



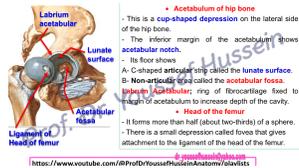
**Hip**  
 Type: Synovial - Polyaxial (Ball and socket)

**Knee**  
 Synovial - modified hinge

**Ankle**  
 Synovial - Variety Hinge

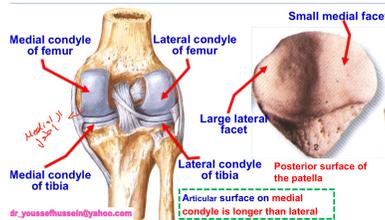
Articular surface

**2- Articular surfaces:**  
 a- Head of the femur.  
 b- Lunate surface of the acetabulum of hip bone.



- Articular surfaces**
- 1- Lower surfaces of both femoral condyles
- 2- Superior surfaces of both tibial condyles (Plateau) *المنطقة المسطحة*
- 3- Posterior surface of the patella.

**Complex:**  
 a- Femoropatellar articulation  
 b- Femorotibial articulation



- A- Superior articular surface:**
  - 1) Lower end of the tibia.
  - 2) Lateral surface of the medial malleolus.
  - 3) Medial surface of the lateral malleolus.
- B- Inferior articular surface; talus.**



- Capsule surrounds the articular surfaces.  
 - Synovial membrane lines the capsule.  
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*Lab*

Capsule

- 1- Hip bone: to the margin of the acetabulum **outside** the labrum acetabular.
  - 2- Femur:
    - a- Anteriorly, to the intertrochanteric line.
    - b- Posteriorly to the neck of the femur **one cm medial** to intertrochanteric crest.
- Accordingly, the neck is partly intracapsular and partly extracapsular.
  - The fibers of the capsule are arranged **longitudinally parallel** to the neck of the femur.
  - Some of the deep fibers of the capsule are arranged **circularly** around the neck forming the **zona orbicularis**.
  - Many of the fibers of the capsule are reflected medially to cover the intracapsular part of the neck called the **retinaculum** of the neck. They keep the bony fragments together in cases of fractures of the neck of the femur.

- ❖ **Capsule of knee joint** is relatively thin
- 1- **Attachment to the femur:** to articular margin of the medial condyle.
  - Laterally, articular margin to lateral condyle outside origin of **popliteus** muscle (popliteus is intracapsular extrasynovial)
- 2- **Attachment to the tibia:** to articular margins of both condyles.
- 3- **Anteriorly,** margins of patella.
- N.B;** the capsule may be absent anteriorly and replaced by quadriceps tendon and ligamentum patellae.

Synovial

covers all non-articular surfaces inside the capsule

- It lines the capsule and nonarticular structures
- 1) **Anteriorly,** extends upward above the patella forming **suprapatellar bursa**.
- 2) **Below the patella,** it forms **infrapatellar fold**.
- 3) **Laterally,** it forms a synovial sheath **around tendon of popliteus**.

Bursa

- ❖ **Bursa On the medial aspect of knee joint**
- 1- A bursa between medial head of gastrocnemius and capsule.
- 2- A bursa between tibial collateral ligament and tendons of (S.G.S).
- 3- A bursa between Semimembranosus and medial condyle of the tibia.

❖ **Bursa On the anterior aspect;**

- 1- **Suprapatellar bursa:** between lower part of anterior surface of femur and quadriceps tendon, continues with synovial membrane.
  - 2- **Subcutaneous prepatellar bursa:** between skin and lower part of the patella.
- Inflammation and enlargement of this bursa usually affects persons who kneel over the knees during work. This condition is known as "house maid's knee"
- 3- **Subcutaneous infrapatellar bursa:** between skin and lower part of tibial tuberosity.
  - 4- **Deep infrapatellar bursa:** between upper end of tibia and ligamentum patellae.



LIGAMENT

**Iliofemoral ligament:**

- It is the **strongest** ligament of the body.
- \*\* Site: anterior to the capsule.
- \*\* Shape: Y-shaped.
- \*\* Attachment:
- 1- Apex attached to the lower part of **anterior inferior iliac spine**.
- 2- Two bands are attached to the **intertrochanteric line**.
- \*\* Functions: Prevents hyperextension of the hip joint.

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**Pubofemoral ligament:**

- \*\* Site: medial to capsule.
- \*\* Shape: triangular
- \*\* Attachment:
- 1- Hip, **iliopectineal eminence and superior pubic ramus**.
- 2- **Femur, intertrochanteric line**.
- \*\* Function: Prevents over abduction of the hip joint.

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**Ischiofemoral ligament:**

- \*\* Site: on the back of the capsule.
- \*\* Shape: spiral ligament
- \*\* Attachment:
- 1- **Hip, the body of the ischium.**
- 2- **Femur, to the greater trochanter.**

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**Transverse acetabular ligament:**

- Attachments: margins of acetabular notch.
- It converts the notch into foramen for passage of nerve & vessel to the joint.
- **Ligament of head of the femur:** (ligamentum teres)
- Shape: It is a triangular ligament and covered by a synovial membrane.
- \*\* Attachment:
- **Apex:** to fovea of head of the femur.
- **Base:** to transverse acetabular ligament.
- \*\* Functions: carries blood supply to head of the femur.

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**Ligamentum patellae (anterior):**

- It is a strong ligament.
- It extends from the **apex** of the patella to the upper part of the **tibial tuberosity**.
- The deep surface is separated from the upper end of tibia by the **deep infrapatellar bursa**.

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**Medial collateral (tibial) ligament:** extends from medial epicondyle of femur to medial condyle and upper part of medial surface of tibia.

- It is **adherent** to the capsule and medial meniscus.
- ↳ **Lateral collateral (fibular) ligament:** extends from lateral epicondyle of femur to head of the fibula (*styloid process*).
- It is separated from the capsule and lateral meniscus by popliteus.

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**Posterior oblique ligament:**

- It is a reflection from the semimembranosus tendon extends upwards and laterally to the lateral condyle of the femur.
- **Arcuate popliteal ligament:** Arches over Popliteus tendon.

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**Cruciate ligaments:**

- They are so called because they form an **X-shaped figure**.
- They are named anterior and posterior according to their attachment to the tibia.
- a- Anterior cruciate ligament:**
  - Attachment to the tibia: to the anterior intercondylar area.
  - Course: It extends upwards, backwards and laterally.
  - Attachment to the femur: to posterior part of the medial surface of the lateral condyle.
  - Function: 1- Prevents posterior displacement of femur on tibia. 2- Prevents hyperextension of the knee.
  - Lax in flexion while tense in full extension
- b- Posterior cruciate ligament (larger and stronger than the anterior):**
  - Attachment to the tibia: to the posterior intercondylar area.
  - Course: It extends upwards, forwards and medially.
  - Attachment to the femur: to the anterior part of the lateral surface of the medial condyle.
  - Functions: It prevents anterior displacement of femur on tibia.

not ligament

**Menisci (Semilunar cartilages, C-shaped):**

- They cover the articular surfaces of both tibial condyles.
- Their peripheral borders are thick, but they gradually become thinner towards their inner borders.
- It is not covered by synovial membrane.
- They are attached to the intercondylar area by anterior and posterior horns.
- **Medial meniscus is larger than lateral meniscus, SO** The lateral horns inside the medial horns.

**Transverse ligament:** It connects the **anterior** horns of both menisci

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**Lateral meniscus, more mobile** because the outer border is separated from the capsule and fibular collateral ligament by the tendon of popliteus. So, it is less frequently to injury.

- Injury of menisci and cruciate ligaments are common especially in football players.
- It is caused by sudden rotatory movements of the partially flexed knee with the foot fixed on the ground.

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**Deltoid (medial) ligament:** Triangular in shape and a very strong ligament.

- Excessive eversion leading to sprain of the ligament and tear off the medial deltoid ligament.

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**Lateral ligament:** It is formed of three bands attached to the lateral malleolus of fibula.

- Excessive inversion leading to sprain of the ligament and tear off the lateral ligament.

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# MOVEMENTS

❖ **Movements of the hip joint**

- **Flexion:** mainly by psoas major and iliacus.
  - helped by sartorius, rectus femoris and pectineus.
- **Extension:** mainly by gluteus maximus.
  - helped by the hamstrings.
- **Flexion and extension occur around a transverse axis.**

- **Adduction:** mainly by adductor longus, brevis and magnus.
  - helped by pectineus and gracilis.
- **Abduction:** mainly by glutei medius and minimus.
  - helped by tensor fasciae latae and sartorius.
- **Abduction and adduction occurs around anteroposterior axis**

❖ **Movements of the hip joint**

- **Medial rotation:** mainly by of the glutei medius and minimus.
  - helped by tensor fasciae latae.
- **Lateral rotation:** by
  - 1) Piriformis.
  - 2) Obturator internus.
  - 3) 2 Gemilli,
  - 4) Quadratus femoris.
  - 5) Obturator externus.
- **Circumduction:** combination of flexion, abduction, extension and adduction done in succession

- The rotation of thigh occurs around a vertical axis passes from head of femur to medial condyle of the femur.

• **Movements of knee joint**

- 1- **Flexion:** mainly by the hamstring muscles (semimembranosus, semitendinosus and biceps femoris).
- **Gastrocnemius, plantaris when the foot is fixed on ground**
- 2- **Extension:** by the quadriceps femoris (rectus femoris, vasti medialis, lateralis, and intermedius).
- 3- **Medial rotation:** (SGS) Sartorius, gracilis & semitendinosus and semimembranosus .
- 4- **Lateral rotation** by the biceps femoris only.

# Locking



## Unlocking of knee joint

At the beginning of flexion by Popliteus muscle

Lateral rotation of femur on tibia by Popliteus when the foot is fixed on the ground

Or medial rotation of tibia on femur by Popliteus when the foot is raised from the ground



## Locking of knee joint

- At the end of extension: tightening of the **anterior cruciate ligament** terminates the movement of the **lateral condyle** of femur
- **Full extension:** The articular surface on the **medial condyle is longer than lateral.**

Medial rotation of femur on tibia when the foot is fixed on the ground

Or lateral rotation of tibia on femur when the foot is raised from the ground

# Locking

• **Locking and unlocking of the knee joint:**

a- **Locking:** during dorsiflexion, the wide anterior part of the trochlear surface of the talus is lodged into the narrow posterior part of the superior articular surface (lock).

b- **Unlocking:** during plantar flexion, the narrow posterior part of the trochlear surface is lodged in the wide anterior part of the superior articular surface. In this position, the foot can be moved slightly from side to side.

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# Blood Supply

- **Arterial supply (anastomoses around the neck of the femur)**

- 1- Ascending branch of the medial circumflex femoral artery
- 2- Ascending branch of the lateral circumflex femoral artery
- 3- Acetabular branch of the obturator artery.
- 4- Superior gluteal artery.
- 5- Inferior gluteal artery.

❖ **Nerve supply of the hip joint**

- 1- Femoral nerve (Nerve to rectus femoris).
- 2- Obturator nerve (anterior branch).
- 3- Nerve to quadratus femoris (sacral plexus).

**Anastomosis around the knee joint**

- **5 Branches from popliteal artery**

- 1- Superior **lateral genicular** artery.
- 2- Inferior **lateral genicular** artery.
- 4- Superior **medial genicular** artery.
- 5- Inferior **medial genicular** artery.
- 3- Middle genicular artery.

- **2 Branches from femoral artery**

- 1- **Descending** genicular artery.
- 2- **Descending** branch of lateral circumflex femoral artery.

- **2 Branches from anterior tibial artery**

- 1 - Anterior **tibial recurrent** artery.
- 2- Posterior **tibial recurrent** artery.

- **1 Branch from posterior tibial artery**

- 1- Circumflex fibular artery.

• **Blood supply**

• **Anastomosis around the ankle joint**

- Branches of the anterior tibial artery
  - Anterior medial malleolar artery
  - Anterior lateral malleolar artery
- Branches of dorsalis pedis artery
  - Medial tarsal artery
  - Lateral tarsal artery.
- Branches of posterior tibial artery
  - Posterior medialis tibialis branches
  - Medial calcaneal branches
- Branches of peroneal artery
  - Tarsal branches
  - Lateral calcaneal branches.

• **Nerve supply:** from the anterior and posterior tibial nerves.

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# Nerve supply

**Nerve supply**

- 1- **Femoral nerve** through nerves to 3 vasti muscles.
- 2- **Obturator nerve** from the posterior division.
- 3- **Tibial nerve;**
  - a- Superior **medial genicular** nerve.
  - b- Inferior **medial genicular** nerve.
  - c- **Middle** genicular nerve.
- 4- **Common peroneal (lateral popliteal) nerve;**
  - a- Superior **lateral genicular** nerve.
  - b- Inferior **lateral genicular** nerve.
  - c- **Recurrent** genicular nerve.

- **Nelaton's line**

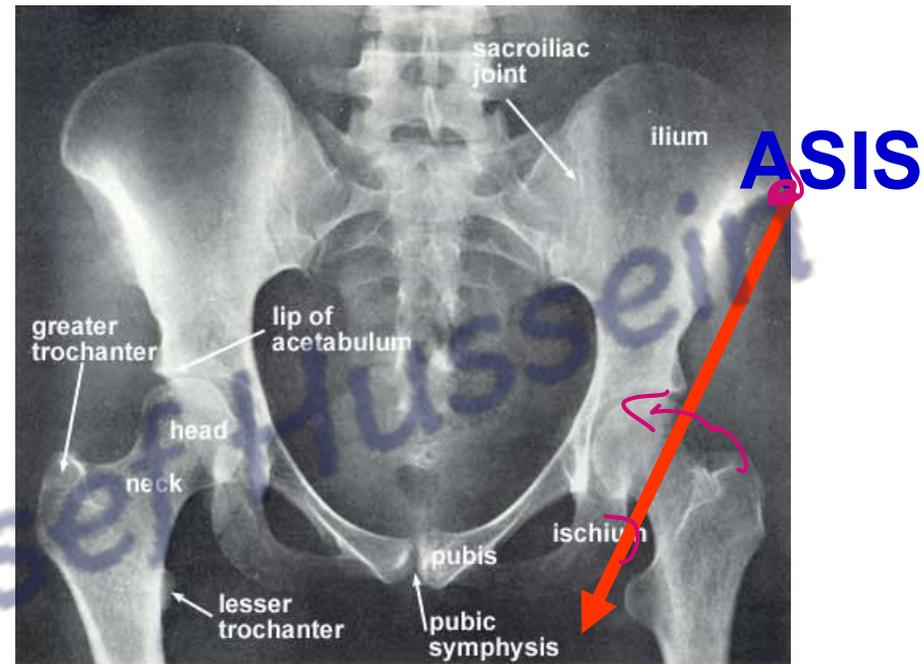
- a line drawn from the **anterior superior iliac spine** to the **ischial tuberosity**. This line normally passes on the top of the greater trochanter.

- **Dislocation of the hip joint**, the top of the greater trochanter is raised above the line.

- **Stability of the hip joint**

- It is very strong and stable joint due to the following factors:

- 1- The depth of acetabulum to accommodate greater part of head of the femur.
- 2- The strong ligaments around the joint.
- 3- The strong muscles around the joint.



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Abduction by  
gluteus medius  
and minimus

Flexion by  
iliacus and psoas major

Spasm of thigh  
muscles

Pull of  
adductors

(a)

(b)

## Fracture of the upper part of femur

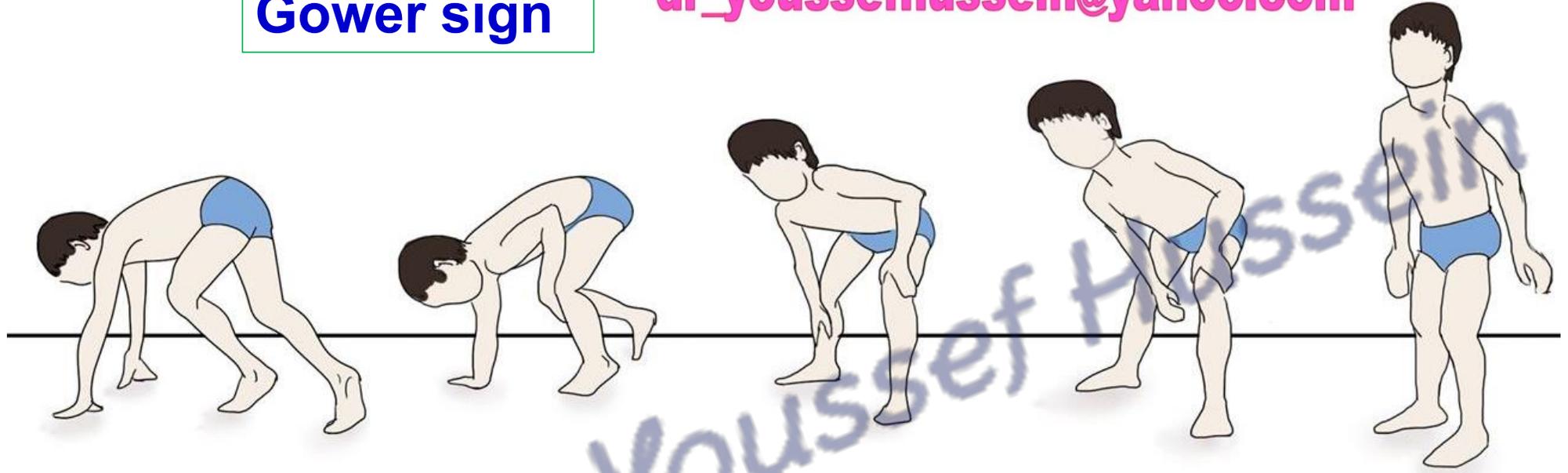
- **Proximal segment:**
- Flexion and lateral rotation by iliopsoas
- Abduction by gluteus medius, minimus
- **Distal segment is pulled medially by the adductor muscles.**

### • Neck of the femur

- It is long and oblique position allows the lower limb to swing easily clear of the pelvis.
- **If fractured**, the shaft is free and rotate laterally around its own axis.
- **Types:** Intracapsular and extracapsular

## Gower sign

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- **Injury of inferior gluteal nerve: Paralysis of the gluteus maximus** muscle leading to difficult in climbing up stairs and rising from the floor is squatting position.

- **Gower's sign**, in Paralysis of the muscle the patient Cannot stand without support, he rises slowly supporting his hand on his leg then on his thigh. He climbs on himself

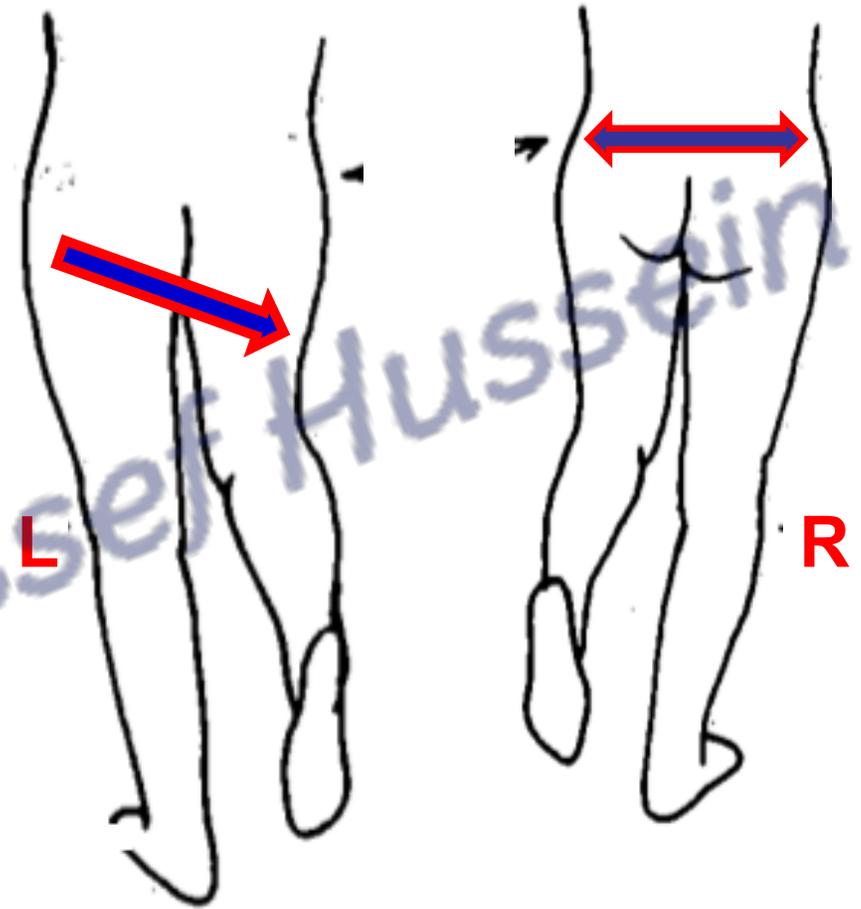
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### ❖ Trendelenburg's sign

- **Paralysis of left superior gluteal nerve**
- When standing on **normal right lower limb**: right glutei medius and minimus contracted to **prevent tilting** of the pelvis to the affected left side
- When standing on the **affected left limb**: pelvis **tilting to the normal right** side due to loss of actions of left glutei medius and minimus

### Paralysis of glutei medius and minimus:

- 1) **One side** paralysis leads to **lurching gait**.
- 2) **Both sides** paralysis lead to **waddling gait** (from side to side like the duck).



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