Bones of Lower Limb

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Bones of the lower limb

- Pelvic bone
- Hip joint
- Femur
- Knee joint
- Patella
- Tibia
- Fibula
- Lateral malleolus
- Medial malleolus
- Ankle joint

Hip
Thigh
Leg
Foot
Hip Bone

• Made up of 3 bones:
  1) **Ilium** *(flat)*, superior in position
  2) **Ischium** *(L)*, postero-inferior in position
  3) **Pubis** *(V)*, antero-inferior in position
The ilium, ischium and pubis meet one another by means of triradiate (Y-shaped) cartilage at the Acetabulum.

At puberty the triradiate cartilage starts to ossify and near the age of 17 the triradiate cartilage will be replaced by bony union.

The three bones meet at the Acetabulum: a socket on the lateral surface of hip bone where the femur head articulates to form the hip joint.
The hip bones articulate with the sacrum at the **sacroiliac joints** posteriorly.
The hip bones articulate with one another at the **symphysis pubis** anteriorly.

**Symphysis pubis** is a cartilaginous joint between the left and right pubic bones.
Ilium

Consist of:
- **Two parts:** body & wing (ala)
- **Four spines:**
  1: ASIS
  2: AIIS
  3: PSIS
  4: PIIS
- **Two surfaces:**
  - Gluteal surface (outer)
  - Sacropelvic surface (inner)

  - The superior border of the wing: Iliac crest (palpable)
Iliac tubercle
The anterior superior spine of the ilium is easily felt and may be visible in the thin subject.
The gluteal surface is divided into 4 parts by three lines:
1- Posterior gluteal line
2- Anterior gluteal line (middle)
3- Inferior gluteal line

MAKE SURE you know the names of the muscles that are attached to the areas between these lines
Left hip bone
Lateral view

Superior
Anterior
Posterior
Inferior
Look at the hip bone from inner (medial) side.
The sacropelvic surface presents:

1- **Iliac tuberosity**: rough area that gives attachment to the interosseous and dorsal sacroiliac ligaments

2- **Auricular surface**: Smooth area articulates with the sacrum to form the sacroiliac joint

3- **Iliac fossa**: Smooth area

Medial border Forms the **Arcuate line** which extends to the **Ilio-pubic eminence**
Iliac tuberosity

Posterior

Anterior
Auricular surface
Arcuate line

Look at the hip bone from inner (medial) side
Ilio-pubic eminence
Marks the point of union between ilium and pubis.
Pubis (anterior-inferior)

Formed of a **body** and **two rami**: superior and inferior

**Pubic crest** is the upper border of pubis
Pubic crest ends laterally by the **pubic tubercle**

The medial surface of the body articulates with the opposite pubis to form the pubic symphysis.

The inferior ramus of the pubic bone joins the ischial ramus to form the **conjoined ramus**.
**Pectineal line** is a ridge on the superior pubic ramus.
Pectineal line of pubic bone

Pubic tubercles
Subpubic arch
Ischium
(posterior-inferior)

Greater sciatic notch
Ischial spine
Lesser sciatic notch
Ischial tuberosity

Body
Ischial ramus
Ischial tuberosity
(Sitting bone)
Acetabulum
It is a C-shaped cavity located on the lateral aspect of the hip bone

- directed laterally, downwards and forwards

- It is notched inferiorly by the acetabular notch which is bridged by the transverse acetabular ligament (part of the acetabular labrum)

- The acetabular ligament converts the acetabular notch into foramen
Its cavity presents a horse-shoe shaped articular surface called **Lunate surface**.

The Lunate surface surrounds a non-articular depression called **acetabular fossa** which is occupied by fat tissue in living.
The ilium forms the superior 2/5 of the lunate surface.

The pubis forms the anterior 1/5 of the lunate surface.

The ischium forms the posterior 2/5 of the lunate surface.
Obturator foramen Covered by a membrane in living subjects

Obturator muscles are attached to obturator membrane

The obturator canals for the passage of the obturator vessels and nerve
Posteriorly:
2 notches
(greater & lesser sciatic notches)
The **sacrospinous ligament** is a thin, triangular ligament. The base of the ligament is attached to the sacrum and coccyx, and the tip attaches to the ischial spine.
Sacrotuberous ligament runs from the sacrum, coccyx and PSIS to the ischial tuberosity.
This pair of ligaments helps to transition the greater and lesser sciatic notches (indentations) into the greater and lesser sciatic foramina (openings).
Anatomical position of the hip bone

It is very important to understand the anatomical position of the hip bone.

In anatomical position:

1. The Anterior superior iliac spine and the pubic tubercle lie in the **same vertical plane**.

2. The ischial spine and the upper border of the symphysis pubis lie in the **same horizontal plane**.

It means that the pelvis is looking forward in the anatomical position.
The 2 hip bones with the sacrum form the pelvis.

Now look! where does the pelvis look? It is looking right at you! Never upwards.

During your first practical session, make sure to have a look at the anatomical position of the pelvis.
Abdominal aorta bifurcates into the left and right common iliac arteries.

Aortic bifurcation is at the level of the fourth lumbar vertebra L4.
The fact that the pelvis is facing (looking) forward is important to understand how structures passing from the pelvis smoothly to join the thigh.

Notice, the **external iliac artery** as it passes from the pelvis into thigh to become the **femoral artery**

*What do you think about the femoral nerve and vein?*
**External iliac artery** continues as **femoral artery**
It enters the thigh from behind the inguinal ligament

**Femoral vein** continues as **External iliac vein**
It leaves the thigh from behind the inguinal ligament
The **inguinal ligament** is a band running from the pubic tubercle to the anterior superior iliac spine.

The inguinal ligament is formed by the external abdominal oblique aponeurosis.
External abdominal oblique
Internal abdominal oblique
Transversus abdominus
Aponeurosis of the abdominal external oblique muscle extends between the anterior superior iliac spine and the pubic tubercle to form a thick band, folded inward, and continuous below with the fascia lata; it is called the **inguinal ligament**.
Greater sciotic foramen above piriformis muscle:
- Superior gluteal nerve, artery, vein

Lesser sciotic foramen:
- Obturator internus muscle tendon
- Pudendal nerve and internal pudendal vessels pass into perineum from gluteal region

Greater sciotic foramen below piriformis muscle:
- Sciatic nerve
- Inferior gluteal nerve, artery, vein
- Pudendal nerve
- Internal pudendal artery and vein
- Posterior femoral cutaneous nerve
- Nerve to obturator internus and gemellus superior muscles
- Nerve to quadratus femoris and gemellus inferior muscles

Obturator canal:
- Obturator nerve
- Obturator vessels

Gap between inguinal ligament and pelvic bone:
- Psoas major, iliacus, pectineus muscles
- Femoral artery
- Femoral vein
- Lymphatics
- Femoral branch of genitofemoral nerve
- Lateral cutaneous nerve of thigh
- Femoral nerve
Femur (thigh bone)

- Longest, heaviest, and strongest bone in the body
- **Proximally**: articulates with the acetabulum of the hip bone forming the **hip joint**
- **Distally**: articulate with the tibia and patella forming the **knee joint**
**Proximal end**
1. Head: \((2/3\) sphere)  
2. Fovea capitis  
3. Neck  
4. Greater trochanter: (Lateral)  
5. Lesser trochanter: (postero-medial)  
6. Trochanteric fossa  
7. Intertrochanteric line: (Anterior)  
8. Intertrochanteric crest: (Posterior)  
9. Quadrate tubercle  
10. Gluteal tuberosity  
11. Pectineal line of femur

**Shaft**
1. Linea Aspera: (posterior)

**Distal end**
1. Femoral Condyles (M & L)  
2. Femoral epicondyles (M & L)  
3. Intercondylar fossa (Posterio)  
4. Patellar surface (Anterior)  
5. Popliteal surface  
6. Adductor tubercle

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**Femur (thigh bone)**

Descends at a 7 degree angle medially
In the proximal third of femur, the linea aspera diverges and continues superiorly as pectineal line and gluteal tuberosity.

In the distal third of femur, the linea aspera diverges and continues inferiorly as medial and lateral supracondylar ridges.
The fovea capitis is an ovoid depression of the femoral head, and gives attachment to the ligament of head of femur.

The ligament of head of femur (round ligament of the femur, ligamentum teres femoris)
Tibia

- Located medially
- Weight-bearing bone of the leg
Medial malleolus is at the distal end of tibia.

Lateral malleolus is at the distal end of fibula.
Anterior

Lateral Condyle → Medial Condyle

Tibial tuberosity

Intercondylar area and eminence
Cross section in the shaft of tibia

Cross section in the shaft of fibula

Posterior surface

Lateral border (Interosseous)

Anterior border

Medial border

Lateral surface

Medial surface

Posterior surface

Lateral border (Interosseous)
The shaft of the tibia is subcutaneous and unprotected anteromedially throughout its course. It is not surprising that the tibia is the commonest long bone to be fractured.
Cross section in the shaft of fibula

- Lateral surface: Provides origin to the muscles in the lateral compartment of the leg.
- Anterior surface: Provides origin to some of the flexor muscles of the leg (Flexor surface).
- Posterior surface: Provides origin to the extensor muscles of the leg (Extensor surface).
Fibula

- The lateral bone of the leg
- Slender bone, smaller than tibia: (No articulation with femur)

Lateral malleolus (articulate with talus)
Articular facet of the head

Styloid process

Head

Neck

Malleolar fossa, located on the medial surface of the lateral malleolus

Inferior

Posterior

medial

Subcutaneous triangular area

Lateral malleolus

Right fibula (posterior view)

Helps to determine left or right
Patella

- Known as the **kneecap**
- Is triangular
- Articulates with the femur
- Covers and protects the anterior articular surface of the knee joint
- Is the largest sesamoid bone in the body is embedded in the quadriceps femoris tendon

Upper part: Serves for the attachment of the tendon of the quadriceps muscle

Lower part: Serves as the origin of the patellar ligament

The patellar ligament inserts into tibial tuberosity
Bones of the foot

Tarsals (7)
Metatarsals (5)
Phalanges (14)

Tarsal bones
1. Talus
2. Calcaneus
3. Navicular (*little boat*)
4. Medial Cuneiform (*wedge-shape*)
5. Intermediate Cuneiform
6. Lateral Cuneiform
7. Cuboid
Calcaneus (heel= كعب)
Talus (ankle= كاحل)
Subtalar joint
Calcaneus

Planter surface of the foot (inferior)
Talus

Planter surface of the foot (inferior)
Head of Talus

Planter surface of the foot (inferior)
Navicular bone

Planter surface of the foot (inferior)
Medial cuneiform bone

Planter surface of the foot (inferior)
Intermediate cuneiform bone

Planter surface of the foot (inferior)
Lateral cuneiform bone

Planter surface of the foot (inferior)
Cuboid

Planter surface of the foot (inferior)
Tuberosity of the fifth metatarsal bone

Proximal phalanx

Middle phalanx

Distal phalanx
The knee joint consists of two joints:
1- between the femur and tibia (tibiofemoral joint)
2- between the femur and patella (patellofemoral joint).
The **ankle joint** is the joint between the talus and the distal ends of tibia and fibula.
Phalanges
Metatarsals
Deep transverse metatarsal ligaments
Distal row
Cuneiforms
Medial Intermediate Lateral
Cuboid
Intermediate bone
Navicular
Proximal row
Talus
Articular surface for ankle joint
Tarsal bones
Subtalar joint
Calcaneus
The femoral triangle is a pyramid-shaped depression formed by muscles in the proximal regions of the thigh and by the inguinal ligament. The major blood supply and one of the nerves of the limb (femoral nerve) enter into the thigh from the abdomen by passing under the inguinal ligament and into the femoral triangle.

The popliteal fossa is posterior to the knee joint and is a diamond-shaped region formed by muscles of the thigh and leg. Major vessels and nerves pass between the thigh and leg through the popliteal fossa.

The posteromedial side of the ankle: Most nerves, vessels, and flexor tendons that pass between the leg and foot pass through a series of canals (tarsal tunnel) on the posteromedial side of the ankle. The canals are formed by adjacent bones and a flexor retinaculum, which holds the tendons in position.