# LOWER LIMB OVERVIEW

- **PALPATIONS OF LOWER LIMB**:
    - The part of the head of the femur that is not intra-acetabular can be palpated on the anterior aspect of the thigh just inferior to the inguinal ligament and just lateral to pulsating femoral artery
    - Patella is situated in an exposed position in front of the knee joint and is easily palpable through the skin
    - Calcaneum is the largest bone of the foot and form the prominence of the heel
    - The constant position of the great saphenous vein in front of the medial malleolus should be remembered for patients requiring emergency blood transfusion
    - The femoral pulse is palpated midway between the anterosuperior iliac spine and the symphysis pubis.
      The femoral vein lies immediately medial to femoral artery
    - The peripheral pulse is checked on the dorsum of the foot between the tendons of extensor hallucis longus and extensor digitorum longus

- The neck of the femur, which connects the head to the shaft, passes downward, backward, and laterally and makes an angle of about 125° in adults and 160° in young child, with the long axis of the shaft. Diseases such as coxa valga and vara can alter the size of this angle

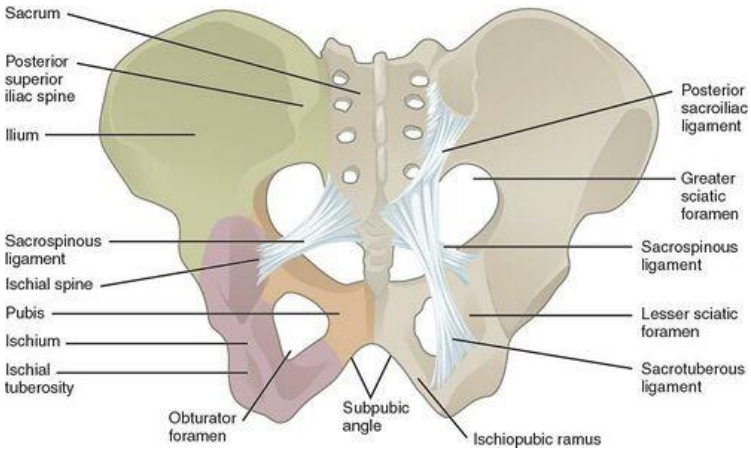
- The cavity of acetabulum is deepened by the presence of a fibrocartilagenous ring called **acetabular labrum.**

- Patella, the largest sesamoid bone, develops within the tendon of quadriceps femoris muscle in front of the knee joint

- Tarsal bones:
    - Calcaneum
    - Talus
    - Navicular
    - Cuboid
    - Three cuneiform bones

  Only talus articulates with tibia and fibula at ankle joint

- The **sacrotuberous ligament** connects the back of the sacrum to the ischial tuberosity
  The **sacrospinous ligament** connects the back of the sacrum to the spine of ischium




- Structures passing through greater sciatic foramen:
    - Piriformis muscle
    - Sciatic nerve
    - Posterior cutaneous nerve of thigh
    - Superior and inferior gluteal nerves
    - Nerves to obturator internus and quadratus femoris
    - Pudendal nerve
    - Internal pudendal artery and vein

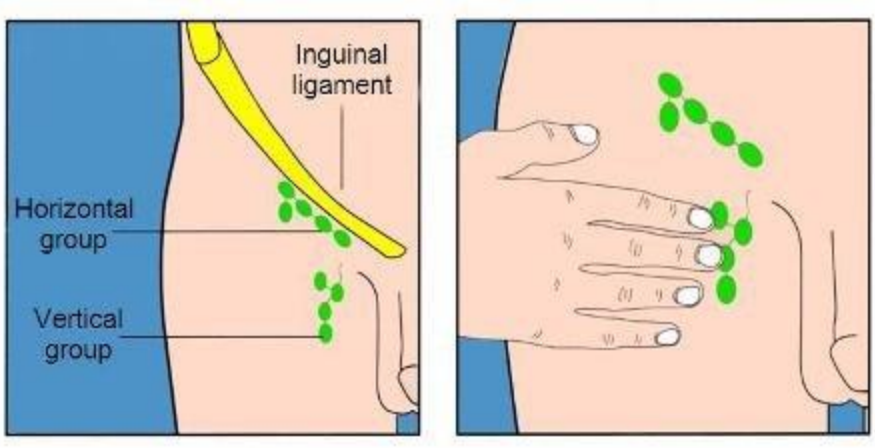
- Structures passing through lesser sciatic foramen:
    - Tendon of obturator internus muscle
    - Nerve to obturator internus
    - Pudendal nerve
    - Internal pudendal artery and vein

- Remember:
    - The gluteus maximus is the largest muscle in the body
    - Sciatic nerve is the largest nerve in the body
    - Iliofemoral ligament is the strongest ligament of hip joint
    - Sartorius is unique in that it can serve as both hip and knee flexor
    - No muscles attach to talus bone
    - Iliopsoas muscle is the prime hip flexor
    - Popliteus is often referred to as “key” to unlocking the knee since it begins knee flexion by laterally rotating the femur on tibia
    - Rectus femoris muscle cross both the hip and knee joint
    - Sartorius is named as tailor’s muscle
    - The primary invertors of foot include tibialis anterior and tibialis posterior
    - The primary evertors of foot include fibularis longus, fibularis brevis, and fibularis tertius

- **Structures passing through saphenous opening:**

- Great saphenous vein
- Some small branches of femoral artery
- Lymph vessels

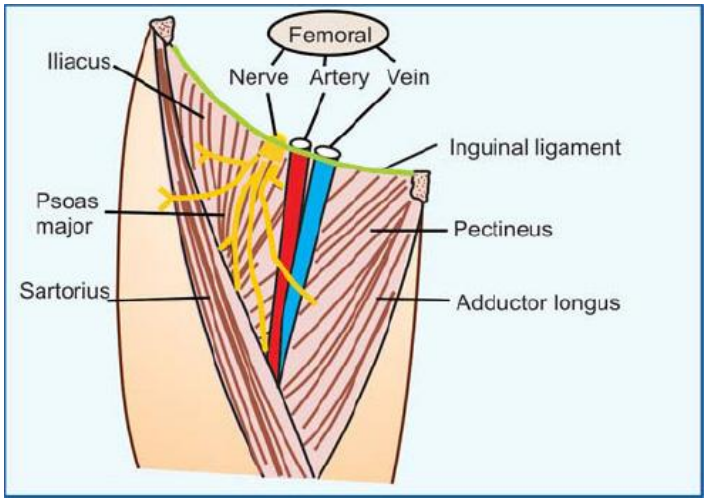
- The **superficial lymph nodes** lie in the superficial fascia between the inguinal ligament and can be divided into horizontal and vertical group.
  The efferent lymph vessels from the superficial inguinal nodes pass through the saphenous opening in the deep fascia and join the deep inguinal nodes.
  The **deep nodes** are located beneath the deep fascia and along the medial side of femoral vein.




- The vastus medialis is the first part of the quadriceps muscle to atrophy in knee joint disease and the last to recover

- **BOUNDARIES OF FEMORAL TRIANGLE**
  Superiorly: Inguinal ligament
  Laterally: Sartorius
  Medially: Adductor longus muscle
  Floor: Gutter shaped and formed from lateral to medial by iliopsoas, pectineus, adductor longus
  Roof: Skin and fascia of thigh

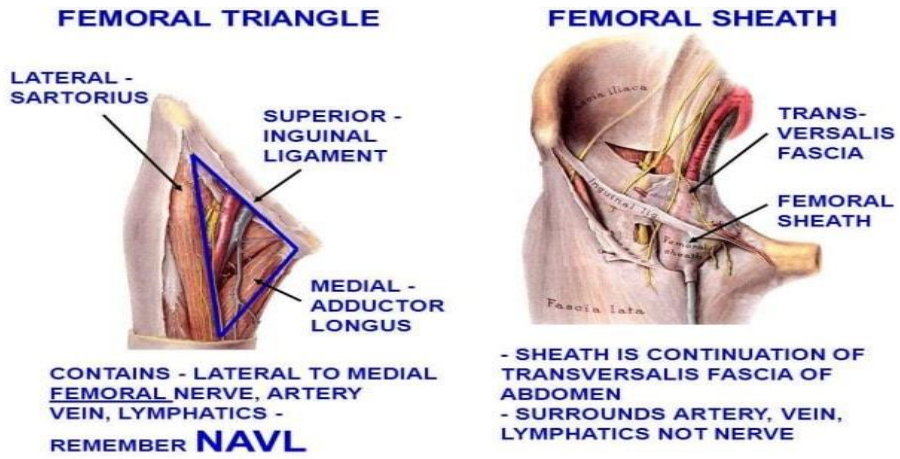
- **CONTENTS OF FEMORAL TRIANGLE**
  Learn mnemonic: NAVEL (from lateral to medial)
  - Femoral nerve and its terminal branches
  - Femoral sheath
  - Femoral artery and its branches
  - Femoral vein and its tributaries
  - Deep inguinal lymph nodes




- **WALLS OF ADDUCTOR CANAL**
  Anteromedial – Sartorius muscle and fascia
  Posterior – Adductor longus and magnus
  Lateral – Vastus medialis

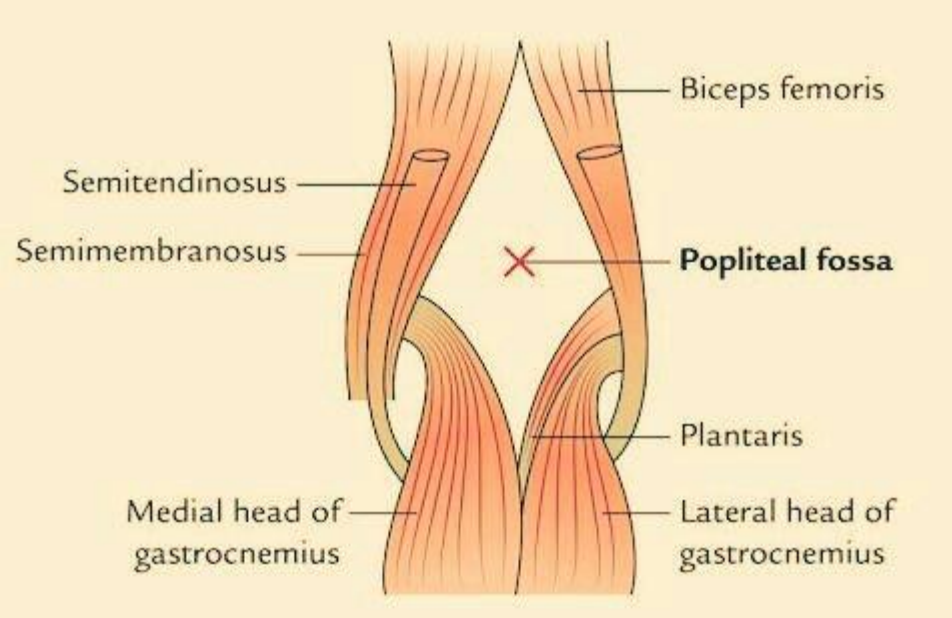
- **CONTENTS OF ADDUCTOR CANAL**
  - Terminal parts of femoral artery
  - Femoral vein
  - Deep lymph vessels
  - Saphenous nerve, nerve to vastus medialis and the terminal part of obturator nerve

- **CONTENTS OF FEMORAL SHEATH**
  From lateral to medial
  - Femoral artery
  - Femoral vein
  - Lymph vessels (in femoral canal)

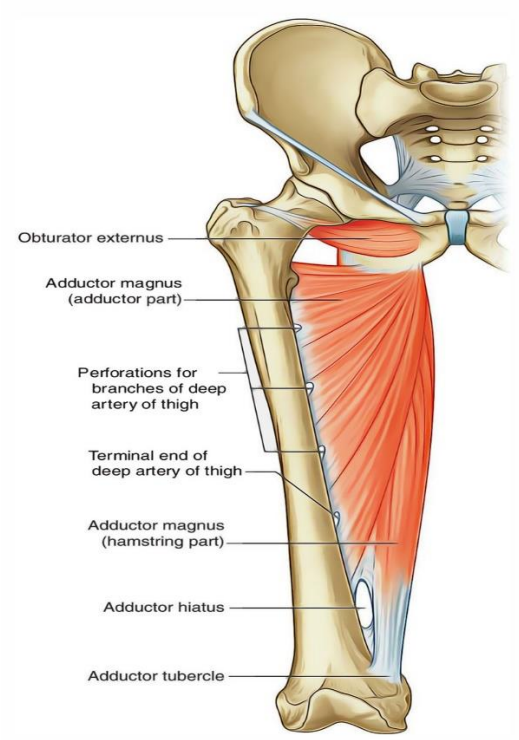



- **FEMORAL CANAL BOUNDARIES**
  - Anteriorly – Inguinal ligament
  - Posteriorly – Superior ramus of pubis
  - Medially – Lacunar ligament
  - Laterally – Femoral vein

- **BOUNDARIES OF POPLITEAL FOSSA**
  - Laterally – Biceps femoris above , lateral head of gastrocnemius and plantaris below
  - Medially – Semimembranosus and semitendinosus above , medial head of gastrocnemius below
  - Anterior wall (Floor) – Popliteal surface of femur, capsule of knee joint, popliteus muscle
  - Roof – Skin, superficial fascia and deep fascia of thigh



- The adductor hiatus transmits femoral artery and vein from the adductor canal in the thigh to the popliteal fossa




- The rectus femoris can rupture in sudden violent extension movements of knee joint

- About six lymph nodes are embedded in the fatty connective tissue of popliteal fossa. They receive:
    - Superficial lymph vessels from lateral side of foot and leg
    - Lymph from knee joint
    - Lymph from deep lymph vessels accompanying anterior and posterior tibial arteries

- Structures that pass immediately anterior to medial malleolus:
    - Great saphenous vein
    - Saphenous nerve

- Two muscle produce inversion of foot:
    1. Tibialis anterior
    2. Tibialis posterior

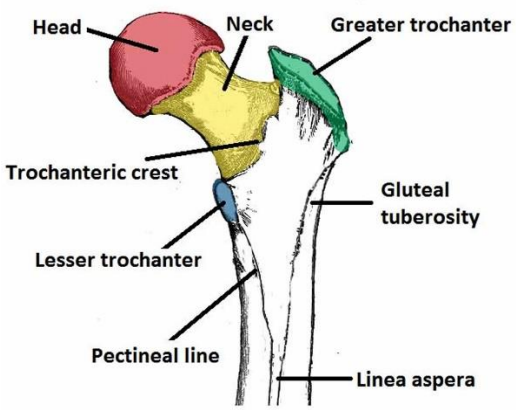
- Gastrocnemius is essential to lift the heel off the ground during walking
- In upright posture, **the soleus** is responsible for pumping venous blood back into the heart from the periphery, and is often called the peripheral heart.

- Foot Dorsiflexion and eversion – Common peroneal nerve
  Foot plantar flexion and inversion – Tibial nerve
  Foot eversion – Superficial peroneal nerve
  Foot dorsiflexion, toe extension – Deep peroneal nerve

- The femoral sheath is a continuation of transversalis and iliopsoas fascia

- Greater trochanter is the attachment site for five muscles:
  - Gluteus medius
  - Gluteus minimus
  - Piriformis
  - Obturator externus
  - Obturator internus

- Lesser trochanter receives insertion of psoas major and iliacus muscle

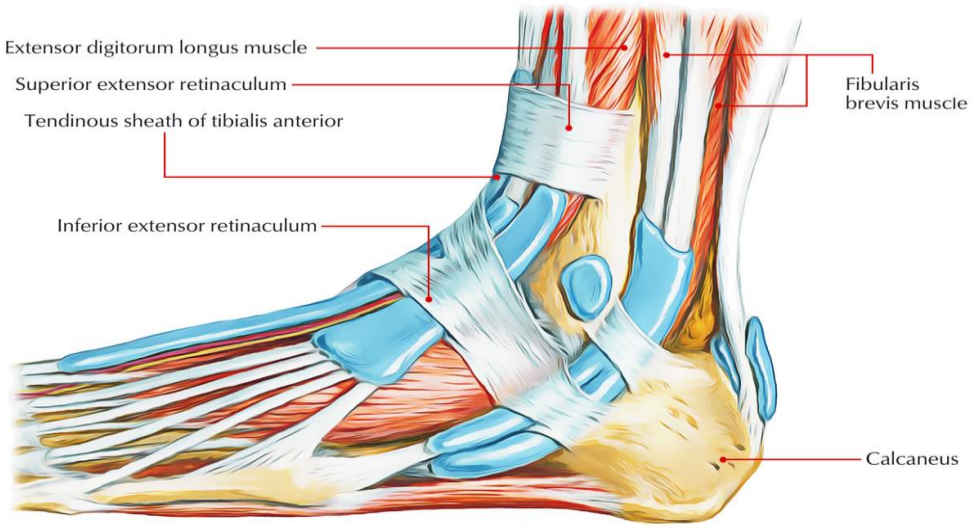



- Muscles attached to first metatarsal bone:
  - Tibialis anterior
  - Fibularis (peroneal) longus
  - First dorsal interosseus
- Heterotopic ossification in the tendon of adductor longus muscle occur chiefly in those who frequently ride horses

- Structures passing superficial to extensor retinaculum
  (From medial to lateral)
  - Saphenous nerve and great saphenous vein
  - Superficial fibular (peroneal) nerve

- Structures passing deep to extensor retinaculum
  (From medial to lateral)
  - Tibialis anterior tendon

- Extensor hallucis longus tendon
- Anterior tibial artery with venae comitantes
- Deep fibular nerve
- Extensor digitorum longus tendon
- Fibularis tertius




- Muscles with dual nerve supply:
  - Pectineus
  - Adductor magnus
  - Biceps femoris

- Cribriform fascia covers saphenous opening

- Position commonly seen in posterior dislocation of hip is internal rotation, flexion and adduction

- Rupture of ligamentum teres may lead to damage of obturator artery

- **<u>NERVES OF LOWER LIMB</u>**
  **LUMBAR PLEXUS (L1 – L4)**
  Mnemonic : I, I Get Leftovers On Friday
  - Iliohypogastric nerve ($L_1$)
  - Ilioinguinal nerve ($L_1$)
  - Genitofemoral nerve ($L_1$, $L_2$)
  - Lateral cutaneous nerve of thigh ($L_2$, $L_3$)
  - Obturator nerve ($L_2$, $L_3$, $L_4$)
  - Femoral nerve ($L_2$, $L_3$, $L_4$)

**LUMBO-SACRAL PLEXUS ($S_1$, $S_2$, $S_3$, $S_4$, $L_4$, $L_5$)**

- Superior Gluteal nerve ($L_4$, $L_5$, $S_1$)
- Inferior Gluteal nerve ($L_4$, $L_5$, $S_1$)
- Sciatic nerve ($L_4$, $L_5$, $S_1$, $S_2$, $S_3$)
- Posterior cutaneous nerve of thigh ($S_1$, $S_2$, $S_3$)
- Pudendal nerve ($S_2$, $S_3$, $S_4$)
- Nerve to piriformis
- Nerve to obturator internus
- Nerve to quadratus femoris

**BRANCHES OF SCIATIC NERVE**

- Tibial nerve
- Common fibular nerve

**BRANCHES OF TIBIAL NERVE IN SOLE OF FOOT**

- Medial calcaneal branches
- Medial plantar nerve
- Lateral plantar nerve

**Around the neck of fibula, common fibular nerve terminates into**

- Superficial fibular nerve
- Deep fibular nerve

- Posterior cutaneous nerve of thigh supplies skin in the popliteal fossa

- Branches of posterior cutaneous nerve of thigh
  - Gluteal branches to the skin over the lower medial quadrant of the buttock
  - Perineal branch to the skin of the back of the scrotum or labium majus
  - Cutaneous branch to back of thigh and upper part of leg

- Lateral cutaneous nerve of thigh supplies
  - Skin of lateral aspect of leg
  - Skin of lower lateral quadrant of buttock

- Superior gluteal nerve supplies gluteus medius, gluteus minimus and tensor fascia lata
- Inferior gluteal nerve supplies gluteus maximus

- Femoral nerve is the largest branch of lumbar plexus
- Sciatic nerve is the largest nerve in the body

- The sciatic nerve ends in lower third of the thigh by dividing into tibial and common fibular (peroneal) nerves
- Sciatic nerve can be injured due to injections in upper medial quadrant of buttocks

- Injury to common fibular nerve causes foot drop. Or
  Lesion of deep peroneal nerve causes foot drop

- NERVE SUPPLY:
  - Anterior compartment of thigh – Femoral nerve
  - Medial compartment of thigh – Obturator nerve
  - Posterior compartment of thigh – Sciatic nerve
  - Anterior compartment of leg – Deep fibular nerve
  - Lateral compartment of leg – Superficial fibular nerve
  - Posterior compartment of leg – Tibial nerve

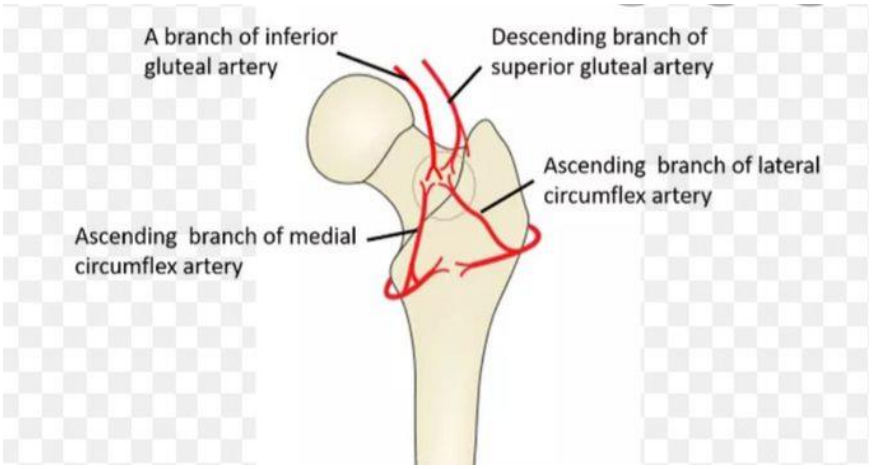
- The **great saphenous vein** usually receives three tributaries at the saphenous opening in the deep fascia:
  1. Superficial circumflex iliac vein
  2. Superficial epigastric vein
  3. Superficial external pudendal vein

- The veins of lower limb are organized into three groups i.e. superficial, deep and perforating veins.
  The superficial veins consist of great and small saphenous veins and their tributaries, which are situated beneath the skin in superficial fascia
  The deep veins are the venae comitantes to the anterior and posterior tibial arteries, the popliteal vein and the femoral veins and their tributaries.
  The perforating veins are commonly vessels that run between the superficial and deep veins.

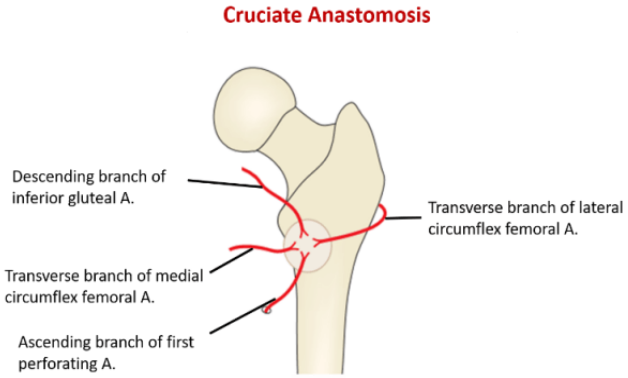
- **BLOOD SUPPLY TO LOWER LIMB**
  - Anterior compartment of thigh – Femoral artery
  - Medial compartment of thigh – Profunda femoris artery and obturator artery
  - Posterior compartment of thigh – branches of profunda femoris artery
  - Anterior compartment of leg – Anterior tibial artery
  - Lateral compartment of leg – Branches from fibular artery
  - Posterior compartment of leg – Posterior tibial artery

- Arteries involved in trochanteric anastomoses:
  - Superior gluteal artery
  - Inferior gluteal artery
  - Medial femoral circumflex artery

- Lateral femoral circumflex artery

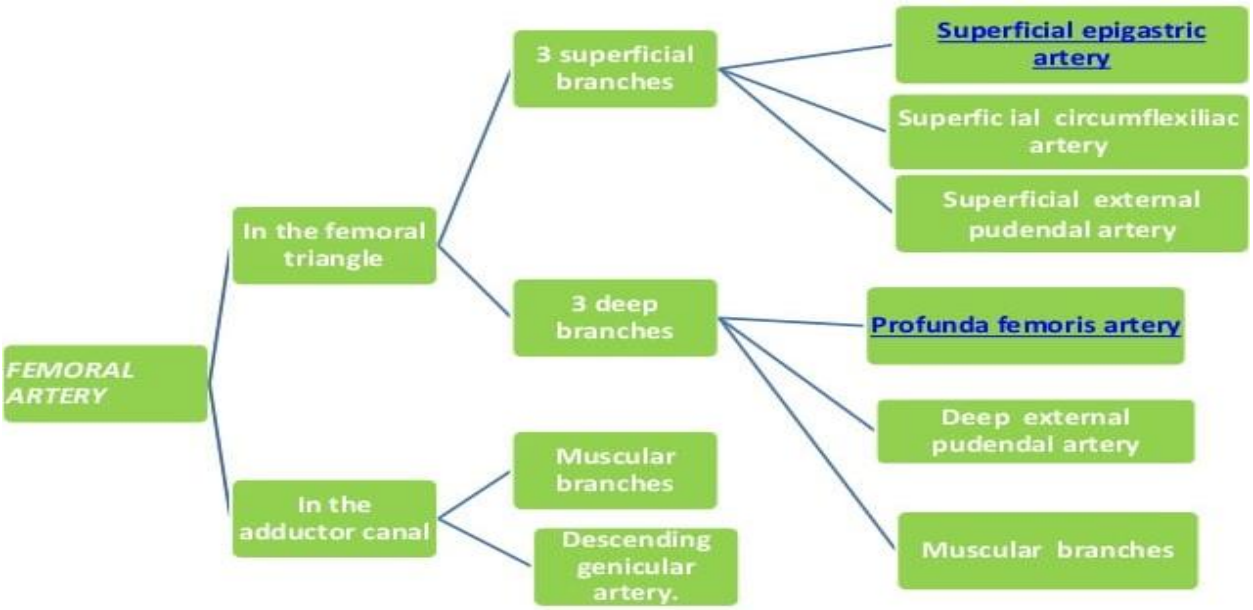



- Arteries involved in cruciate anastomoses
  - Inferior Gluteal artery
  - Medial femoral circumflex artery
  - Lateral femoral circumflex artery
  - First perforating artery, a branch of profunda artery




- The femoral artery is the continuation of external iliac artery.
  The femoral vein drains into external iliac vein

- Branches of Femoral artery:
  - Superficial circumflex iliac artery
  - Superficial epigastric artery
  - Superficial external pudendal artery
  - Deep external pudendal artery
  - Profunda femoris artery
  - Descending genicular artery




- Obturator artery is a branch of internal iliac artery

- The popliteal artery ends at the level of lower border of popliteus muscle by dividing into anterior and posterior tibial arteries

- L4 – L5 lesion will lead to weakness of dorsiflexion and difficulty in heel walking
  L5 – S1 lesion will lead to weakness of plantar flexion, difficulty in toe walking and decreased Achilles reflex
  L3 – L4 lesion will result in weakness of knee extension and decreased patellar reflex

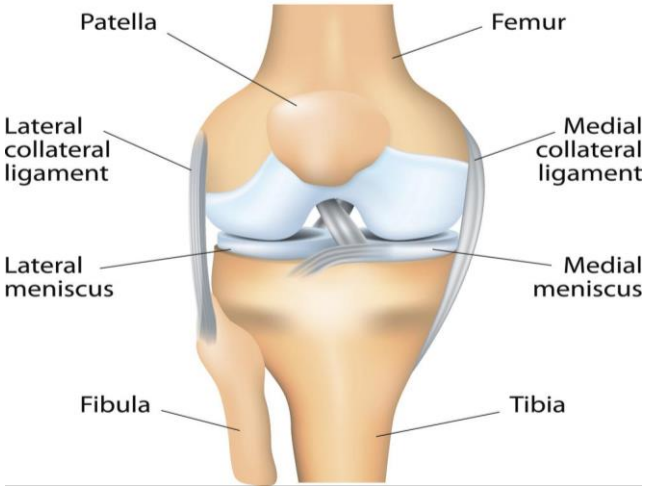
- Gluteus medius is a stabilizer of the pelvis. When the left leg is lifted off the ground, the right side of the pelvis will drop due to loss of support and increased weight-bearing. The Gluteus medius muscle prevents this muscle drop of the opposite side of pelvis.

- **Joint Types**

| | |
|---|---|
| Hip Joint | Synovial ball-and-socket joint |
| Knee Joint | Synovial Hinge Joint |
| Proximal Tibiofibular Joint | Synovial plane, gliding joint |
| Distal Tibiofibular Joint | Fibrous joint |
| Ankle Joint | Synovial Hinge Joint |
| Subtalar Joint<br>(between talus and calcaneum) | Synovial Plane Joint |
| Calcaneocuboid Joint | Synovial Plane Joint |
| Cuneonavicular Joint | Gliding Joint |
| Cuboidonavicular Joint | Fibrous Joint |

| | |
|---|---|
| Tarsometatarsal Joint | Synovial Plane Joint |
| Intermetatarsal Joints | Synovial Plane Joint |

- **Ligaments of Hip Joint**:
  1. Iliofemoral ligaments – prevents overextension during standing
  2. Pubofemoral ligament – limits extension and abduction
  3. Ischiofemoral ligament – limits extension
  4. Transverse acetabular ligament
  5. Ligament of head of femur – lies within the joint
- The **knee joint** is the largest and most complicated joint in the body. It consist of two main parts:
  1. Paired condylar joints between the rounded medial and lateral condyles of the femur above and the corresponding condyles of the tibia and their cartilaginous menisci below
  2. Gliding joint between patella and the patellar surface of femur




- **LIGAMENTS OF KNEE JOINT**

  **<u>Extracapsular ligaments</u>**
    - Ligamentum patellae
    - Lateral collateral ligament
    - Medial collateral ligament
    - Oblique popliteal ligament – strengthens the posterior aspect of the capsule

  **<u>Intracapsular ligaments</u>**

    - Anterior cruciate ligament (ACL)
      - Prevents posterior displacement of the femur on tibia
      - With the knee joint flexed, the ACL prevents tibia from being pulled anteriorly relative to the femur
    - Posterior cruciate ligament (PCL)
      - Prevents anterior displacement of femur on tibia

- With the knee joint flexed,  the PCL prevents tibia from being pulled posteriorly relative to the femur