Joint type: Reel and socket variety of Synovial Joint
Parts:
- Foveolateral
- Pubolateral
- Ischiopatellar

Capsule:
- Fibrous capsule
- Acetabular labrum
- Transverse acetabular ligament
- Ligament of head of femur

Blood supply:
- Obturator artery
- Circumflex femoral artery
- Gluteal arteries

Plate 12: Rectum
- Medial epiphyseal a. (ligamentum teres a. br. of obturator medial circumflex)
- Epiphyseal a. (lateral)
- Ascending cervical a. (piercing capsule giving metaphysical branches)
- Lateral circumflex femoral a.
- Medial circumflex femoral a. (main supply)
- Retinacular a.
- Extraepiphyseal arterial ring

Plate 15: Vascular Supply of Femur
Muscles N. Supply = Femoral Nerve

Muscles & Movements

1. Flexion = Psoas
2. Extension = Gluteus Maximus + Hamstring
3. Adduction = Adductor Longus, Brevis, Magnus
4. Abduction = Gluteus Medius and Minimus
5. Medial Rotation = Tensor Fascia Latae
   Ant. fibre of Gluteus Medius and Minimus
6. Lat. Rotation = Two Obturator
   Two Gemelli
   Quadratus Femoris

Applied

1. Congenital dislocation - Head of the femur slips
   Upward, as acetabulum is deficient, upward
   Reduced gait, Brandebergt
2. Perthes - Destruction & flat of head, ↑ Joint space
3. Coxa vara: ↓ Neck-Shaft angle
   Childhood = 150°
   Adult = 127°
4. TB - Refuse pain in knee
5. Aspiration - ASIS → 5cm below
   Upward, Backward, Medially
6. Avascular Necrosis: in
   Subcapital # due to Damage to Retinacular Mem
7. Geoffroy's line Antevertor foramen Neck of Femur
Acromion
Deltoid
Cephalic vein
Biceps major
Axillary nerve and Post circumflex humeral vessels
Supraspinatus
Infraspinatus
Teres minor
Teres long head
Subscapularis
Subacromial bursa
Axillary N. & Post. Circumflex humeral vessels
Capsule
VENOUS AND LYMPHATIC DRAINAGE AND COMPARISON OF LOWER AND UPPER LIMBS

FACTS TO REMEMBER

- Long saphenous vein with saphenous nerve lie anterior to medial malleolus.
- Short saphenous vein lies behind lateral malleolus.
- Varicose veins are due to tortuosity of the long saphenous vein and occur mostly due to prolonged standing.
- Long saphenous vein is used to bypass the coronary artery after inverting the vein.

CLINICOANATOMICAL PROBLEM

A 30-year-old female during her pregnancy noted blue tubular structures over her calf and thigh. These are prominent after standing for a long time.

MULTIPLE CHOICE QUESTIONS

Which one of the following factors does not help in venous return from lower limb?

- a. Positive intrathoracic pressure
- b. Arterial pressure and overflow from the capillary bed
- c. Compression of vena comitantes accompanying the arteries by arterial pulsation
- d. Presence of valves which supports the long column of blood and divides the long column into shorter parts.

Number of valves in long saphenous vein are:

- a. 1–8
- b. 10–20
- c. 20–25
- d. 25–30

Upper medial group of inguinal lymph nodes drains all the following regions except:

- a. Infracostal part of anterior abdominal wall
- b. Perineum including most of the external genitalia
- c. Gastrocnemius
- d. Tibialis posterior

1. a 2. b 3. d 4. b 5. a 6. b

ANSWERS

- What are these blue tubular structures?
- Why do these develop in lower limbs only?

Ans: These blue tubular structures are the varicose veins in the lower limbs. These develop due to pressure of the foetal head on the veins in the pelvis, preventing the return of venous blood back into the circulation. These develop only in lower limbs as venous blood has to flow against gravity. Though there are valves inside the vein to permit unidirectional flow of blood, still varicose veins develop due to some incompetency of the valves and the pressure of the foetal head. On prolonged standing the veins got more prominent, as venous blood has to travel vertically upwards for a long time. Varicose veins usually disappear after pregnancy.
Joints of Lower Limb

INTRODUCTION

The weight-bearing joints of the lower limb are more stable. Hip joint allows the same movement as the mobile shoulder joint, but the range of movement is restricted.

Knee joint allows similar movements as the elbow besides the very important locking of the joint for long time standing. The leg bones do not permit the movements of supination and pronation for reasons of stability.

The ankle joint also allows limited movements for the same reason. The additional movements of inversion and eversion provided at the subtalar joints are to adjust the foot to the uneven ground.

HIP JOINT

DISSECTION

Ligate the femoral vessels and nerve with thick thread 2 cm below the inguinal ligament. Cut them above the ligature.

Cut sartorius muscle 5 cm below its origin and rectus femoris 3 cm below its origin and reflect these downwards. Detach the iliopsoas muscle from its insertion into lesser trochanter and separate the two parts.

The capsule of the joint and the thickened iliofemoral ligament are now exposed. Supplement the study of the ligaments and movements on the dried bones.

Type

Ball and socket variety of synovial joint (multiaxial).

Articular Surfaces

The head of the femur articulates with the acetabulum of the hip bone to form the hip joint. The head of the femur forms more than half a sphere, and is covered with hyaline cartilage except at the fovea capitis. The acetabulum presents a horseshoe-shaped, lunate articular surface, an acetabular notch and an acetabular fossa (Figs 12.1a and b). The lunate surface is covered with cartilage. Though the articular surfaces on the head of the femur and on the acetabulum are reciprocally curved, they are not co-extensive.

The hip joint is unique in having a high degree of stability as well as mobility. The stability or strength depends upon:

a. Depth of the acetabulum and the narrowing of its mouth by the acetabular labrum.

b. Tension and strength of ligaments.

c. Strength of the surrounding muscles.

d. Length and obliquity of the neck of the femur.

e. Atmospheric pressure: A fairly wide range of mobility is possible because of the fact that the femur has a long neck which is narrower than the equatorial diameter of the head.
Joints of Lower Limb

Ligaments

Ligaments include:
The fibrous capsule,
The iliofemoral ligament,
The pubofemoral ligament,
The ischiofemoral ligament,
The ligament of the head of the femur,
The acetabular labrum, and
The transverse acetabular ligament.

The fibrous capsule is attached on the hip bone to the acetabular labrum including the transverse acetabular ligament, and to bone above and behind the acetabulum; and on the femur to the intertrochanteric line in front, and 1 cm medial to the intertrochanteric crest behind (Fig. 12.2).

![Fig. 12.2: Fibrous capsule of the hip joint](image)

Anterosuperiorly, the capsule is thick and firmly attached. This part is subjected to maximum tension in the standing posture. Posterosuperiorly, the capsule is thin and loosely attached to bone.

The capsule is made up of two types of fibres. The outer fibres are longitudinal and the inner circular ones are called zona orbicularis. The longitudinal fibres are best developed anterosuperiorly, where many of them are reflected along the neck of the femur to form the retinacula. Blood vessels supplying the head and neck of the femur, travel along these retinacula. The synovial membrane lines the fibrous capsule, the intracapsular portion of the neck of the femur, both surfaces of the acetabular labrum, the transverse ligament, and fat in the acetabular fossa. It also invests the round ligament of the head of the femur (Fig. 12.2).

The joint cavity communicates with a bursa lying deep to the tendon of sartorius major, through a circular opening in the capsule located between the pubofemoral ligament and vertical band of the iliofemoral ligament (Fig. 12.3).

The iliofemoral ligament, or inverted Y-shaped ligament of Bigelow, lies anteriorly. It is one of the strongest ligaments in the body. It prevents the trunk from falling backwards in the standing posture. The ligament is triangular in shape. Its apex is attached to the lower half of the anterior inferior iliac spine, and the base to the intertrochanteric line. The upper oblique and lower vertical fibres form thick and strong bands, while the middle fibres are thin and weak (Fig. 12.3).

![Fig. 12.3: Iliofemoral and pubofemoral ligaments](image)

The pubofemoral ligament supports the joint inferomedially. It is also triangular in shape. Superiorly, it is attached to the iliopubic eminence, the obturator crest and the obturator membrane. Inferiorly, it merges with the anteroinferior part of the capsule and with the lower band of the iliofemoral ligament.

The ischiofemoral ligament is comparatively weak. It covers the joint posteriorly. Its fibres are twisted and extend from the ischium to the acetabulum. The fibres of the ligament form the zona orbicularis. Some of them are attached to the greater trochanter (Fig. 12.4).

The ligament of the head of the femur, round ligament or ligamentum teres is a flat and triangular ligament. The apex is attached to the fovea capitis, and the base to the transverse ligament and the margins of the acetabular notch. It may be very thin, or even absent. It transmits arteries to the head of the femur, from the acetabular branches of the obturator and medial circumflex femoral arteries (see Fig. 4.7).

The acetabular labrum is a fibrocartilaginous rim attached to the margins of the acetabulum. It narrows the mouth of the acetabulum. This helps in holding the head of the femur in position (Fig. 12.5).

The transverse ligament of the acetabulum is a part of the acetabular labrum which bridges the acetabular
notch. The notch is thus converted into a foramen which transmits acetabular vessels and nerves to the joint (Figs. 12.1 and 12.5).

**Relations of the Hip Joint**

**Anterior Relations**
Tendon of the iliopsoas separated from the joint by a bursa and femoral vein, femoral artery and femoral nerve (Fig. 12.5).

**Posterior Relations**
The joint, from below upwards, is related to the following muscles: Tendon of obturator externus covered by the quadratus femoris, obturator internus and gemelli, piriformis, sciatic nerve and the gluteus maximus muscle.

**Superior Relations**
Reflected head of the rectus femoris covered by the gluteus minimus, gluteus medius and partly by gluteus maximus.

**Inferior Relations**
Lateral fibres of the pectineus and the obturator externus. In addition there are gracilis, adductors longus, brevis, magnus and hamstring muscles.

**Blood Supply**
The hip joint is supplied by the obturator artery, two circumflex femorals and two gluteal arteries. The medial and lateral circumflex femoral arteries form an arterial circle around the capsular attachment on the neck of the femur. Articular arteries arise from this circle and supply the intracapsular part of the neck and the greater part of the head of the femur. A small part of the head, near the lesser capitis is supplied by the acetabular branches of the obturator and medial circumflex femoral arteries (see Fig. 4.7).
• Hip diseases show an interesting age pattern:
  a. Below 5 years: Congenital dislocation and tuberculosis (Fig. 12.6)
  b. 5 to 10 years: Perthes' disease
  c. 10 to 20 years: Coxa vara (Fig. 12.7)
  d. Above 40 years: Osteoarthritis
• In arthritis of hip joint, the position of joint is partially flexed, abducted and laterally rotated.
• Fracture of the neck of the femur may be subcapital, near the head (Fig. 12.8), cervical in the middle, or basal near the trochanters. Damage to retinacular arteries causes avascular necrosis of the head. Such a damage is maximal in subcapital fractures and least in basal fractures. These fractures are common in old age, between the age of 40 and 60 years. Femur neck fracture is usually produced by trivial injuries. Trochanteric fracture may be intertrochanteric, i.e. between the trochanters or subtrochanteric, i.e. below the trochanters. These fractures occur in strong, adult subjects, and are produced by severe, violent injuries (Fig. 12.8).
• Shenton's line, in an X-ray picture, is a continuous curve formed by the upper border of the obturator foramen and the lower border of the neck of the femur. In fracture neck femur, line becomes abnormal (Fig. 12.9).

Fig. 12.6: Congenital dislocation of hip joint

![Fig. 12.7: Coxa vara and coxa valga](image)

![Fig. 12.8: Fracture of neck and trochanteric fracture](image)

### KNEE JOINT

**DISSECTION**
Strip the extra structures around the knee joint, leaving behind the fibrous capsule, ligaments and parts of muscles/tendons attached to the bones/ligaments.

**Features**
The knee is the largest and most complex joint of the body. The complexity is the result of fusion of three joints in one. It is formed by fusion of the lateral
Nerve Supply
The hip joint is supplied by the femoral nerve, through the nerve to the rectus femoris; the anterior division of the obturator nerve; the nerve to the quadratus femoris; and the superior gluteal nerve.

Movements
1. Flexion and extension occur around a transverse axis.
2. Adduction and abduction occur around an anteroposterior axis.
3. Medial and lateral rotation occur around a vertical axis.
4. Circumduction is a combination of the foregoing movements.

Hip joint extension and slight abstraction and medial rotation is the close packed position for the hip joint which means that the ligaments and the capsules are most taut in this position. But the surfaces are most congruent in slightly flexed, abducted and laterally rotated position of the hip.

In general, all axes pass through the centre of the head of the femur, but none of them is fixed because the head is not quite spherical.

Flexion is limited by contact of the thigh with the anterior abdominal wall. Similarly, adduction is limited by contact with the opposite limb. The range of the other movements is different from one another: Extension 15°, abduction 50°, medial rotation 25°, and lateral rotation 60°.

The movement of the hip is closely related to the position of the knee because of the presence of two muscles which act on both hip and knee. In the extended position of the knee, the stretch on the hamstring muscles does not allow the hip to move into its complete flexion range. Similarly with knee completely flexed, the hip joint may not attain complete extension due to tension in the Rectus femoris which gets stretched at the hip and the knee.

When the hip joint is bearing weight, the femur is fixed. But like any other joint, here also the proximal bone, i.e. pelvis is capable of moving on the fixed distal femur. The pelvis can either move into anterior tilting (equivalent to flexion of hip) or posterior tilting (equivalent to extension of the hip).

The muscles producing these movements are given in Table 12.1.

### Table 12.1: Muscles producing movements at the hip joint

<table>
<thead>
<tr>
<th>Movement</th>
<th>Chief muscles</th>
<th>Accessory muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>Psoas major and iliacus</td>
<td>Pectineus, rectus femoris, and sartorius; adductors (mainly adductor longus) participate in early stages</td>
</tr>
<tr>
<td>Extension</td>
<td>Gluteus maximus and hamstrings</td>
<td>Pectineus and gracilis</td>
</tr>
<tr>
<td>Adduction</td>
<td>Adductors longus, brevis and magnus</td>
<td>Tensor fasciae latae and sartorius</td>
</tr>
<tr>
<td>Abduction</td>
<td>Glutei medius and minimus</td>
<td>Piriformis, gluteus maximus and sartorius</td>
</tr>
<tr>
<td>Medial rotation</td>
<td>Tensor fasciae latae and the anterior fibres of the glutei medius and minimus</td>
<td></td>
</tr>
<tr>
<td>Lateral rotation</td>
<td>Two obturators, two gemelli and the quadratus femoris</td>
<td></td>
</tr>
</tbody>
</table>
Articular Surfaces

The knee joint is formed by:
1. The condyles of the femur.
2. The patella (Figs 12.10 to 12.12).
3. The condyles of the tibia. The femoral condyles articulate with the tibial condyles below and behind, and with the patella in front.

Ligaments

The knee joint is supported by the following ligaments.
1. Fibrous capsule (Fig. 12.11).
2. Ligamentum patellae (Fig. 12.12).
3. Tibial collateral or medial ligament (Fig. 12.11).
4. Fibular collateral or lateral ligament (Fig. 12.11).

Type

It is a condylar synovial joint, incorporating two condylar joints between the condyles of the femur and tibia, and one saddle joint between the femur and the patella. It is also a complex joint as the cavity is divided by the menisci.

Fig. 12.9: Shenton's line

Fig. 12.10: Lower end of the femur and patella

Fig. 12.11: Tibial and fibular collateral ligaments