

Introduction to lower limb and its bones

Curricular Objectives: By the end of this session students are expected to

Theory

1. Outline the parts and regions of the lower limb
2. Comprehend the effect of lower limb function on treatment decisions
3. Outline the general arrangement of the of the nerves supplying the lower limb
4. Summarize the arterial supply and venous drainage of the lower limb
5. Describe the bones of the lower limb and their main markings
6. List the joints of the lower limb and their types
7. Discuss the use of X-ray in diagnoses of various lower limb conditions
8. Compare between upper and lower limbs in relation to structure and function

Practical

1. Distinguish the different parts and regions of the lower limb
2. Identify the bones of the lower limb and label their main markings
3. Identify the joints of the lower limb
4. Label the lower limb bones and their main markings in an X- ray film

Selected references and suggested resources

- ✦ Clinical Anatomy by Regions, Richard S. Snell, 10th edition
- ✦ Grant's Atlas of Anatomy, 13th Edition
- ✦ McMinn's Clinical Atlas of Human Anatomy, 7th Edition
- ✦ [Anatomy for Babylon medical students](#) (Facebook page)
- ✦ [Anatomy for Babylon medical students](#) (YouTube channel)
- ✦ [Human Anatomy Education](#) (Facebook page)
- ✦ [Human anatomy education](#) (YouTube channel)

Feedback and suggestions

- ✦ <http://goo.gl/forms/SjyjGeUpvH>

Session check list

❖ **Clinical highlights:**

- Lower limb injuries, bone fractures, and joint dislocations are commonly seen in traumatology departments. In addition lower limb is frequently involved in clinical examination for systemic diseases like brain and metabolic disease
- Examples of medical conditions encountered in every day work include varicose veins, vascular deficiencies, knee swelling, and peripheral nerve injuries
- Solid based knowledge on the anatomy of the lower limb, gross features of its bones, muscles, vessels and nerve supply is essential for undergraduate students and junior doctors

❖ **Key landmarks:**

- ✦ Hip
- ✦ Femur
- ✦ Tibia, Fibula
- ✦ Tarsal bones

❖ The lower limb

- It is specialized to support the weight of the body and produce locomotion rather than prehension
- It is made (similar to upper limb) from proximal part called the hip girdle (connecting it to the trunk) and free distal part
- It is divided into four major parts:
 - 1- **Gluteal region** (side and back of pelvis)
 - 2- **Thigh** (from hip to knee)
 - 3- **Leg** (from knee to ankle)
 - 4- **Foot** (from ankle to toes)
- Similar to the arm and forearm, the thigh and the leg are divided into compartments by the deep fascia and each compartment has its own muscles, vessels and nerves
- The proximal end of the thigh is separated anteriorly from the abdominal wall by the inguinal region (groin) and posteriorly from the gluteal region by the gluteal fold
- The hollow region on the posterior aspect of the knee is called popliteal fossa
- The five digits of the foot are numbered 1st to 5th from medial (big toe) to lateral (little toe)
- Bones include the hip (forms the pelvic girdle), femur (bone of thigh), Tibia and fibula (bones of the leg), Tarsal, metatarsal and phalangeal bones (bones of the foot)
- Joints of the lower limb include the sacroiliac, hip, knee, tibiofibular, ankle, intertarsal, intermetatarsal, metatarsophalangeal, and interphalangeal joints
- The nerve supply of the lower limb is derived from lumbar (ventral rami of L1-4 spinal nerves) and sacral (ventral rami of L4, 5 and S1, 2, 3, 4 spinal nerves) plexuses
- There are six main nerves that supply the lower limb; they are the femoral, obturator, sciatic (tibial, common peroneal parts), superior gluteal and inferior gluteal nerves. Memorizing the course and regional supply of these nerves is of great value in clinical practice
- The blood supply is derived from one major artery (like that of upper limb). The lower limb is supplied mainly by the femoral artery which is a continuation of the external iliac artery after it enters the thigh from the abdomen. Several smaller arteries provide minor contribution. Unlike the upper limb, lower limb arteries are vulnerable to occlusion thus it is important to memorize the arterial tree and its surface markings and be able to palpate the arteries
- Venous blood of the lower limb is drained through superficial (superficial to the deep fascia) and deep veins interconnected with each other by perforating veins just like that in the upper limb. But unlike those of the upper limb, the superficial veins are at great risk of structural damage and development of varicose veins while the deep veins are at risk of what is called deep vein thrombosis
- The lymphatics of the lower limb originate in the foot. The superficial and deep lymph vessels pass superiorly to the superficial and deep lymph nodes within the inguinal region

- ❖ **The Hip** (irregular bone)
 - It is made of three smaller bones (ilium, ischium and pubis) that are fused together
 - The hip is anchored to the axial skeleton by the strong sacroiliac joint
 - Right and left hips articulate with each other anteriorly at the symphysis pubis
 - Its external surface is related to lower limb while the internal surface is related to the pelvis
 - Its curved thickened upper border is called iliac crest
 - It has a large cup-shaped cavity on its outer surface called the acetabulum
 - It has a large (almost rounded) gap in its lower part called obturator foramen through which nerves, vessels and lymphatics pass between the pelvis and the lower limb
- ❖ **Femur** (long bone)
 - The longest and strongest bone of the body, it is $\approx 1/4^{\text{th}}$ of the height of the individual
 - Like any long bone, it is composed of three parts: upper end, shaft, and lower end
 - Its upper end consists of the head, neck, and greater and lesser trochanter
 - Its head articulates with the hip bone at the acetabulum (forming the hip joint)
 - There is an angle between the neck and the shaft making the neck vulnerable to fracture
 - Its lower end articulates with patella and tibia (forming the knee joint)
- ❖ **Patella** (largest sesamoid bone)
 - It is situated in front of the knee joint, hence it is also called knee cap
 - It has a tendency to dislocate laterally and if fractured bone reunion is not possible
- ❖ **Tibia** (long bone)
 - It is the large medial bone of the leg
 - Its upper end is expanded into two condyles that articulate with the lower end of the femur
 - The anterior aspect of its upper end show a rough triangular area called the tibial tuberosity
 - Its shaft is subcutaneous and has a sharp anterior border
 - The lower end is small and projects infero-medially as medial malleolus
- ❖ **Fibula** (long bone)
 - It is the smaller lateral bone of the leg
 - It consists of three parts: upper end, shaft, and lower end
 - Its head is small and articulate with the tibia
 - Its lower end is expanded to form lateral malleolus
- ❖ **Tarsal bones** (short bone)
 - There are seven tarsal bones arranged in three rows: proximal (2), middle (1) and distal (4)
- ❖ **Metatarsals and phalanges** (long bone)
 - There are five metatarsal bones. They are numbered one to five from medial to lateral
 - There are 14 phalanges in each foot: two in big toe and three in each finger
 - Each bone (metacarpal and phalanx) has three parts: base (proximal end), shaft, and head (distal end)
- ✚ **Note:** Further details on individual bones will be covered with specific lower limb regions

Lab activity list

For each task below, identify the listed structures then answer the related questions

❖ Task 1 (parts and bones of the lower limb)

- Gluteal region (Hip bone/ Sacrum/ Sacroiliac joint)
- Gluteal cleft / Inguinal region/ Knee/ Shin/ medial and lateral Maleoli
- Thigh (femur)
- Leg (Tibia and fibula)
- Foot (tarsal bones, metatarsal bones, phalanges)
- Look at the femur and compare its size with the humerus
- ⊕ The inguinal region refers to the lateral aspect of the thigh (true/false?)

❖ Task 2 (Hip)

- ✓ Ilium/ Anterior superior iliac spine/ Posterior superior iliac spine
- ✓ Pubis/ Pubic tubercle/ Symphysis pubis
- ✓ Ischium/ Ischial spine/ Ischial tuberosity
- ✓ Acetabulum/ Obturator foramen
- Look at the hip and differentiate between its anterior and posterior aspects
- ⊕ The symphysis pubis is a joint between which bones?
- ⊕ Which part of the hip bone is used when sitting?
- ⊕ Which part of the hip articulate with the sacrum?

❖ Task 3 (Femur)

- ✓ Head, Neck, Shaft, Lower end
- ✓ Greater and lesser trochanters
- Compare the size of the femur and the humerus. Which is larger?
- ⊕ Which part of the femur articulate with the hip?

❖ Task 4 (Tibia)

- ✓ Expanded upper end (medial and lateral condyles/ tibial tuberosity)
- ✓ Shaft (medial surface/ anterior border)
- ✓ Lower end (medial malleolus)
- ⊕ Which part of the tibia is subcutaneous?

❖ Task 5 (Fibula)

- ✓ Head, neck, shaft/ Lower end (lateral malleolus)
- ⊕ The head of the fibula articulate with _____

❖ Task 6 (Foot bones)

- ✓ Tarsal bones
- ✓ First – 5th metatarsals
- ✓ Proximal, middle, and distal phalanx
- ✓ Joints: Ankle joint, Tarso-metatarsal joint, Metatarsophalangeal joint, Interphalangeal joint

Review questions:

1. The fibula transmits the weight of the body from the femur to the foot. (True/ False?) . Explain
2. The region on the back of the knee is called _____
3. In the image on the right there are two pictures
 - a) Is it A or B that show the leg bones?
 - b) What bones are shown in the other picture?
 - c) What bone markings you use to help you differentiate the two?

**Homework**

During the morning tour, the pediatrician asked the fourth year medical student to measure the length of the lower limbs of 5 years old girl who is suspected to have discrepancy between right and left leg length

- A. What surface landmarks are usually used to measure the lower limb length?
- B. How can you find each surface marking on your patients?