INTERNATIONAL SURGICAL ANATOMY TEACHING SERIES

ISATS HANDOUT 2023/24

Lower limb

High Yield I Surgical Relevance I CPD Accredited

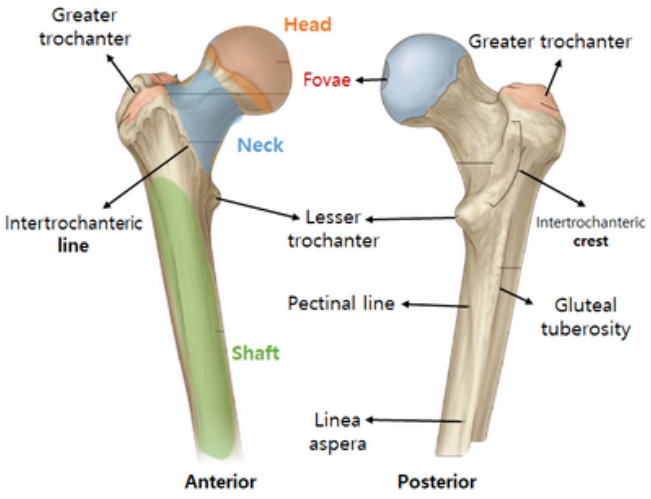
LOWER LIMB ANATOMY

***Objectives**: To understand the bony anatomy, ligaments, muscle compartments and neurovascular supply of the lower limb, hip joint, knee joint and ankle joint. Further to apply this anatomical knowledge in performing a hip arthroplasty*

Bony Anatomy

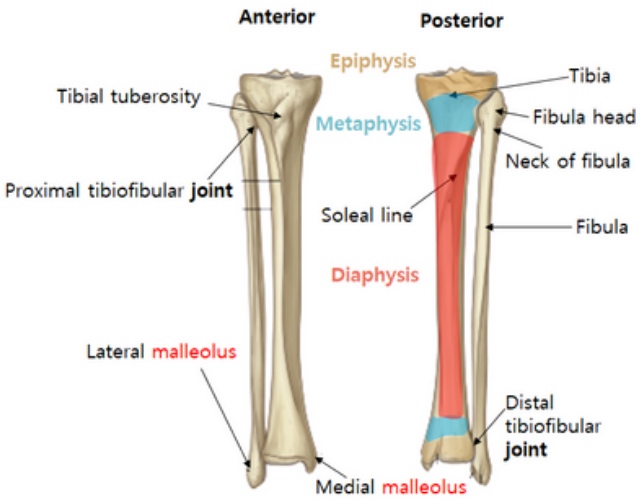
Femur

- Commonest femur fractures are neck of femur fractures:
  - **Intracapsular fracture** - Occurs superiomedial to intertrochanteric line
    - *Surgical emergency as failure to treat can lead to **avascular necrosis** of femoral head
  - **Extracapsular fracture** - occurs inferolateral to intertrochanteric line



Tibia & Fibula

- Tibia and fibula are both **long bones** located between the knee and ankle joint
- Tibial tuberosity - insertion point for muscles
- Proximal & Distal tibiofibular joints - synovial joint permitting limited gliding movement

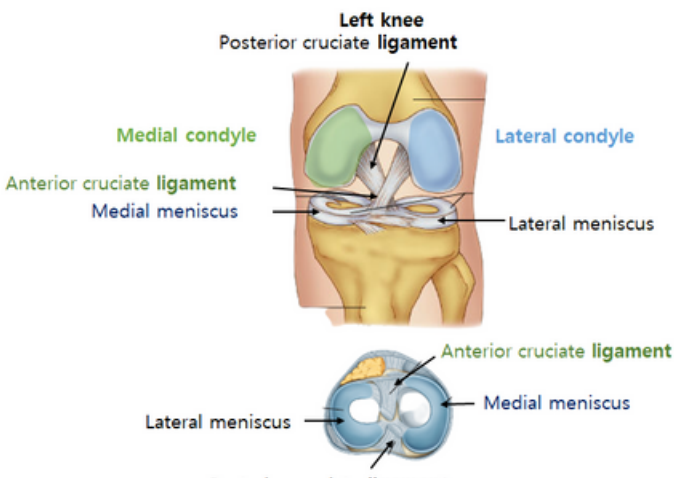


Foot

- The foot is composed of 26 bones of various types, i.e. long bones (metatarsal), short bones (talus).
- The talus has retrograde blood supply,
  * Surgical emergency if talus fracture occurs as can lead to **avascular necrosis**

Knee joint

- Knee joint is a **synovial hinge joint**
- Knee joint is stabilised by 4 ligaments, 2 menisci
- **Knee locking** occurs when femur rotates medially with respect to tibia - permits knee extension with minimal muscular effort
- **O'Donoghue's unhappy triad**
  - Lateral to medial traumatic force on the knee joint
  - Classically damages ACL, MCL, Medial meniscus
  - Treatment involves ACL ligament reconstruction and meniscectomy



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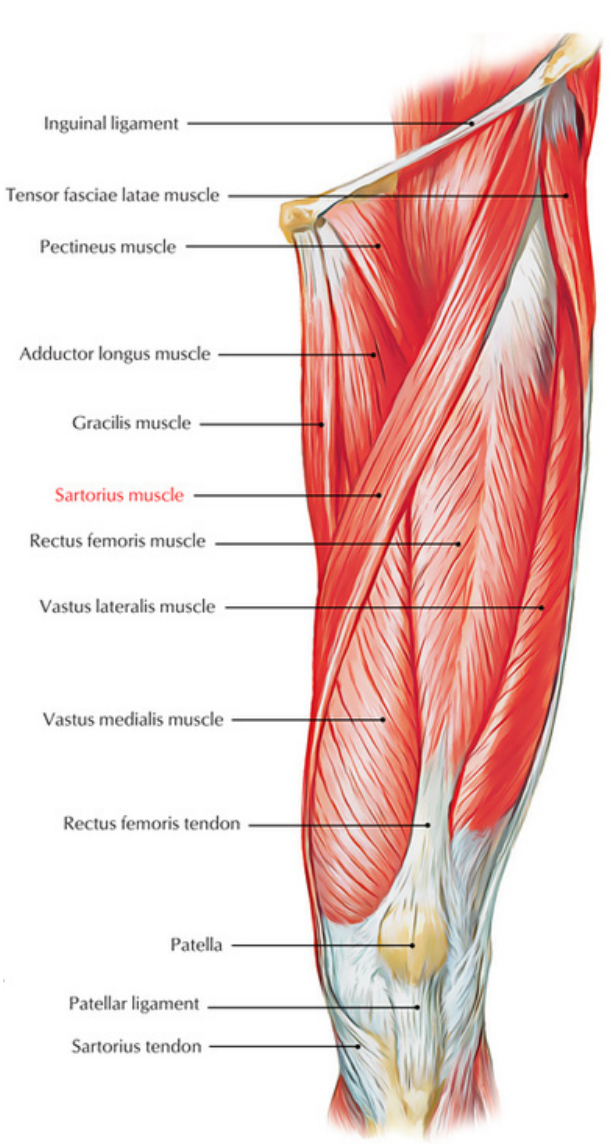
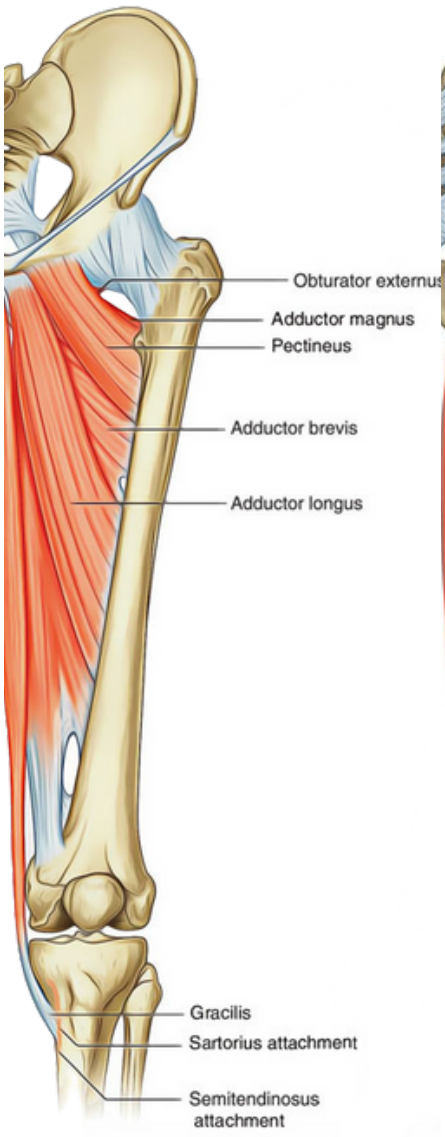
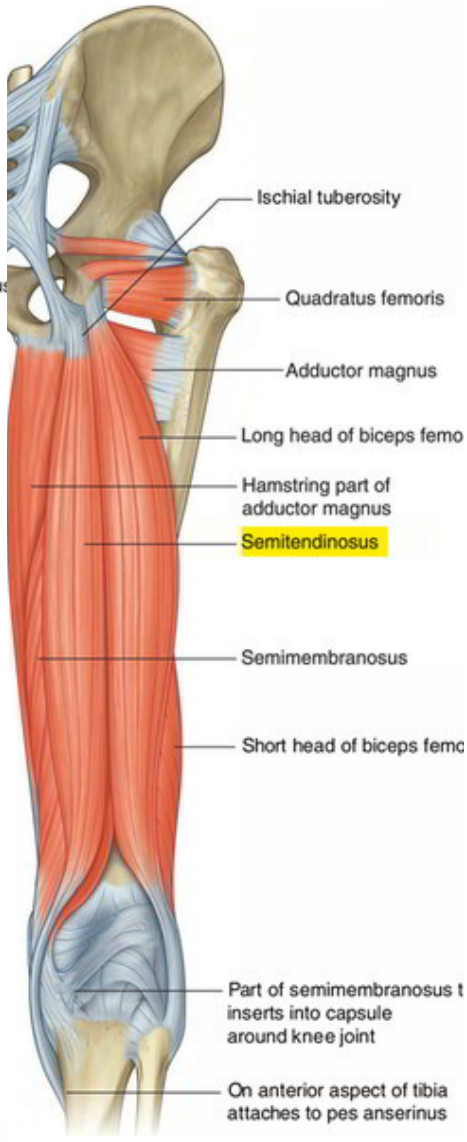
Muscular Anatomy

Thigh

Muscle Compartment	Function	Innervation
Anterior	Hip flexion, Knee extension	Femoral nerve
Medial	Adduction	Obturator nerve
Posterior	Hip extension, Knee flexion	Sciatic nerve







Anterior Thigh **Medial Thigh** **Posterior Thigh**

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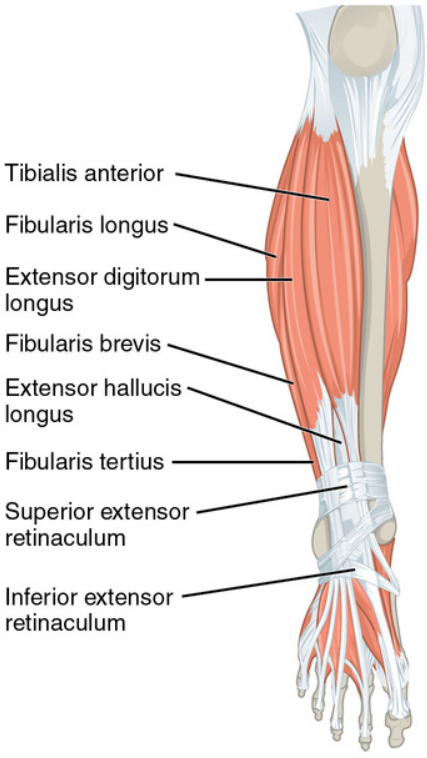
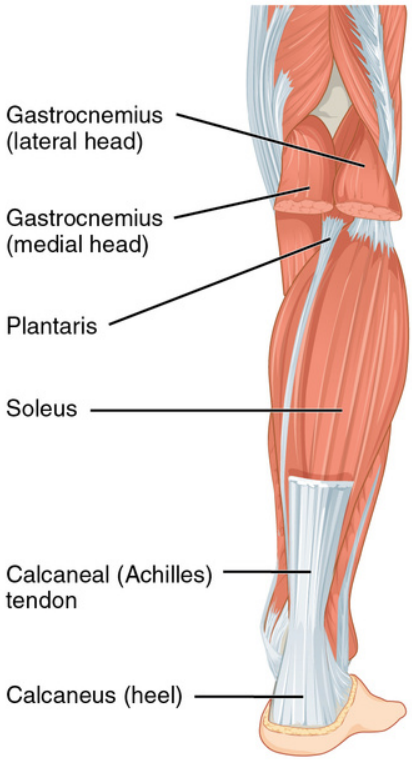
Muscular Anatomy

Leg

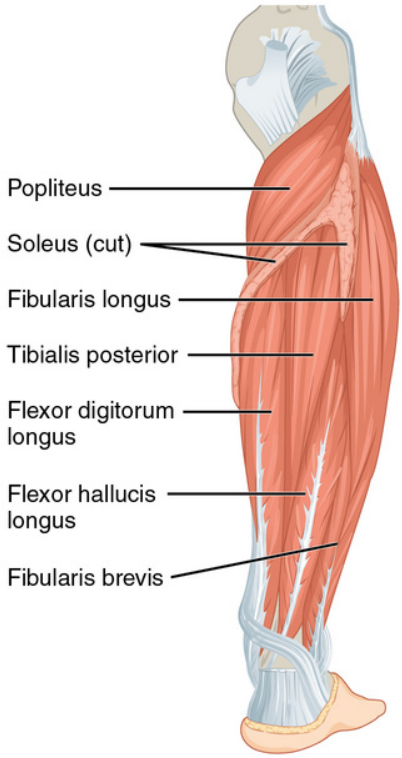
Muscle Compartment	Function	Innervation
Anterior	Dorsiflexion, Toe extension	Deep peroneal nerve
Lateral	Eversion	Superficial peroneal nerve
Posterior	Plantarflexion, Toe flexion	Tibial nerve



Superficial muscles of the right lower leg (anterior view)



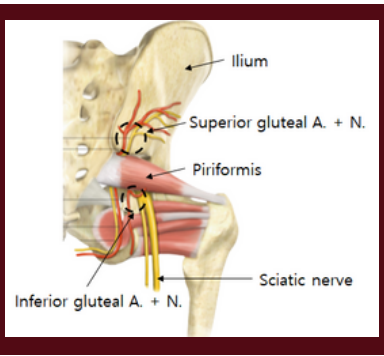
Superficial muscles of the right lower leg (posterior view)



Deep muscles of the right lower leg (posterior view)

Gluteal Region

- Superficial and Deep group
- Gluteus maximus receives inferior gluteal neurovascular supply
- All the rest superior gluteal supply
- Sciatic nerve sits inferior to piriformis



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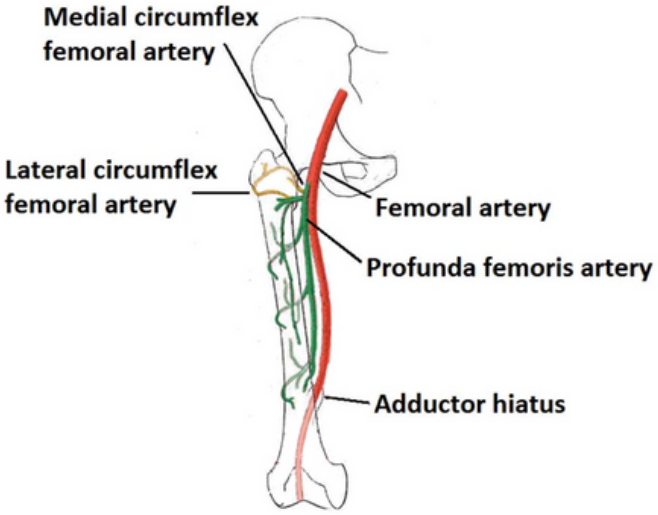
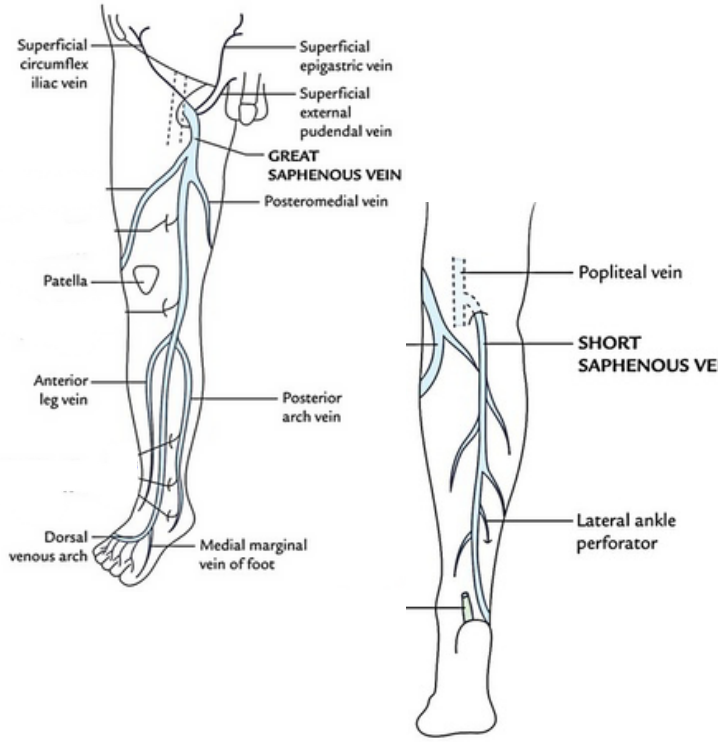
Arterial supply

- **Supply to thigh & femur:**
  - External iliac artery -> femoral artery (under inguinal ligament) -> Profunda femoris -> Medial + Lateral circumflex arteries
- **Supply to leg**
  - Femoral artery -> passes through adductor hiatus -> Popliteal artery -> Anterior tibial artery + Tibioperoneal trunk -> Peroneal artery + Posterior tibial artery -> Medial + Lateral plantar artery



Venous drainage

- Greater saphenous vein drains into femoral vein at **saphenofemoral junction.**
- **Lesser saphenous vein** drains into anterior and posterior tibial veins at popliteal fossa -> popliteal vein at **saphenopopliteal junction**-> femoral vein



NERVE SUPPLY TO THE LOWER LIMB – SUMMARY

THIGH

Nerve	Spinal Nerve	Supply
Femoral	L2 to L4	Anterior Compartment
Obturator	L2 to L4	Medial Compartment
Sciatic	L4 to S3	Posterior Compartment

LEG

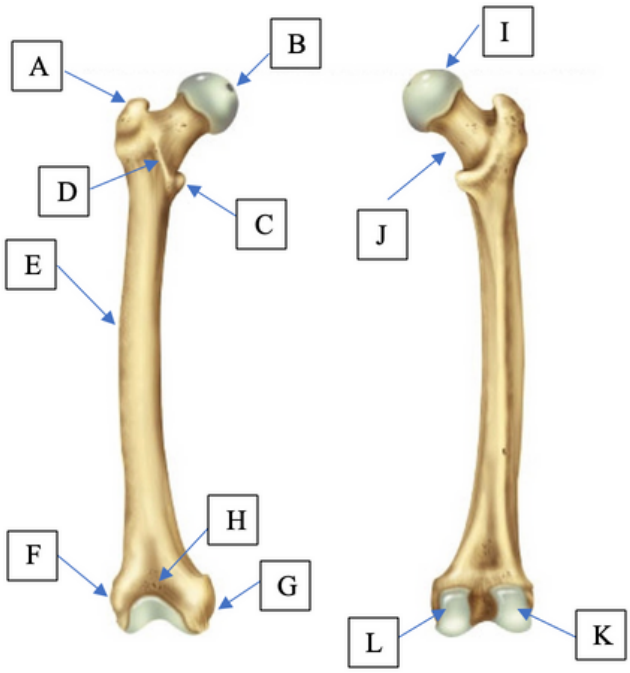
Nerve	Spinal Nerve	Supply
Tibial	L4 to S1	Posterior Compartment
Superficial Peroneal	Branches of Sciatic (L4 – S3)	Lateral Compartment
Deep Peroneal	Branches of Sciatic (L4 – S1)	Anterior Compartment

LOWER LIMB ANATOMY

Test yourself...

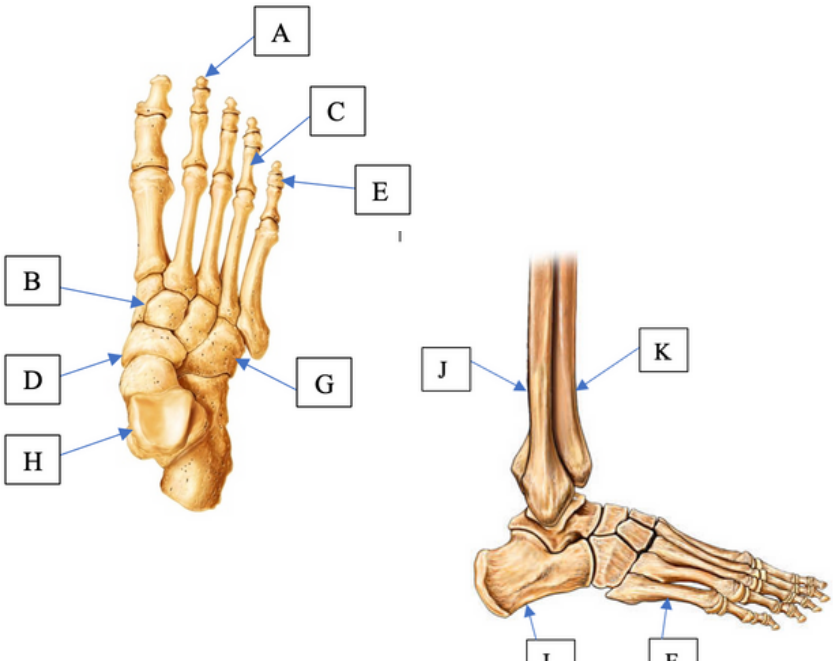
1) Label the structures...

- A .....
- B .....
- C .....
- D .....
- E .....
- F .....
- G .....
- H .....
- I .....
- J .....
- K .....
- L .....



2) Label:

- A .....
- B .....
- C .....
- D .....
- E .....
- F .....
- G .....
- H .....
- I .....
- J .....
- K .....



LOWER LIMB ANATOMY

Test yourself...

MCQ 1

1.Which artery branches off the popliteal artery to provide blood supply to the lateral aspect of the calf and foot?

A. Anterior tibial artery
B) Tibial artery
C) Peroneal artery
D) Posterior tibial artery

MCQ 2

1.The external iliac artery becomes the femoral artery as it crosses which anatomical landmark?

A) Ischial tuberosity
B) Pubic symphysis
C) Greater trochanter of the femur
D) Sacral promontory

MCQ 3

The common iliac artery bifurcates into which two major arteries, one of which supplies blood to the lower limb?

A) Brachial and femoral arteries
B) External and internal iliac arteries
C) Ulnar and radial arteries
D) Common and deep femoral arteries

MCQ 4

Which nerve is commonly referred to as the "knee-jerk reflex" nerve and is responsible for the patellar reflex?

A) Sciatic nerve
B) Femoral nerve
C) Common peroneal nerve
D) Saphenous nerve

MCQ 5

Damage to the common peroneal nerve may result in foot drop due to weakness in which muscle group?

A) Quadriceps
B) Gastrocnemius
C) Tibialis anterior
D) Hamstrings

MCQ 6

The muscle group known as the "hamstrings" consists of which three muscles?

A) Biceps femoris, semitendinosus, and rectus femoris
B) Vastus lateralis, vastus medialis, and semimembranosus
C) Semitendinosus, semimembranosus, and gastrocnemius
D) Rectus femoris, semitendinosus, and soleus

LOWER LIMB ANATOMY

Test yourself...

OSCE Station - Case Based Discussion

A 30-year-old construction worker presents to the emergency department with severe pain and deformity in his right lower leg. He reports that while working at the construction site, a heavy object fell onto his leg. He was unable to move the leg after the injury and noticed immediate swelling and bruising. He is afebrile, HR 90 bpm, BP 130/80 and RR of 19.

One inspection, the right lower leg appears swollen but no open wound was appreciated. On palpation, pain was elicited along the right shin and the surrounding area.

Q1. What further investigations would you like to perform?

Q2. What is the most likely diagnosis?

Q3. How would you classify this fracture?

Q4. What is the immediate management for this patient?

Q5. What are the factors affecting the treatment plan for this patient?

Q6. What are the potential complications for this patient?

Answers

A - Greater trochanter, B - Fovea capitis , C - Lesser trochanter , D - Intertrochanteric line, E - Shaft of femur, F - Lateral epicondyle, G - Medial epicondyle, H - Patellar surface, I - Head of femur , J - Neck of femur, K - Lateral epicondyle, L - Medial epicondyle

A - Distal phalanx, B - Medial cuneiform , C - Proximal phalanx , D - Navicular , E - Middle phalanx , F - Metatarsal, G - Cuboid , H - Body of Talus , I - Calcaneus , J - Fibula, K - Tibia

MCQs
C, B, B, B, C, C

OSCE
1. Complete history and examination, Bloods (baseline), Group and Save, AP & Lateral Knee X-Rays
2. Closed fracture of the tibia
3. Non-displaced, Transverse, Closed fracture of the tibia
4. ARs - Resuscitate, Reduction (if displaced), Restriction (using a cast / splint), Rehabilitate + Pain management using WHO analgesic ladder
5. Treatment could be conservative (cast) or internal fixation (surgery). It depends on the fracture type & location, Alignment, Patient's age & Co-morbidities, Surgeon's expertise.
6. Compartment syndrome, Non-union, Mal-union, Infection