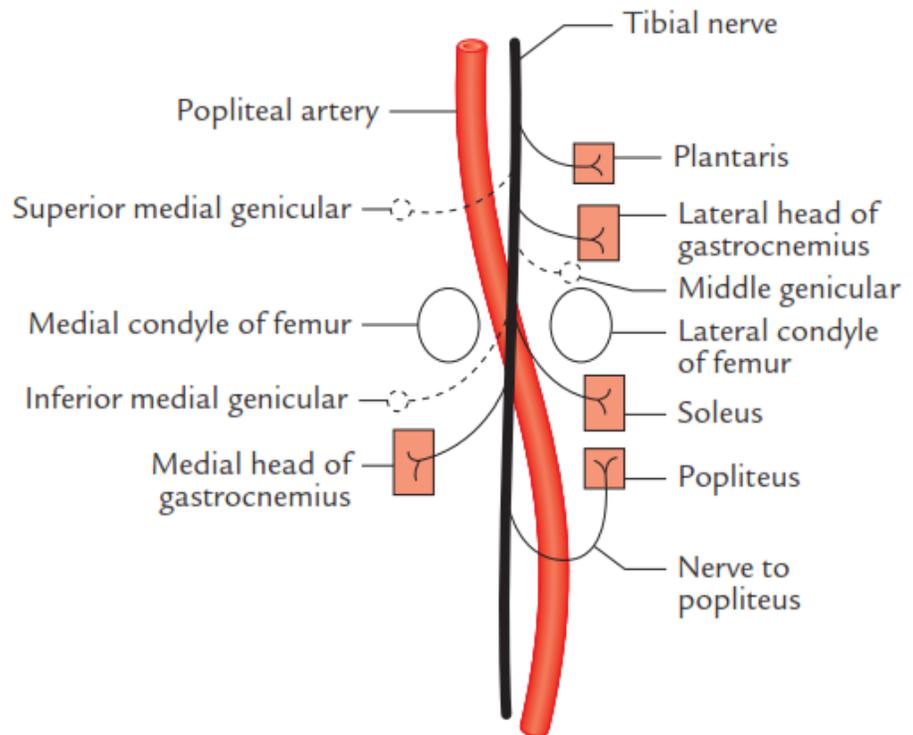


### Branches:

In the **back of the thigh**; it gives muscular branches to all the hamstrings muscles except the short head of biceps femoris.

In the **popliteal fossa**;

- **Muscular branches** to gastrocnemius (both heads), plantaris, soleus and popliteus.
- **Cutaneous branch** called **Sural nerve**, It runs vertically downward underneath the deep fascial roof of fossa and leaves the fossa by piercing the roof near its inferior angle to supply the strip of skin on the back of the leg down to the lateral malleolus and along the lateral side of the foot. It commonly receives a **peroneal communicating branch** from the **common peroneal nerve**.
- **Articular (genicular) branches** pass to the superior tibiofibular joint via the nerve to popliteus and to the knee joint. The articular branches to the knee are named superior medial, middle and inferior medial genicular nerves.
- **Vascular branches**: supply the vasomotor fibers to the popliteal artery.



### The common peroneal nerve

It is the *smaller terminal branch of the sciatic nerve*. It appears in the popliteal fossa beneath the long head of the biceps femoris and slopes downward and laterally along the medial side of the tendon of biceps femoris up to the lateral angle of the fossa, and continues to the lateral side of the leg where it winds around the neck of the fibula (*just beneath the skin and can easily be injured by fracture neck of fibula*) and enters the lateral compartment of the leg.

### Branches:

In the back of the thigh; it gives muscular branch to the short head of biceps femoris.

In the popliteal fossa;

- **Cutaneous branches**: which are:
  - ✓ Peroneal sural communicating branch: that joins the sural nerve of the tibial nerve
  - ✓ Lateral cutaneous nerve of the calf (AKA, lateral sural nerve): supplies the skin on the upper part of the lateral side of the leg.
- **Genicular branches**: these are;
  - ✓ Superior and inferior lateral genicular nerves both supply the knee joint.
  - ✓ Recurrent genicular nerve supplies the superior tibiofibular joint.

### Popliteal artery

It is the continuation of femoral artery. It begins at the adductor hiatus in the adductor magnus muscle. It appears in the popliteal fossa on the supero-medial side under the lateral border of the semimembranosus muscle, crosses

the floor of popliteal fossa obliquely from medial to lateral side to reach the lower border of the popliteus muscle where it terminates by dividing into: anterior & posterior tibial arteries.

### Relations

- **Anteriorly (deep):** floor of the popliteal fossa (i.e., popliteal surface of femur, posterior aspect of the knee joint, and fascia covering the popliteus muscle).
- **Posteriorly (superficial):** from deep to superficial; semimembranosus, popliteal vein, tibial nerve, fascial roof, superficial fascia and skin.

The **tibial nerve and popliteal vein** lie **lateral** to the artery in its upper part, cross **posterior** to its middle part and become **medial** to its lower part.

### Branches

Muscular branches: to the lower parts of the hamstring muscles & upper parts of the calf muscles

Articular branches: they are 5-6 in number & supply the knee joint and take part in the formation of genicular anastomosis around the knee joint.

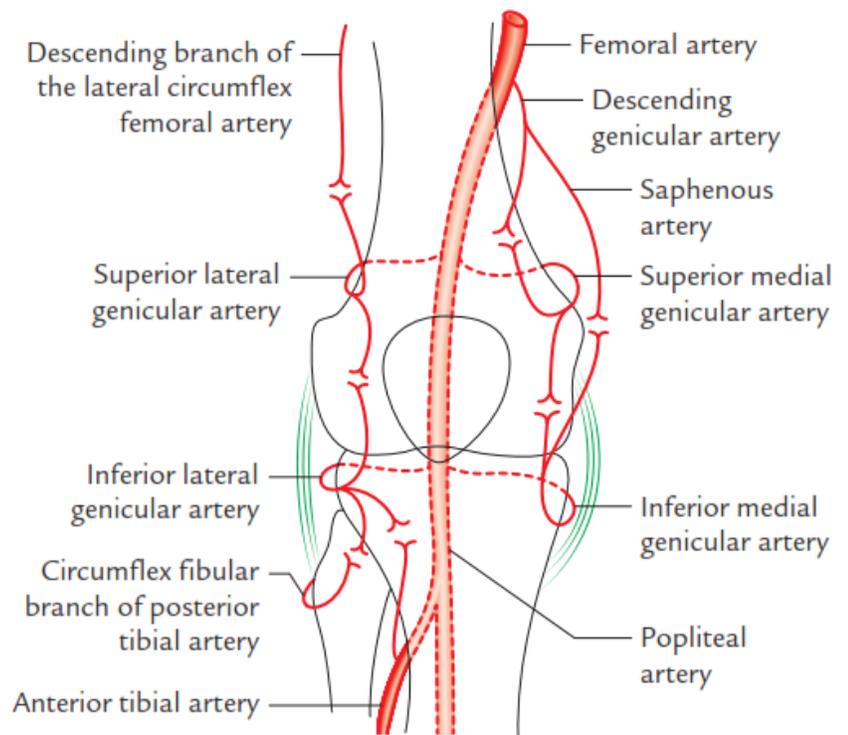
- **Superior medial and superior lateral genicular arteries:** They wind around the corresponding side of the femur immediately above the corresponding femoral condyles.
- **Inferior medial and inferior lateral genicular arteries:** they wind around the corresponding tibial condyles and pass deep to the corresponding collateral ligaments of the knee joint.
- **Middle genicular artery:** It pierces the oblique popliteal ligament of the knee to supply the cruciate ligaments and synovial membrane of the knee joints.

### Genicular anastomosis

It is an arterial anastomosis around the knee joint formed by the branches of popliteal, anterior tibial and posterior tibial, femoral, and profunda femoris arteries. This anastomosis maintains adequate blood supply to the knee joint and leg during flexion of the knee joint, when the popliteal artery is compressed (kinked) and blood flow in it becomes sluggish.

The genicular anastomosis takes place as follows:

1. Superior medial genicular artery anastomoses with the descending genicular branch of the femoral artery and inferior medial genicular artery.
2. Inferior medial genicular artery anastomosis with the superior medial genicular artery and saphenous artery—a branch of the descending genicular artery (a branch of femoral artery).
3. Superior lateral genicular artery anastomoses with the descending branch of the lateral circumflex femoral artery and inferior lateral genicular artery
4. Inferior lateral genicular artery anastomoses with the superior lateral genicular artery, anterior and posterior recurrent branches of the anterior tibial artery, and circumflex fibular branch of posterior tibial artery.



## Popliteal vein

The popliteal vein is formed at the lower border of the popliteus by the union of veins (**venae comitantes**) accompanying the anterior and posterior tibial arteries. It ascends superficial to popliteal artery and crosses it from the medial to lateral side in the popliteal fossa. The popliteal vein continues as **femoral vein** at adductor hiatus.

### Tributaries

1. Small saphenous vein.
2. Veins corresponding to the branches of popliteal artery.

### Clinical Correlations:

• **Popliteal pulse:** *To feel the popliteal pulse, first flex the knee to relax the popliteal fascia. Then place the fingertips of both hands in the popliteal fossa with thumbs resting on patient's patella. Popliteal pulse is the most difficult pulse to feel amongst all the peripheral pulses.*

• **Popliteal aneurysm:** *The popliteal artery is more prone to aneurysm (an outward bulging from that wall of an artery) than any other artery in the body. Clinically, popliteal aneurysm presents as pulsatile midline swelling in the popliteal fossa.*

• **Baker's cyst:** *It is cystic swelling which occurs in the popliteal fossa due to inflammation of synovial bursa underneath the tendon of semimembranosus or protrusion of synovial membrane of the cavity of knee joint through the fibrous capsule of the joint.*

## Posterior cutaneous nerve of the thigh

It pierces the fascial roof about the middle of the popliteal fossa and provides cutaneous innervation up to the middle of the back of leg.

## Genicular branch of the obturator nerve

It is the continuation of the posterior division of the obturator nerve. It first run on the posterior surface of the popliteal artery and then pierces oblique popliteal ligament to supply the capsule of the knee joint.

## The popliteal lymph nodes

These are about six in number and are arranged around the popliteal vessels. They receive lymph from;

- The skin and superficial fascia of the heel and the lateral side of the foot via afferent lymphatics that accompany the small saphenous vein.
- From the deep structures of the leg and foot via afferent lymphatics that accompany the anterior and posterior tibial vessels.
- The knee joint.

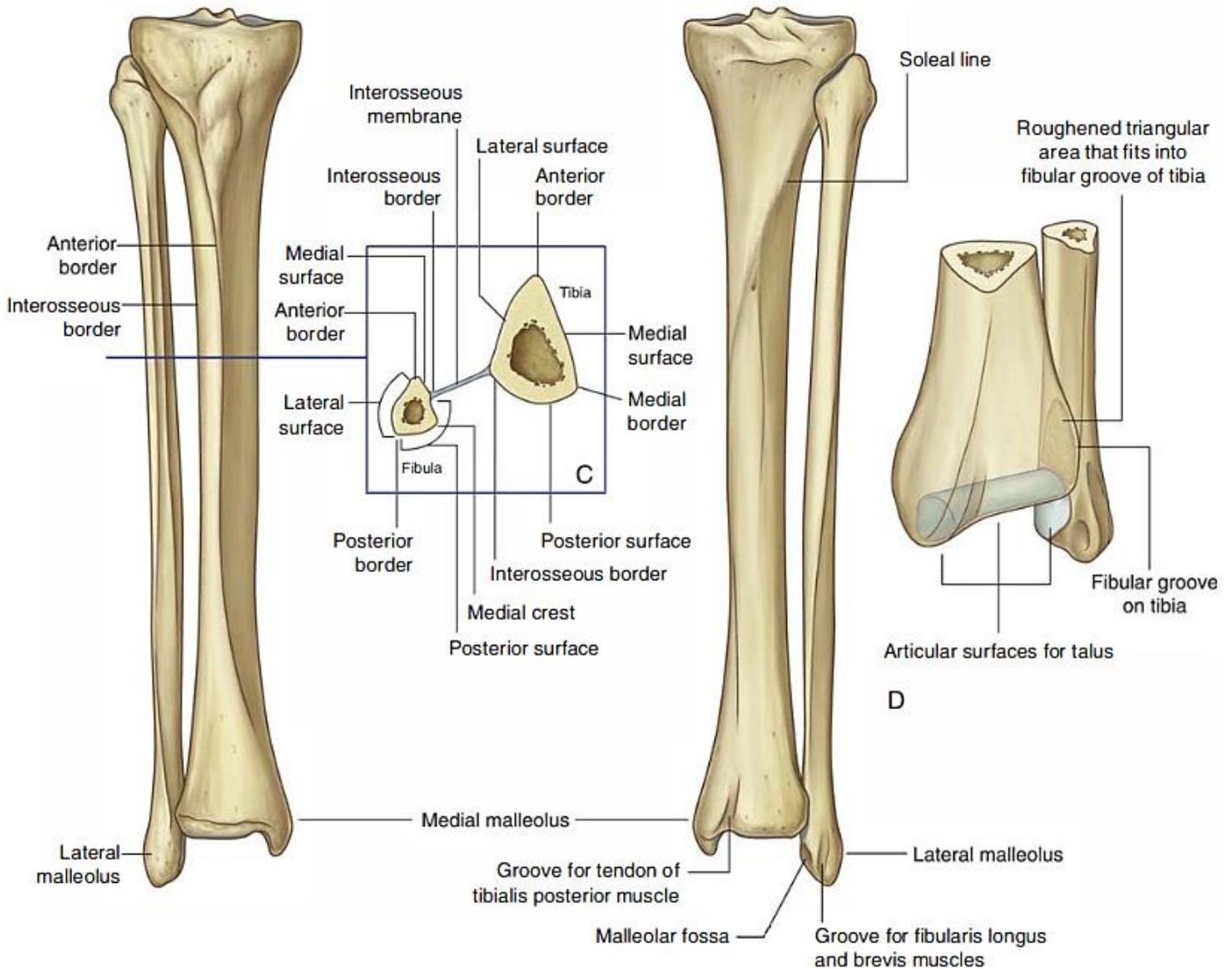
The efferent vessels pass along the popliteal and femoral vessels to the **deep inguinal lymph nodes**.

# THE LEG

## Bones of the leg

### The tibia

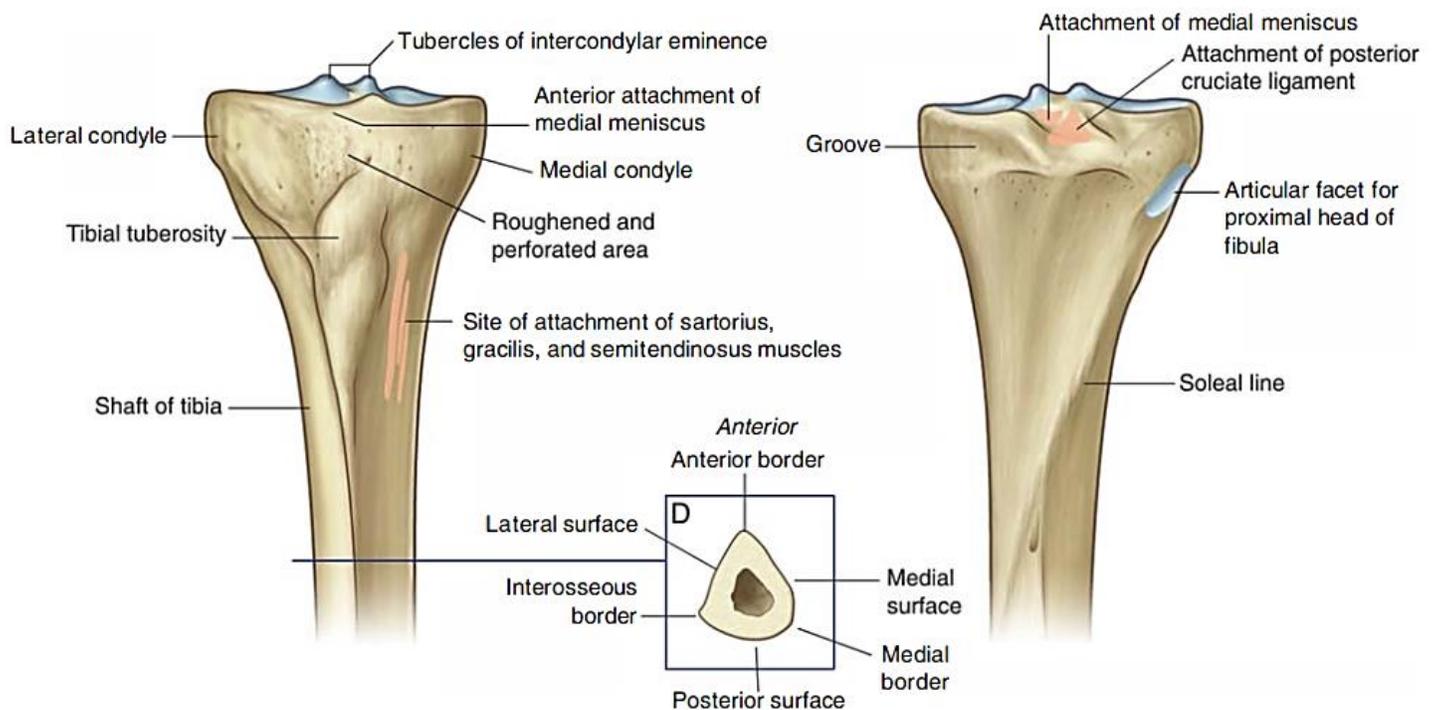
The tibia is the second longest bone in the body and represents the medial weight-bearing bone of the leg. It articulates proximally with the femoral condyles to form the knee joint and the head of the fibula to form the proximal tibiofibular joint. Distally it articulates with the talus to form the ankle joint and the distal end of the fibula to form the distal tibiofibular joint.



### The proximal end

The superior surface of the expanded proximal end of the tibia; the **tibial plateau**; has 2 oval articular surfaces called the **medial and lateral tibial condyles** separated in the midline by the **intercondylar area**. This area is divided into anterior and posterior parts by a bony elevation called the **intercondylar eminence** which is in turn divided by the cruciate ligaments of the knee into **medial and lateral intercondylar tubercles**. The larger medial tibial condyle has a horizontal groove on its posteromedial surface for the semimembranosus tendon. The smaller lateral tibial condyle has a small articular facet on its inferior surface for articulation with the head of the fibula at the proximal tibiofibular joint.

The proximal end of the tibia is separated from the upper part of the shaft by a smooth horizontal line which continues anteriorly with the **tibial tuberosity**. The upper part of the tuberosity is smooth and marks the area of the attachment of the fibrous capsule of the knee joint. The lower part is rough and marks the area of attachment of the ligamentum patellae.



### The shaft

The shaft of the tibia is triangular in cross section and has 3 borders and 3 surfaces termed in opposition. The **anterior and medial borders** with the **medial surface** in between are **subcutaneous**. The anterior border forms the shin. The subcutaneous medial surface is smooth and palpable throughout its length except in its upper part where it is roughened by the insertion of the 3 pes anserinus muscles and the medial collateral ligament of the knee. Distally, the medial surface is continuous as the **medial malleolus**. The **lateral** or **interosseous border** descends vertically from below the proximal tibiofibular joint to the concave surface of the medial malleolus and gives attachment to the **interosseous membrane**. The posterior surface lies between the medial and lateral borders and has an oblique **soleal line** running from below the proximal tibiofibular joint to meet the medial border at the junction of the upper and middle thirds of the shaft. It gives attachment to the tibial part of soleus muscle and to the popliteus fascia.

### The distal end

The distal end is slightly expanded as the **head of the tibia** and the lower surface of which is saddle-shaped and articulates with the talus to form the ankle joint. On the lateral surface is an articular facet for the distal end of the fibula. The lower end is prolonged downwards and medially as the **medial (tibial) malleolus**. The lateral surface of the malleolus is concave and articulates with the talus.

### The fibula

The fibula is the slender small lateral bone of the leg which has no role in weight-bearing but acts mainly to give muscular attachments. It does not participate in the knee joint formation. It articulates with the tibia proximally and distally to form the proximal and distal tibiofibular joints and with the talus distally to form the ankle joint.

**The proximal end** This has a slightly expanded and elongated **head** with a constricted **neck** distal to it. The superomedial surface of the head articulates with the lateral tibial condyle. Proximal to this articular facet lies the elongated apex of the head called the **styloid process**. The articular facet faces medially while the styloid process is directed laterally.

## The shaft

The fibular shaft is slender and is buried in the mass of leg muscles. Being molded by these muscles, its shape largely depends on the degree of muscularity. It has 3 borders and 3 surfaces termed in opposition.

The **anterior border** begins from the apex of a rough triangular area on the lateral surface of the lateral malleolus and ascends upwards marking the attachment of the anterior intermuscular septum which separates the extensor from the peroneal compartments.

The **interosseous border** lies medially and begins from the apex of a rough triangular area on the medial surface of the lateral malleolus and ascends upwards close to the anterior border leaving a narrow **anterior surface** in between from which the anterior compartment muscles take origin.

The **posterior border** limits the **peroneal** or **lateral surface** posteriorly and passes superolaterally. The area between the posterior and anterior borders is the lateral surface giving origin to the peroneal muscles.

The **medial crest** is an oblique line that appears to split upwards and backwards from the interosseous border at the junction of the middle and lower thirds of the shaft. It lies between the posterior and medial borders. This crest gives attachment to the intermuscular septum just behind tibialis posterior muscle. The **fusiform area** between the interosseous border and medial crest gives origin to tibialis posterior. The area between the posterior border and the medial crest is the **posterior surface** and gives origin to the deep flexors.

## The distal end

This is expanded as the triangular **lateral (fibular) malleolus** which is larger and about 2cm more distal than the medial malleolus. The distal end of the shaft just above the malleolus has a rough triangular area; with the apex directed upwards; for the attachment of the interosseous ligament medially. Inferior to this is a smooth triangular articular area; with the apex directed downwards; for articulation with the talus. The direction of this smooth area appears as an arrow indicating whether the fibula is right or left. The posterior margin of the malleolus is grooved by the tendons of the peronei and acts as a pulley for these muscles. The **malleolar fossa** is a depression that lies between the tip of the malleolus and the articular triangular facet.

