## PART II: BONES OF THE PELVIC GIRDLE AND LOWER LIMB

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<td>Pelvic girdle</td>
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<td><img src="image" alt="Image of Pelvic Girdle" /></td>
<td>Each coxal (hip) bone is formed by the fusion of an ilium, ischium, and pubic bone; the coxal bones fuse anteriorly at the pubic symphysis and form sacroiliac joints with the sacrum posteriorly; girdle consisting of both coxal bones is basin-like</td>
<td>Iliac crest; anterior and posterior iliac spines; auricular surface; greater and lesser sciatic notches; obturator foramen; ischial tuberosity and spine; acetabulum; pubic arch; pubic crest; pubic tubercle</td>
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<tr>
<td>Thigh</td>
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<td><img src="image" alt="Image of Femur" /></td>
<td>Femur is the sole bone of thigh; between hip joint and knee; largest bone of the body</td>
<td>Head; greater and lesser trochanters; neck; lateral and medial condyles and epicondyles; gluteal tuberosity; linea aspera</td>
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*The number in parentheses ( ) following the bone name denotes the total number of such bones in the body.*

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Kneecap
(Figure 8.9)

Patella is a sesamoid bone lodged in the tendon of the quadriceps (anterior thigh) muscles

Leg
(Figure 8.10)

Tibia is the larger and more medial bone of leg; between knee and foot

Fibula is lateral bone of leg; sticklike

Medial and lateral condyles; tibial tuberosity; anterior crest; medial malleolus

Head; lateral malleolus

Anterior view of pelvic girdle and left lower limb

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Tibia

• The **larger & medial** bone of the leg

• Functions:
  - Attachment of muscles
  - Transfer of weight from femur to skeleton of the foot
  - Articulations
Articulations

- Only the tibia articulates with the distal end of femur to form the *knee joint*

- Both the tibia & fibula articulate with the talus to form the *ankle joint*

- The proximal & distal ends of the tibia & fibula articulate together to form the *tibiofibular joints*
Tibia

Proximal end:
- Condyles
- Tibial tuberosity

Shaft:
- Three surfaces (ant, med, lat)

Distal end:
- Distal surface
- Medial malleolus
Tibia

• **Medial & lateral condyles**: articulate with the corresponding condyle of the femur

• **Tibial tuberosity**: the attachment site of the patellar tendon

• Anterior surface of the shaft: *shin bone*

• **Distal end**: articulate with the talus to form part of the ankle joint
Surface Anatomy

Palpate on a living knee:

- **Patella**: base, margins, apex
- Anterior margins of the *[medial & lateral condyles]*
- Approximate level of the *“Knee Joint Line”*
(a) Patella

- Apex
- Facet for medial condyle of femur
- Facet for lateral condyle of femur
- Surface for patellar ligament

Anterior

Posterior
Fibula

- Slender

- Lateral bone of the leg

- *Non-weight bearing*

- Mainly for the attachment of lateral leg muscles
Fibula

- **Head**: articulate with the tibia to form the proximal *tibiofibular joint*

- **Shaft**: for attachment of muscles

- **Latreal malleolus**: articulate with the tibia to form the *distal tibiofibular joint*, and with the talus contributing to the *ankle joint*
Surface anatomy

Palpate the following:

- Medial tibial condyle
- Tibial tuberosity
- Head of fibula
- Shin bone
- Medial malleolus
- Lateral malleolus
Muscles of the thigh

• **Anterior compartment:** primary *extensors of the knee* joint

• **Medial compartment:** *adductors* of the thigh

• **Posterior compartment:** assist *flexion of the knee* and *extension of the hip*
Anterior compartment

**Quadriceps femoris:**
- Vastus medialis (from intertrochanteric line)
- Vastus lateralis (from greater trochanter)
- Vastus intermedius (ant & lat surface of femur)
- Rectus femoris (from ASIS)

**Sartorius** (ASIS to sup med surface of tibia)
Anterior compartment

- **Quadriceps femoris insertion**: to base of the patella, then by patellar ligament to tibial tuberosity

- Innervation: FEMORAL NERVE (L2-L4)
Femoral nerve

- Arises from the lumbar plexus

- Descends within the groove between the psoas major and iliacus muscles

- Lateral to the femoral artery as it enters the thigh
Lumbar Plexus

Key:

- Ventral rami

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Femoral nerve entrapments

- Herniation of intervertebral discs (L2/L3 or L3/L4)
- At the level of inguinal ligament (femoral nerve neuropathy)

This may result in:
- Weak extension of the knee
- Weak patellar tendon reflex (L4 level reflex)
- Cutaneous sensory changes (anterior thigh & L4 dermatome)
Medial compartment

• From pubis to linea aspera of the femur:
  - Adductor longus
  - Adductor brevis
  - Adductor magnus
  - Gracilis

• Innervation: OBTURATOR NERVE (L2-L4)
Obturator nerve

- Arises from the lumbar plexus
- Courses medial to the psoas major muscle
- Enters the thigh through the obturator canal
- Sensory: medial skin of thigh (cutaneous)
Posterior compartment

**Hamstrings:**
- Semitendinosus (ischial tuberosity to tibia)
- Semimembranosus
- Biceps femoris: long head (ischial tuberosity to fibula)
- Biceps femoris: short head (femur to fibula)
Posterior compartment

- Act across the hip and knee joints except the short head of biceps femoris

- Innervation: SCIATIC NERVE (L4-S3)
Sciatic nerve

• Arises from the sacral plexus

• **Leaves the gluteal region** at a point approximately half-way along a line joining the ischial tuberosity and greater trochanter

• Terminates 12-15 cm above the knee by dividing into the **tibial nerve** and **common peroneal nerve**
Sciatic nerve entrapments

- Posterolateral *herniation* of the intervertebral discs (nerve root entrapment)
- Misplaced needle when attempting injections in the gluteal region

Sciatica

- Radiating, deep pain within the buttocks, posterior thigh, and often below the knee
- Paresthesia or anesthesia (dermatomal in distribution)
1st cervical nerve (C1) exits above C1 vertebra

8th cervical nerve exits below C7 vertebra (there are 8 cervical nerves but only 7 cervical vertebrae)

Lumbar disc protrusion does not usually affect nerve exiting above disc. Lateral protrusion at disc level L4–5 affects 5th lumbar nerve, not 4th lumbar nerve. Protrusion at disc level L5–S1 affects 1st sacral nerve, not 5th lumbar nerve.

Medial protrusion at disc level L4–5 rarely affects 4th lumbar nerve but may affect 5th lumbar nerve and sometimes 1st–4th sacral nerves.
Which bony points of the lower limb are reliable landmarks for measuring the length of the lower limb?
Ligaments of the knee joint

• The knee depends heavily on ligaments for stability…………Why?

• Ligament injuries of the knee have more serious long term implications than a fracture of the femur or tibia……..Why?
Ligaments of the knee joint

• **Anterior and posterior cruciate ligaments:** prevent anteroposterior displacement of the tibia

• **Medial and lateral collateral ligaments:** restrain rotation and lateral movement at the knee
Ligaments of the knee joint

• **Anterior cruciate ligament (ACL):**
  - arises from the anterior intercondylar area of the tibia
  - runs posteriorly and laterally
  - attaches to the back of the medial side of the lateral femoral condyle
Ligaments of the knee joint

• **Posterior cruciate ligament (PCL):**
  - arises from the *posterior intercondylar area* of the tibia
  - extends anteriorly and *medially*
  - attaches to the lateral side of the *medial femoral condyle*
Anterior cruciate injury

• The ACL limits forward movement of the tibia on the femur

• Often ruptured in sports by sharp twisting movement (very common injury)
Posterior cruciate injury

• PCL can be torn in 2 ways:
  
  ➢ A blow to the upper end of the tibia when the knee is flexed (e.g., head on collision while seated on a motor cycle)
  
  ➢ Hyperextension
Fig. 14.38  Mechanism of rupture of the posterior cruciate ligament by (a) hyperextension: (b) impact to the upper end of the tibia with the knee flexed.
Posterior cruciate injury

• Assessment: **posterior drawer sign** with the knee flexed to 90° and the tibia is passively pushed posteriorly on the femur
Ligaments of the knee joint

- **Medial (tibial) collateral ligament:** pass from the medial epicondyle of the femur to the medial surface of the proximal end of tibia

- Fused posteriorly with the capsule of the knee joint
Ligaments of the knee joint

- **Lateral (fibular) collateral ligament:** pass from the lateral epicondyle of the femur to the head of fibula

- Lateral to- and free of- the joint capsule
Medial collateral injury

- Usually associated with tear of the ACL
-Caused by valgus strain
Hockey puck

Patella (outline)

Tibial collateral ligament (torn)

Medial meniscus (torn)

Anterior cruciate ligament (torn)
Lateral collateral injury

• Rarely injured on its own, except in lacerations

• Not as important as the other ligaments

• If injured, there is a high incidence of injury to the common peroneal nerve