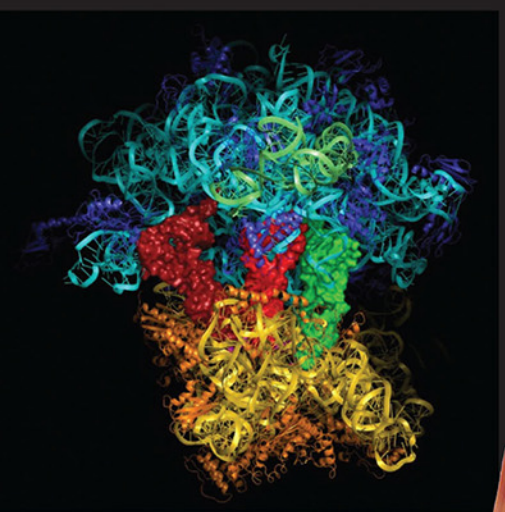
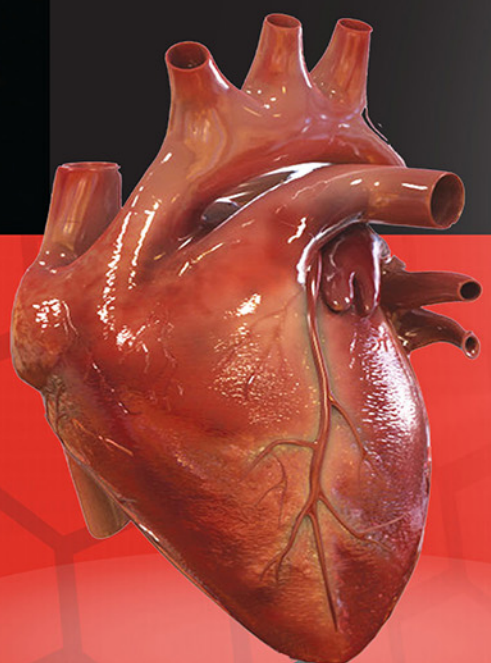
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JAYPEE

2nd Edition

Viva in Anatomy, Physiology & Biochemistry







Anjula Vij

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Chapter 3

Lower Limb

Bones of Lower Limb

Hip Bone (Fig. 3.1)

Q.1 What are the different parts of a hip bone?
The hip bone is made up of three parts, the *ilium* superiorly, *ischium* postero-inferiorly and *pubis* antero-inferiorly. The three parts join to form a cup-shaped hollow articular surface, the *acetabulum.*

Q.2 How will you determine to which side the hip bone belongs?
In a hip bone, the acetabulum is directed laterally and the flat ilium forms upper part of bone, lying above the acetabulum. The obturator foramen lies below the acetabulum.

Q.3 What is the normal anatomical position of the hip bone in the body?
- Pubic tubercle and anterior superior iliac spine lie in the same vertical plane.
- The pelvic surface of the body of pubis is directed backwards and upwards.
- The ischial spine and upper border of symphysis pubis lie in same horizontal plane and
- Symphysis pubis lies in the median plane.

Q.4 What is the level through which the highest point of the iliac crest passes (intercristal plane)?
The intercristal plane passes at the level of interval between the spines of L_3 and L_4 vertebrae.

Q.5 What is the clinical importance of intercristal plane?
In clinical practice, lumbar puncture is done between the L_3 and L_4 vertebrae.

Q.6 What are the structures attached to the anterior superior iliac spine?
It provides:
- Attachment to the lateral end of inguinal ligament and
- Origin of sartorius.

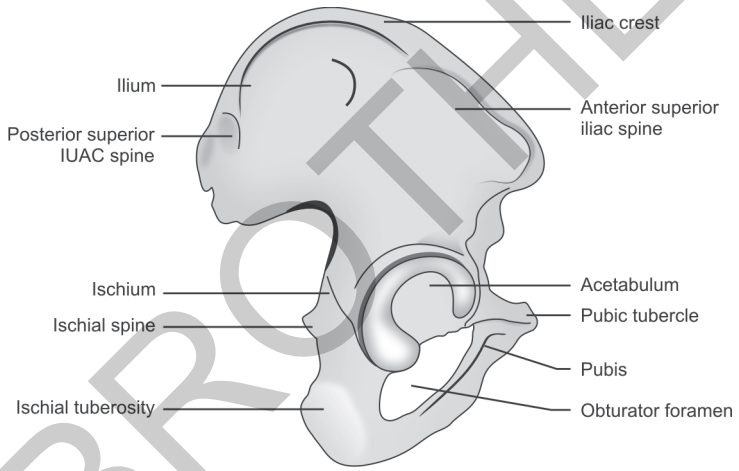


Fig. 3.1: Hip bone

Q.7 Name the structures attached to the iliac crest.
Anterior 2/3 of iliac crest has:
- *Outer lip* which provides
  - Attachment of fascia lata,
  - Origin of tensor fasciae lata,
  - Insertion to external oblique muscle and
  - Origin to latissimus dorsi just behind the highest point.
- *Intermediate area* provides origin to internal oblique muscle.
- *Inner lip* provides
  - Origin to transversus abdominis,
  - Attachment to fascia iliaca and fascia transversalis,
  - Origin to quadratus lumborum in posterior 1/3 and
  - Attachment to thoracolumbar fascia.

Posterior 1/3 segment of iliac crest has:
- *Lateral slope:* Origin of gluteus maximus.
- *Medial slope:* Origin of erector spinae.
- *Medial margin:* Interosseous and dorsal sacroiliac ligaments.

Q.8 Name the structures attached to anterior inferior iliac spine.
Anterior inferior iliac spine gives:
- Origin to straight head of rectus femoris in superior half and
- Attachment to iliofemoral ligament in inferior half.

Q.9 Name the structures attached to posterior border of ilium.
It provides:
- Attachment to upper fibers of sacrotuberous ligament and
- Origin to fibers of piriformis.

Q.10 What are the structures attached to gluteal surface of ilium?
- Gluteus medius arises between anterior and posterior gluteal lines.
- Gluteus minimus arises between anterior and inferior gluteal line.
- Gluteus maximus (upper fibers) arise behind the posterior gluteal line.
- Below inferior gluteal line reflected head of rectus femoris arises.

Q.11 Name the structures attached to the pubic tubercle.
- Medial end of inguinal ligament.
- Ascending loops of cremaster muscle.

Q.12 Name the structures attached to the crest of pubis.
- Lateral head of rectus abdominis (origin)
- Pyramidalis (origin).
  Medial head of rectus abdominis arises from anterior pubic ligament.

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Q.13 What are the structures attached to pectineal line?
The structures attached to pectineal line are:
- Conjoint tendon and lacunar ligament at medial end.
- Pectineal ligament lateral to lacunar ligament.
- Origin of pectineus muscle and fascia covering it, from the whole length.
- Insertion of psoas minor.

Q.14 Name the structures attached to ischial spine.
The structures attached to ischial spine are:
- Sacrospinous ligament
- Origin of coccygeus and levator ani.
- Origin of superior gemellus

Q.15 What are the structures attached to ischial tuberosity?
From upper area of ischial tuberosity arise semimembranous superolaterally and semitendinosus and long head of biceps femoris superomedially.

From lower lateral area adductor magnus arise.

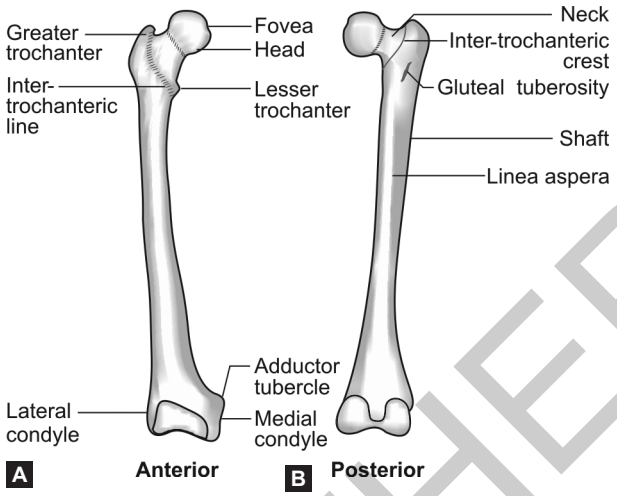
Q.16 What are the nerves related to hip bone?
- Sciatic nerve related to lower margin of greater sciatic notch.
- Obturator nerve in the obturator canal.
- Nerve to obturator internus crosses the base of ischial spine.
- Pudendal nerve crosses base of ischial spine.
- Nerve to quadratus femoris runs on ischium as it crosses the greater sciatic notch.

Femur (Figs 3.2A and B)

Q.17 What is the normal anatomical position of the femur in the body?
The head of femur is directed medially, upwards and slightly forwards and the shaft is obliquely downwards and medially, so that the two condyles at lower surface lie in same the horizontal plane.

Q.18 What is the arterial supply of the head of femur?
The medial part near fovea, supplied by medial epiphyseal arteries derived from ascending branch of medial circumflex femoral artery and posterior division of obturator artery.

The lateral part of head is supplied by lateral epiphyseal arteries derived from lateral circumflex femoral artery.



Figs 3.2A and B: Right femur

Q.19 What is the nutrient artery of the femur?
It is derived from second perforating artery.

Q.20 What is angle of anteversion?
The angle of anteversion (angle of femoral torsion) is the angle between the transverse axes of upper and lower ends of femur. It is about 15 degrees.

Q.21 Name the structures attached to intertrochanteric line of femur.
The following structures are attached to intertrochanteric line:
- Capsular ligament of hip joint
- Iliofemoral ligament
- Upper fibers of vastus lateralis and vastus medialis.

Q.22 Which muscle is inserted into trochanteric fossa?
Obturator externus.

Q.23 Which muscle is inserted in gluteal tuberosity?
Deep fibers of gluteus maximus.

Q.24 What is the origin of popliteus muscle?
From anterior part of groove on lateral aspect of lateral condyle of femur.

Q.25 What is the importance of ossification center for lower end of femur?
The ossification center for lower end of femur appears at end of 9th month of intrauterine life (the day of birth). It is of medicolegal importance in cases of newly born child found dead to decide whether it was viable or not.

Q.26 What is characteristic of primary ossification center of femur?
It is the second long bone in body to start ossifying.

Q.27 Why the fractures of neck of femur, leads to the necrosis of the head?
Because it will interrupt the blood supply to the head which is derived from:
- Vessels travelling up from diaphysis
- Vessels in the retinacula of the hip capsule.

Q.28 Why the intracapsular fracture of the neck of the femur are more dangerous than extracapsular fracture?
The intracapsular fracture interrupts the blood supply, to the femoral head resulting in necrosis whereas in the extracapsular fracture, the blood supply to the head remains unaffected and so there is no danger of avascular necrosis.

Q.29 What is coxa vara?
In this condition the angle between the femoral neck and shaft is decreased i.e., less than 160°. This results from adduction fractures.

Q.30 What is coxa valga?
Increase in the angle between femoral neck and shaft due to abduction fractures.

Q.31 At which level fracture of shaft of femur is dangerous?
Fracture of the lower end of femur are dangerous because proximal edge of the distal fragment is tilted backwards by the gastrocnemius, which tears the popliteal artery which lies directly behind it.

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Tibia and Fibula (Figs 3.3A and B)

Q.32 Name the structures attached to the intercondylar area of tibia.
From before backwards, it provides attachment to:
- Anterior horn of medial meniscus
- Anterior cruciate ligament
- Anterior horn of lateral meniscus
- Posterior horn of lateral meniscus
- Posterior horn of medial meniscus
- Posterior cruciate ligament.

Q.33 What are the structures related to anterior surface of lower end of tibia?
From medial to lateral side it is related to tibialis anterior, extensor hallucis longus, anterior tibial vessels, deep peroneal nerve and extensor digitorum longus.

Q.34 What are the structures related to the posterior surface of lower end of tibia?
From medial to lateral side it is realted to tibialis posterior, flexor digitorum longus, posterior tibial artery, tibial nerve and flexor hallucis longus.

Q.35 What is the arterial supply of tibia?
Nutrient artery to tibia is a branch of the posterior tibial artery. It is the largest nutrient artery in the body.

Q.36 Although the tibia is one of the commonest sites of acute osteomyelitis but knee joint is not involved. Explain?
The knee joint is not involved because the capsule is attached near articular margins of tibia, proximal to epiphyseal line.

Q.37 The fracture of tibia is slow healing. Why?
The tibia is commonly fractured at the junction of upper 2/3 and lower 1/3 of its shaft, where it is most slender and this site is poorly supplied by blood vessels.

Q.38 How will you determine the side to which the fibula belongs?
The head is slightly expanded in all directions and lateral malleolus is expanded anteroposteriorly and is flattened from side to side. The medial side of lower end bears a triangular articular facet anteriorly and malleolar fossa posteriorly.

Q.39 Which structure lies between two heads of origin of peroneus longus?
Common peroneal nerve.

Q.40 Name the structures attached to malleolar fossa.
Malleolar fossa provides attachment to posterior talofibular and posterior tibiofibular ligament.

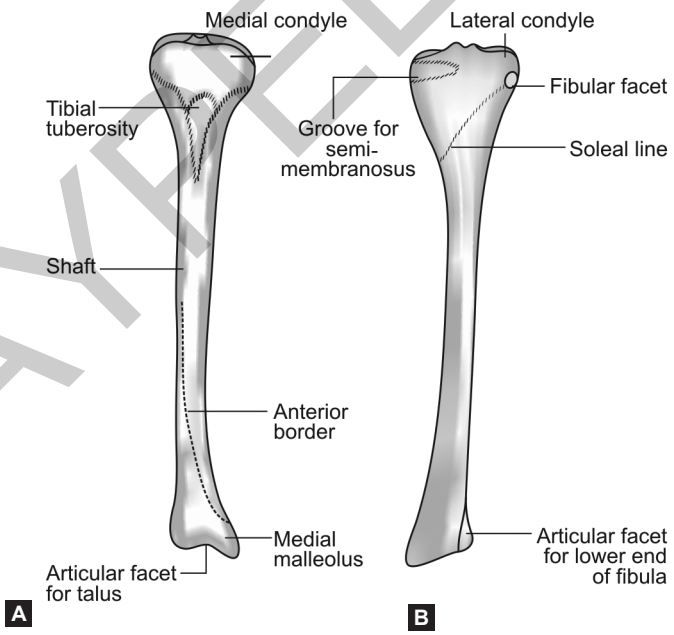
Q.41 Fibula violates the general rule of ossification. Explain.
Normally in a long bone, growing end of a long bone ossifies first and unites with the shaft last while the non-growing end ossifies last and fuses with the shaft first. But in fibula, the ossification center for nongrowing end, i.e. lower end appears first but does not fuse last. This occurs because:
- The upper epiphysis (fuses last) is the growing end of the bone and
- Center for lower end appears first because it is a pressure epiphysis.

Q.42 What are the functions of fibula? (Fig. 3.4)
- It provides origin to muscles.
- It acts as a pulley for the tendons of peroneus longus and brevis.
- It forms a part of the ankle joint.
- It helps to increase the stability of ankle joint by lateral malleolus and ligaments attached to it.

Patella

Q.43 What is the function of patella?
The patella improves the leverage of the quadriceps femoris by increasing the angulation of the line of pull on the leg.

Q.44 How the stability of the patella is increased?
Due to outward angulation between long axes of thigh and leg the patella has a tendency to dislocate outwards. This is prevented by:
- *Muscular factor:* Insertion of vastus medialis on medial border of patella extends of a lower level than that of the vastus lateralis laterally.
- *Bony factor:* Lateral edge of patellar articular surface of femur is deeper than medial edge.



Figs 3.3A and B: Tibia (right) (A) Anterior view, (B) Posterior view

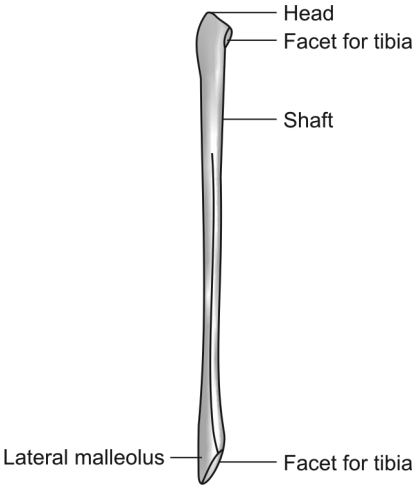


Fig. 3.4: Right fibula

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Q.45 What are the different sesamoid bones present in the lower limb?
The following sesamoid bones are present in the lower limb:
- Patella, articulates with femur.
- Two small sesamoid bones in the tendons of flexor hallucis brevis, articulate with the head of the first metatarsal bone.
- One in the peroneus longus tendon, articulates with cuboid.
- Others may be present in the tendons of tibialis anterior, lateral head of gastrocnemius and gluteus maximus.

Q.46 What is 'fabella'?
It is a small, rounded sesamoid bone present in the lateral head of gastrocnemius. It articulates with the posterior surface of the lateral condyle of femur.

Bones of Foot (Fig. 3.5)

Q.47 Name the tarsal bone of foot.
- *Proximal row:* Talus, calcaneum,
- *Distal row:* Cuboid and medial, intermediate and lateral cuneiform. Navicular is interposed between the two rows

Q.48 Name the structures attached to medial tubercle of calcaneum.
Medially:
- Origin of abductor hallucis
- Flexor retinaculum.

Anteriorly:
- Origin of flexor digitorum brevis
- Plantar aponeurosis

Q.49 Name the structures attached to lateral tubercle of calcaneum.
Origin of abductor digiti minimi.

Q.50 What are the structures attached to sustentaculum tali?
To its medial margin are attached
- Spring ligament, anteriorly
- Slip from tibialis posterior, in middle
- Superficial fibers of deltoid ligament, along its whole length and
- Medial talocalcaneal ligament, posteriorly.

Q.51 What is the structure attached to tuberosity of navicular bone?
Insertion for tibialis posterior.

Q.52 Name the structures related to plantar groove of cuboid.
- Through groove pass tendon of peroneus longus.
- To posterior ridge, deep fibers of long plantar ligament.

Q.53 What are the differences between metacarpal and metatarsal?

Metacarpal	*Metatarsal*
Head and shaft: Prismoid	Flattened from side to side
Shaft: Uniform thickness	Tapers distally
Dorsal surface of shaft	Elongated, flat triangular area Uniformly convex
Base: Irregular	Cuts sharply and obliquely

Q.54 What are the "accessory bones"?
These are separate small pieces of bone which have not fused with the main bone e.g.,
- Os trigonum (posterior tubercle of talus) and
- Os vesalianum (tuberosity of fifth metatarsal).

Q.55 What is 'bunion'?
It is inflamed adventitial bursa over the head of first metatarsal bone.

Joints of Lower Limb

Hip Joint (Fig. 3.6)

Q.56 What is the type of hip joint?
Hip joint is a ball and socket type of synovial joint.

Q.57 What are the factors which increase the stability of the hip joint?
The stability of hip joint is increased by the following factors:
- Depth of acetabulum with a narrow mouth, made by acetabular labrum.
- Tension and strength of ligaments.
- Strength of the surrounding muscles.
- Length and obliquity of neck of femur.

The wide range of mobility depends upon the neck of femur which is narrower than the equatorial diameter of the head.

Q.58 What is the attachment of ligament of the head of femur?
It is attached laterally to fovea on head of femur and medially to two ends of acetabular notch and to transverse ligament.

Q.59 What are the ligaments strengthening the capsule of hip joint?
- Iliofemoral ligament: Strongest, Y-shaped ligament.
- Pubofemoral ligament
- Ischiofemoral ligament (Figs 3.7A and B).

Q.60 What are the relations of the hip joint?
The relations of the hip joint are:
- *Anteriorly:* Lateral fibers are pectineus, iliopsoas, straight head of rectus femoris.
- *Posteriorly:* Quadratus femoris covering obturator externus and ascending branch of medial circumflex femoral artery, the piriformis, obturator internus with two gemelli separate the sciatic nerve from the nerve to quadratus femoris.

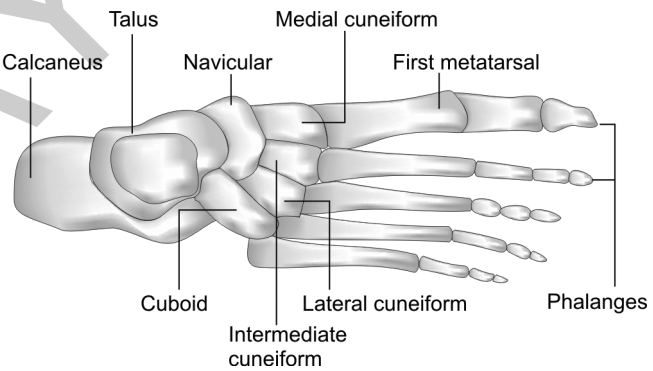


Fig. 3.5: Skeleton of the foot (viewed from above)

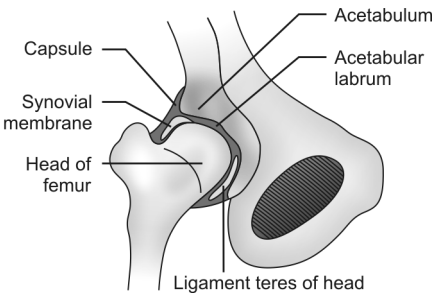
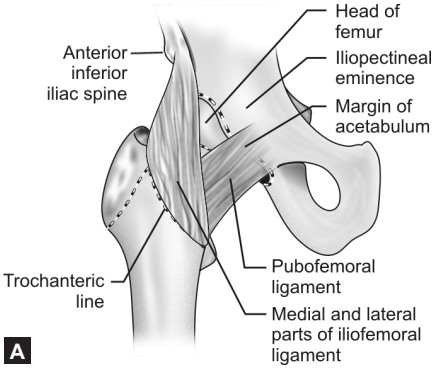
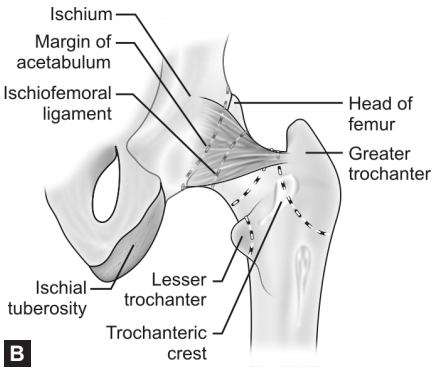


Fig. 3.6: Hip joint

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Figs 3.7A and B: Hip joint. (A) anterior aspect, (B) Posterior aspect. The capsular attachments (blue) and epiphyseal lines (magenta) are shown

- *Superior:* Reflected head of rectus femoris covered by gluteus minimus.
- *Inferior:* Lateral fibers of pectineus and obturator externus.

Q.61 What is the blood supply to the hip joint?
The hip joint is supplied by the medial circumflex femoral and the lateral circumflex femoral vessels (Fig. 3.8). There also may be contribution by the acetabular branch of femoral artery.

Q.62 What is the axis of different movements of hip joint?
- For rotation, vertical axis passing through the center of head of femur and its lateral condyle.
- Extension and flexion, occur around a transverse axis.
- Adduction and abduction, occur around an anteroposterior axis.

Q.63 What is the range of movements at the hip joint?
Flexion is limited by contact of thigh with anterior abdominal wall.

Adduction is limited by contact with opposite limb.

Range of other movements: Lateral rotation 60°, Medial rotation 25°, Abduction 50° and extension 15°.

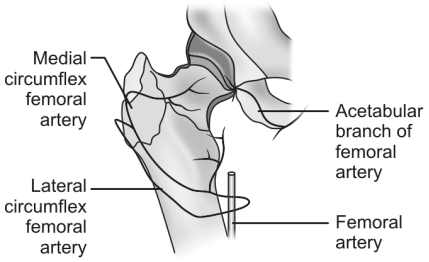


Fig. 3.8: Blood supply of hip joint

Q.64 What are the nerves supplying the hip joint?
The hip joint is supplied by:
- Femoral nerve, through nerve to rectus femoris,
- Anterior division of obturator nerve,
- Accessory obturator nerve,
- Nerve to quadratus femoris and
- Superior gluteal nerve.

Q.65 What are the different muscles producing extension of the hip joint?
Gluteus maximus and hamstrings.

Q.66 Which muscles produce abduction of the hip joint?
Chief muscles: Gluteus medius and minimus.
Accessory muscles: Tensor fasciae latae and sartorius.

Q.67 What is Trendelenburg test?
This test is employed for testing the stability of the hip joint. A positive test indicates a defect in osseomuscular stability especially abductors of hip joint and the patient has a "lurching" gait. If the patient is asked to stand on one leg. If the abductors of thigh are paralyzed on that side, they will be unable to sustain the pelvis against the body weight and pelvis tilts downwards on unsupported side.

Q.68 Name the adductors of hip joint.
- Adductor longus
- Adductor brevis
- Adductor magnus
- Gracilis
- Pectineus.

Q.69 Name the medial rotators of hip joint.
Gluteus medius and minimus:
- Tensor fasciae latae
- Adductor longus, brevis and magnus.

Q.70 Name the flexors of hip joint.
Mainly: Psoas major, iliacus, rectus femoris
Accessory muscles: Adductors are also flexors of hip joint.

Q.71 What is the cause of Weaver's bottom?
Inflammation of bursa over ischial tuberosity.

Q.72 In which injury of the hip joint sciatic nerve is likely to be damaged?
It is likely to be injured in the posterior dislocation of the hip joint associated with fracture of the posterior lip of the acetabulum, to which the nerve is closely related.

Knee Joint

Q.73 What is the function of anterior and posterior cruciate ligament?
- Anterior cruciate ligament: Prevents hyperextension of knee joint.
- Posterior cruciate ligament: Prevents hyperflexion of knee joint.

Q.74 What is compartment syndrome?
It is an increase in fluid pressure (> 30 mm) within an osseofascial compartment and leads to muscle and nerve damage. Usually occurs in anterior compartment of thigh as a result of crush injury can also occur in anterior compartment of leg due to fracture of the tibia.

Q.75 What is Legg-Perthes disease?
It is characterized by idiopathic avascular necrosis of the head of femur. Caucasian boys are more commonly affected and it is usually characterized by unilateral hip pain external rotation (slight) and a limp.

Q.76 What type of joint is the knee joint?
Compound synovial joint, having
- *Condylar synovial joint:* Between the condyles of femur and tibia.
- *Saddle synovial joint:* Between femur and patella (Fig. 3.9).

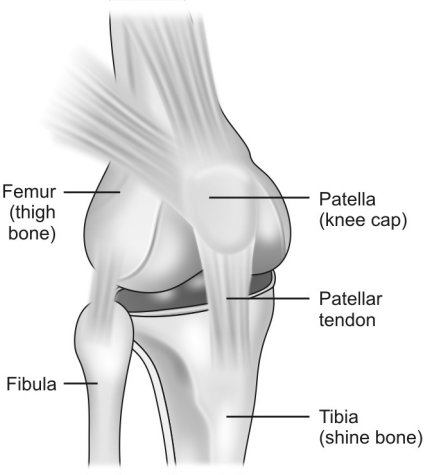


Fig. 3.9: The knee joint

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Q.77 What are the articular surfaces in knee joint?
Condyles of femur:
- Condyles of tibia and
- Patella.

Q.78 What are the bony landmarks in the region of the knee?
1. *Adductor tubercle:* is felt just above the medial condyle of the femur.
2. *Head of the fibula:* is felt at posterolateral aspect of the knee. Lies 1.5 cm below the level of the knee joint.
3. *Tibial tubercle:* is felt in front of the knee in upper part of the tibia.
4. *Tibial condyles:* are felt on each side of the lower part of the ligamentum patellae.

Q.79 Name the ligaments of knee joint.
- Fibrous capsule
- Ligamentum patellae
- *Collateral ligaments:* Tibial and fibular
- *Popliteal ligaments:* Oblique and arcuate
- *Cruciate ligaments:* Anterior and posterior
- *Meniscus:* Medial and lateral
- Transverse ligament (Figs 3.10A and B).

Q.80 What is coronary ligament?
It is the part of fibrous capsule lying between the menisci and tibia.

Q.81 What are the openings in the fibrous capsule of knee joint?
1. For suprapatellar bursa and
2. For the exit of tendon of popliteus with its synovial bursa.

Q.82 What are the attachments of arcuate popliteal ligament?
It passes from the head of fibula to the posterior margin of the intercondylar area of tibia.

Q.83 What are the attachments of oblique popliteal ligament?
It arises as an expansion from the tendon of semi-membranous. It blends with the posterior surface of fibrous capsule. It is attached to the intercondylar line and lateral condyle of femur and posterior aspect of medial condyle of tibia.

Q.84 Name the structures piercing oblique popliteal ligament.
1. Posterior division of obturator nerve and
2. Middle genicular nerve and vessels.

Q.85 What are menisci and what are their functions?
These are two fibrocartilaginous structures, semilunar in shape, which make the tibial articular surface deeper and divide the joint cavity partially into upper and lower compartment (Fig. 3.11).
Functions:
- They act as shock absorbers.
- They make the articular surfaces more congruent. They can adapt to varying curvatures of different parts of femoral condyles.

Q.86 What is the arterial supply of knee joint?
- Genicular branches of popliteal artery,
- Descending genicular branch of femoral artery,
- Descending branch of lateral circumflex femoral artery.
- Recurrent branches of anterior tibial artery and
- Circumflex fibular branch of posterior tibial artery.

Q.87 Name the arteries forming the anastomosis around the knee joint.
Medially:
- Descending genicular
- Superior medial genicular
- Inferior medial genicular

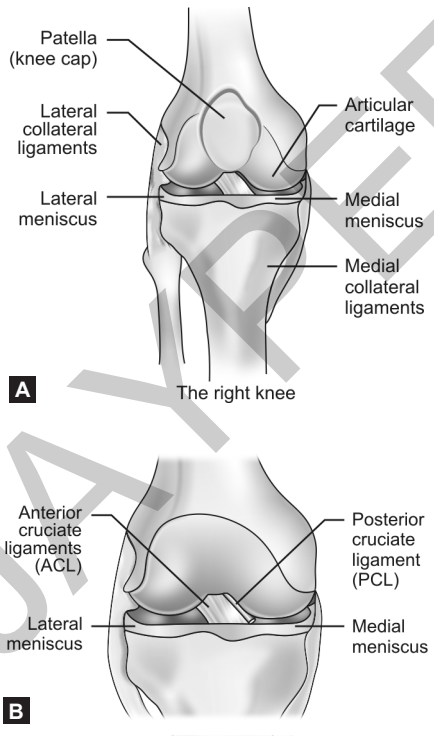
Laterally:
- Descending branch of lateral circumflex femoral
- Superior lateral genicular
- Inferior lateral genicular
- Anterior lateral recurrent
- Posterior lateral recurrent
- Circumflex fibular (Fig. 3.12).

Q.88 What is the nerve supply of knee joint?
1. Femoral nerve,
2. Genicular branches of tibial and common peroneal nerves and
3. Posterior division of obturator nerve.

Q.89 What are the movements possible at knee joint?
- Flexion
- Extension
- Medial and lateral rotation.

Q.90 What is 'conjunct' and 'adjunct' rotation?
- *Conjunct rotation:* Rotation of knee joint combined with flexion and extension.
- *Adjunct rotation:* Rotation of knee joint occurring independently in a partially flexed knee.

Q.91 What are the changes in the axis of movement of the knee joint with flexion and extension?



Figs 3.10A and B: Ligament of the knee joint

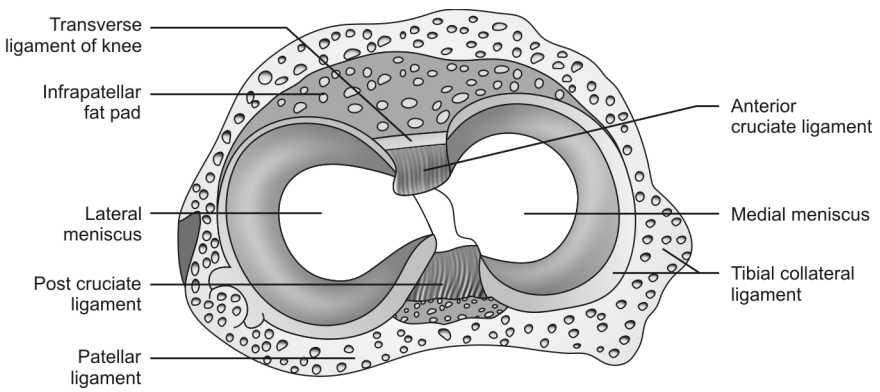


Fig. 3.11: Knee menisci

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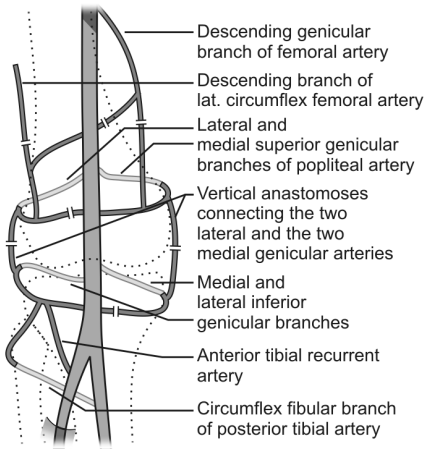


Fig. 3.12: Anastomoses around the knee joint

The flexion and extension of the knee joint takes place on a transverse axis which shifts along with the movements. Because of the spiral profiles of the femoral condyles, the axis shifts upwards and forwards during extension and backwards and downwards during flexion.

Q.92 What are the locking and unlocking movements of the knee joint?

In full extension from the position of flexion the last 30° of extension is accompanied by medial rotation of the femur on the tibia or lateral rotation of the tibia on the femur depending on whether the tibia or the femur is fixed. This is conjunct rotation and occurs passively as a part of the extension movement, is described as 'locking' of the knee joint.

From the position of full extension, the beginning of flexion is accompanied by lateral rotation of the femur or medial rotation of the tibia depending on whether the tibia or the femur is fixed. This rotation is called 'unlocking' of the knee joint. The contraction of popliteus is responsible for this unlocking movement.

Q.93 Name the intra-articular structures of the knee joint.

- *Cruciate ligaments:* Anterior and posterior
- *Menisci:* Medial and lateral
- Infrapatellar pad of fat
- Synovial membrane
- Origin of popliteus.

Q.94 Name the bursa around knee joint?

Anteriorly:

- Subcutaneous prepatellar bursa
- Subcutaneous infrapatellar bursa
- Deep infrapatellar bursa and
- Suprapatellar bursa.

Medially:

- Bursa deep to medial head of gastrocnemius.
- Bursa deep to tibial collateral ligament.
- Semimembranosus bursa
- Anserine bursa and
- Occasionally, bursa between tendons of semitendinosus and semimembranosus.

Laterally:

- Bursa deep to lateral head of gastrocnemius
- Bursa between fibular collateral ligament and tendon of popliteus
- Bursa between fibular collateral ligament and biceps femoris and
- Bursa between tendon of popliteus and lateral condyle of tibia.

Q.95 Name the bursa communicating with the knee joint.

- Suprapatellar bursa
- Popliteal bursa
- Bursa deep to medial head of gastrocnemius (Figs 3.13A and B).

Q.96 What is anserine bursa?

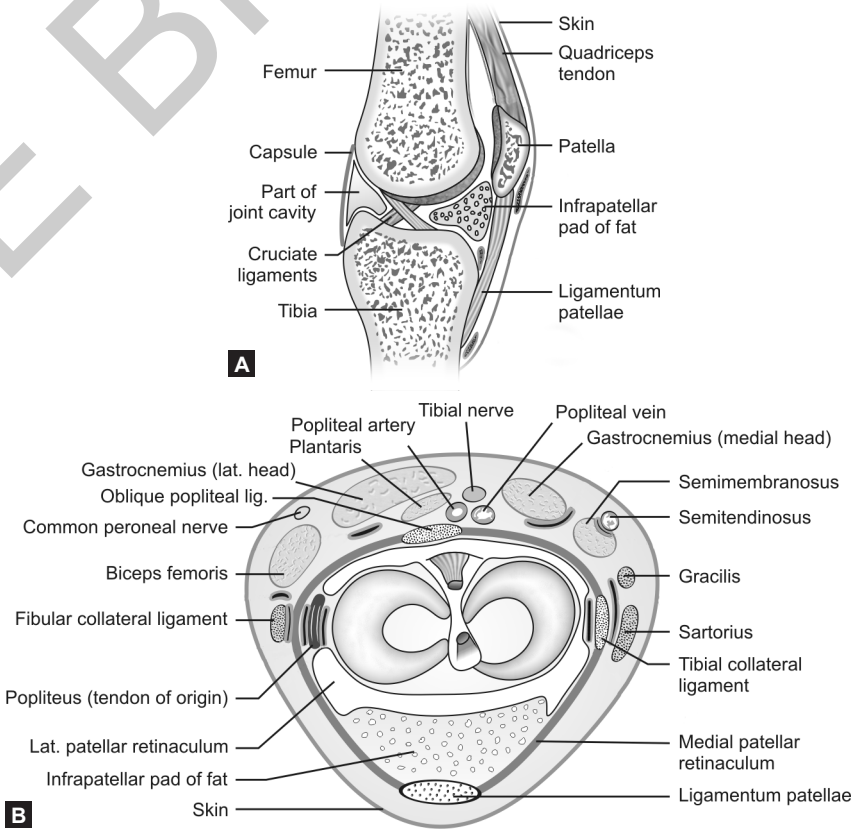
It is bursa with several diverticula which separate the tendons of sartorius, gracilis and semitendinosus from bony surface of tibia.

Q.97 Name the different muscles producing movements of knee joint.

	Principal muscles	*Accessory muscles*
Extension	Quadriceps femoris	Tensor fasciae lata
Flexion	Semitendinosus, Biceps femoris, Semimembranosus.	Sartorius, Gracilis, Popliteus, Gastrocnemius
Medial rotation	Semitendinosus, Semimembranosus	Sartorius, Gracilis
Lateral rotation	Biceps femoris	

Q.98 Name ligaments which become taut in full extension and flexion of the knee joint.

- *In full extension*:
  - Anterior cruciate ligament.
  - Tibial and fibular collateral ligament.
  - Oblique popliteal ligament.
- *In full flexion:*
  - Posterior cruciate ligament.



Figs 3.13A and B: (A) Schematic sagittal section through the knee joint to show some bursae related to the joint, (B) Schematic transverse section to show some bursae around the knee joint

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Q.99 What could cause a tear of the menisci (semilunar cartilages) of the knee joint?
The menisci are usually torn by a twisting force with knee flexed. When the flexed knee is forcibly abducted and externally rotated, the medial meniscus is trapped between the medial condyles of the femur and tibia and is torn.

A severe adduction and internal rotation of the flexed knee may result in a tear of the lateral meniscus. But this injury is less common.

Q.100 Why the tears of medial meniscus are more frequent than that of lateral meniscus?
Because the medial meniscus is more firmly attached to the upper surface of the tibia, capsule and the tibial collateral ligament and therefore, is less able to adapt itself to sudden changes of position. The lateral meniscus on the other hand, is drawn backwards and downwards on the groove on the posterior aspect of the lateral tibial condyle by the medial fibers of popliteus. This prevents, the lateral meniscus from being impacted between the articular surfaces of the femur and the tibia during movements of the knee joint.

Q.101 Why in tear of medial meniscus there is locking of the knee before it is fully extended?
Because the torn segment of the cartilage is displaced and lodges between the femoral and tibial condyles and prevents full extension of the knee.

Q.102 Why the pain of hip joint is referred to the knee?
Because of the common nerve supply of the two joints.

Ankle Joint

Q.103 What type of joint is ankle joint?
Hinge variety of synovial joint.

Q.104 What are the articular surface of ankle joint?
- *From above:*
  - Lower end of tibia with medial malleolus
  - Lateral malleolus and
  - Inferior transverse tibiofibular ligament.
- *From below:* Body of talus.

Q.105 Name the ligaments of ankle joint.
- Fibrous capsule
- *Lateral ligament:* Consists of
  - Anterior talofibular ligament,
  - Posterior talofibular ligament and
  - Calcaneofibular ligament.
- *Medial (deltoid) ligament:* It has
  1. *Superficial part:* Consists of
     - Anterior fibers (tibionavicular)
     - Middle fibers (tibiocalcanean) and
     - Posterior fibers (Posterior tibiotalar).
  2. *Deep part* (Anterior tibiotalar) (Figs 3.14A and B).

Q.106 Name the tendons crossing the deltoid ligament.
- Tibialis posterior and
- Flexor digitorum longus.

Q.107 Name the structures related to ankle joint.
Anteriorly: From medial to lateral side:
- Tibialis anterior
- Extensor hallucis longus
- Anterior tibial vessels
- Deep peroneal nerve
- Extensor digitorum longus and
- Peroneus tertius.

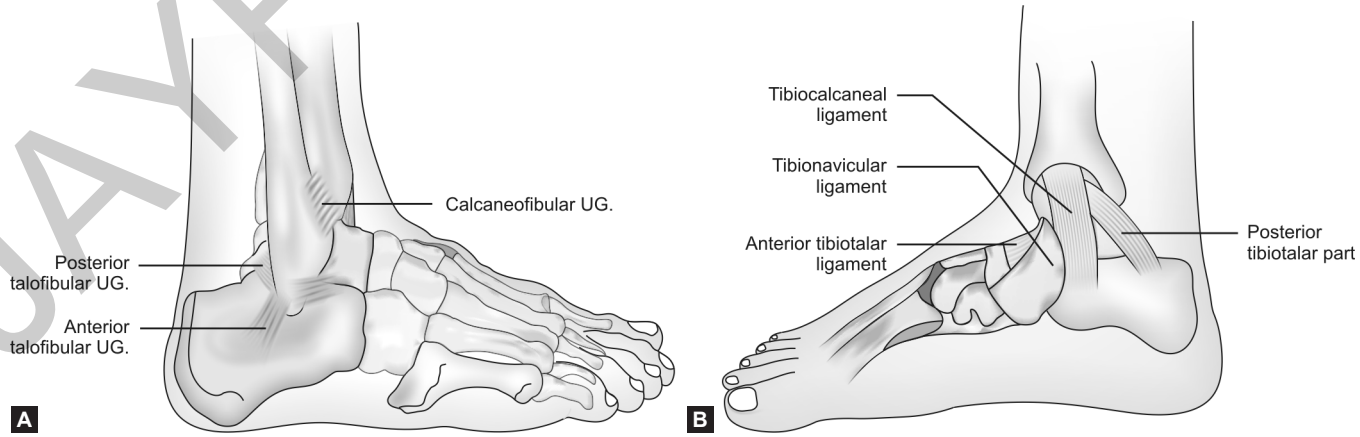
Posteriorly: From medial to lateral side
- Tibialis posterior
- Flexor digitorum longus
- Posterior tibial vessels
- Tibial nerve
- Flexor hallucis longus
- Peroneus brevis and
- Peroneus longus.

Q.108 What are the movements produced at ankle joint?
- Dorsiflexion
- Plantar flexion
- *Accessory movements:* With plantar flexion, slight amount of side to side gliding, abduction and adduction are permitted.

Q.109 What is the axis of movements of the ankle joint?
It is represented by a transverse line drawn across the front of the ankle about 1.25 cm above the tip of the medial malleolus.

Q.110 What is the close-pack position of the ankle joint?
Dorsiflexion is the close-pack position of the joint in which the wider front part of the talus articulates with the mortise formed by the malleoli and lower end of the tibia. In this position, there is maximal congruence of the joint surface and tension of the ligaments.

Q.111 Name the muscles producing movements at ankle joint.
Dorsiflexion:
- *Main muscle:* Tibialis anterior.
- *Accessory muscles:*
  - Externsor digitorum longus,
  - Extensor hallucis longus and
  - Peroneus tertius.



Figs 3.14A and B: (A) Ankle joint: lateral collateral ligament of ankle, (B) Ankle joint: medial ligament of ankle

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Plantar flexion:
- *Main muscles:*
  - Gastrocnemius and
  - Soleus
- *Accessory muscles:*
  - Flexor digitorum longus,
  - Flexor hallucis longus,
  - Tibialis posterior and
  - Plantaris.

Q.112 What is most frequent fracture at the ankle joint?
Pott's fracture, usually produced by an abduction external rotation injury.

Tibiofibular Joints

Q.113 What type of joints are tibiofibular joints?
- *Superior tibiofibular joint:* Plane synovial joint.
- *Lower tibiofibular joint:* Syndesmosis type of fibrous joint.

Q.114 Name the structures passing through interosseous membrane of tibiofibular joint.
- Anterior tibial vessels
- Perforating branch of peroneal artery.

Joints of Foot

Q.115 What do you understand by inversion and eversion of foot?
Inversion: Movement in which medial border of foot is elevated and sole faces medially and inwards.
Eversion: Movement in which lateral border of foot is elevated and sole faces laterally and outwards.

Q.116 Name the joints at which inversion and eversion takes place.
- Subtalar (talocalcaneal) joint and
- Talocalcaneonavicular joint.

Q.117 What is the axis of the inversion and eversion?
Oblique axis which runs forwards, upwards and medially.

It passes between back of calcaneum, sinus tarsi and superomedial aspect of neck of talus.

Q.118 Name the evertors of foot.
- Mainly by, peroneus brevis and longus.
- Also by, peroneus tertius.

Q.119 Name the invertors of foot.
Principal muscles:
- Tibialis anterior and
- Tibialis posterior.

Accessory muscles:
- Flexor hallucis longus and
- Flexor digitorum longus

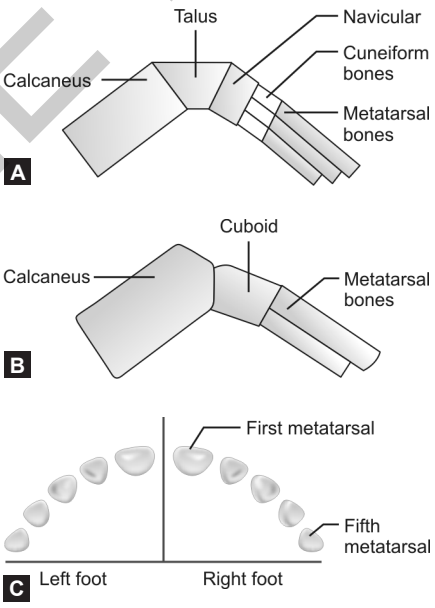
Q.120 Why are the movements of inversion and eversion required in man?
Inversion and eversion of the foot are essential for walking on rough, uneven or sloping surfaces.

Arches of Foot

Q.121 Classify the arches of foot.
- Longitudinal arches: Two
  - Medial and
  - Lateral
- Transverse arch (Figs 3.15A to C).

Q.122 How the arches of foot are maintained?
- By the configuration of articulating bones forming the arch.
- By the ligaments and muscles binding the adjacent bones and ends of an arch.
- By tendons of muscle which act as sling and thus help to suspend the arch from above.
- Plantar aponeurosis by connecting anterior and posterior ends of longitudinal arches like a tie beam.

Q.123 What are the functions of arches of foot?
- Rigid support for the weight of body in standing position.
- As mobile spring board during walking and running.



Figs 3.15A to C: (A) Scheme to show constitution of the medial longitudinal arch of the foot, (B) Scheme to show constitution of the lateral longitudinal arch of the foot, (C) Scheme to show the transverse arch formed by the two feet. Note that each foot forms half of the arch

- As shock absorbers in jumping.
- Protects the soft tissues of sole of foot.

Q.124 How the medial longitudinal arch is formed?
By calcaneum, talus, three cuneiforms and three medial metatarsals. The summit of arch is formed by talus.

Q.125 How the lateral longitudinal arch is formed?
By the calcaneum, cuboid and lateral two metatarsals.

Q.126 How the transverse arch is formed?
By the bases of the five metatarsals and the adjacent cuboid and cuneiforms of both feet.

Q.127 What are the attachments of spring ligament?
It passes from anterior margin of sustentaculum tali of calcaneus to plantar surface of navicular bone.

Q.128 What are the attachments of long plantar ligament?
It is attached posteriorly to plantar surface of calcaneus in front of lateral and medial tubercles and anteriorly to plantar surface of cuboid distal to groove for peroneus longus.

Q.129 Which structures maintain the medial longitudinal arch?
The bony configuration do not contribute to the maintenance of this arch.
- *Ligaments:*
  - The medial part of the plantar aponeurosis acts as a tie beam.
  - The plantar calcaneonavicular ('spring') ligament supports head of talus and forms intersegmental ties (connect adjacent bones).
- *Muscles:*
  - Medial half of the flexor digitorum brevis and abductor hallucis act as tie beams (connect ends of arch).
  - Tibialis anterior, tibialis posterior and flexor hallucis longus act by forming sling and suspend the arch.

Q.130 How the lateral longitudinal arch of the food is maintained?
- *Ligaments:*
  - The short plantar ligament, long plantar ligament and dorsal ligaments form intersegmental ties.
  - Lateral part of the plantar aponeurosis acts as a tie beam.
- *Muscles:*
  - The peroneus longus and peroneus brevis muscles form the slings.

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– Lateral half of the flexor digitorum brevis and abductor digiti minimi act as tie beam.

Q.131 How the transverse arch of the foot is maintained?
Tarsal and metatarsal bones contribute in maintaining the concavity of arch.
- *Ligaments*
  - Ligaments that bind together the cuneiforms and the bases of the metatarsals form intersegmental ties.
  - Superficial and deep transverse metatarsal ligaments act as tie beams.
- *Muscles:*
  - The peroneus longus and tibialis posterior form slings.
  - Abductor hallucis acts as tie beam.

Q.132 What are the deformities of the foot resulting from defects of the longitudinal arches of the foot?
1. *Pes planus (flat foot):* Due to flattening of the longitudinal arch, in particular the medial arch.
2. *Pes cavus (high arched foot):* The congenital form is probably due to shortness of the plantar fascia (aponeurosis). The acquired form can be due to contracture of the intrinsic muscles of the foot.

Q.133 What is the 'talipes deformity' of the foot?
In talipes the foot no longer lies in the plantigrade position. The person walks either on the heels or on the toes. When he walks on the heel the condition is known as *talipes calcaneus* while walking on the toes is known as *talipes equinus*. In both these conditions the foot may be inverted (*varus*) or everted (*valgus*).

Q.134 What is hallux valgus?
In hallux valgus, there is lateral deviation of the great toe at the metatarsophalangeal joint. More common in women than men.

Q.135 What is 'hammer toe'?
The affected toe is hyperextended at metatarsophalangeal and distal interphalangeal joint and flexed at proximal interphalangeal joint.

Thigh

Q.136 What is midinguinal point and what is its importance?
Midinguinal point is a point midway between anterior superior iliac spine and the pubic symphysis. It is an important land-mark. The femoral artery and head of femur lie beneath the midinguinal point.

Q.137 What is Holden's line and what is its importance?
The deep layer of superficial fascia is firmly attached to the deep fascia of thigh along a horizontal line a little lateral to pubic tubercle and extends for about 8 cm laterally. This line of firm attachment is called Holden's line.
Clinical importance: The extravasation of urine between these two layers cannot extend into thigh because of the firm attachment.

Q.138 How is patellar plexus formed?
It is a plexus of nerves in front of patella and upper end of tibia. It is formed by
- Anterior division of lateral and medial cutaneous nerve of thigh
- Intermediate cutaneous nerve of thigh and
- Infrapatellar branch of saphenous nerve.

Q.139 What is housemaid's knee?
Chronic enlargement of prepatellar bursa is known as housemaid's knee because it commonly occurs in housemaid's who have to kneel regularly for sweeping the floor.

Q.140 What is miner's beat knee?
It is acute suppurative prepatellar bursitis in miners.

Q.141 What is clergyman's knee?
It is enlargement of subcutaneous infrapatellar bursa in clergyman.

Q.142 What is iliotibial tract and what are its functions?
The thickening of fascia lata on the lateral side of the thigh is called the iliotibial tract.
Functions:
1. Iliotibial tract stabilizes knee both in extension and partial flexion, i.e., during walking and running.
2. In leaning forwards with slightly flexed knees, it is the only antigravity force to support the knee.

Q.143 What are the modifications of deep fascia of thigh?
- *Saphenous opening*: Oval gap 4 cm below and lateral to pubic tubercle. Upper, lateral and lower margins form a crescentic sharp edge and medially deep part of fascia passes behind the femoral sheath.
- *Cribriform fascia:* Cover the saphenous opening and is pierced by great saphenous vein, two superficial arteries and lymphatics.
- *Iliotibial tract:* Receives insertion of ¾ of gluteus maximus and tensor fasciae latae.

Femoral Triangle

Q.144 Why femoral triangle is known as Scarpa's triangle?
Because it was first described by Antonio Scarpa (1747-1832) in Italy.

Q.145 What are the boundaries of femoral triangle?
It is bounded by (Figs 3.16 to 3.18)
- *Laterally:* Medial border of sartorius.
- *Medially:* Medial border of adductor longus.
- *Base:* Inguinal ligament.
- *Apex:* Directed downwards and is formed by meeting of medial and lateral boundaries.
- *Roof:*
  - Skin,
  - Superficial fascia and
  - Deep fascia.
- *Floor:*
  - Laterally by iliacus and psoas major.
  - Medially by adductor longus and pectineus.

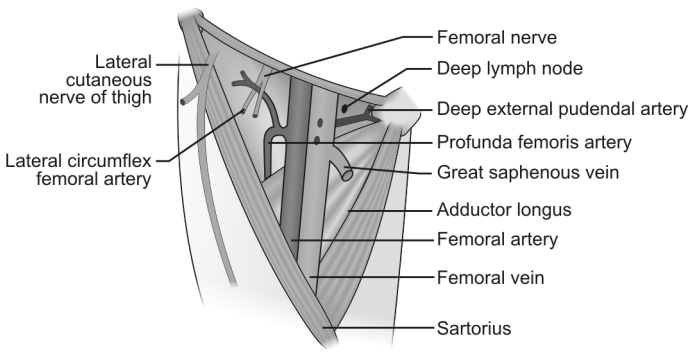


Fig. 3.16: Femoral triangle and its contents

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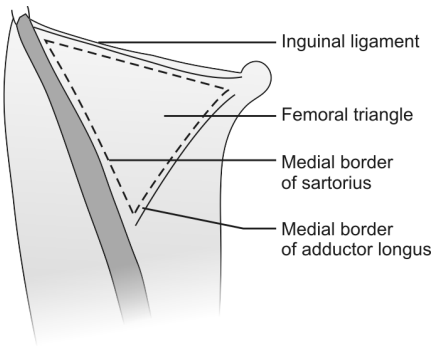


Fig. 3.17: Boundaries of femoral triangle

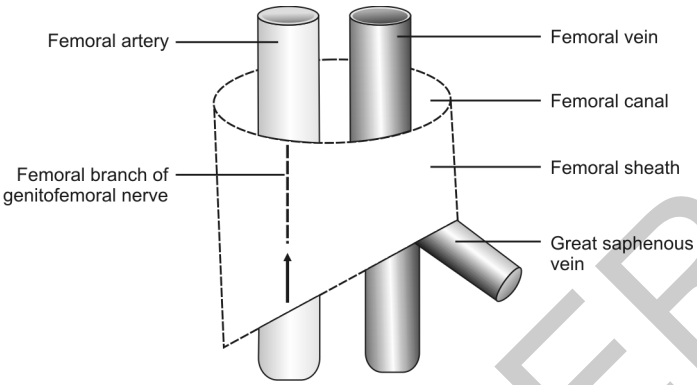


Fig. 3.19: Femoral sheath

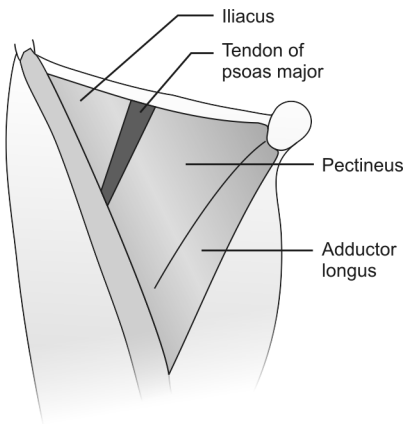


Fig. 3.18: Floor structure of femoral triangle

Q.146 What are the contents of femoral triangle?
- Femoral artery
- Branches of femoral artery:
  - Deep branches: Profunda femoris, deep external pudendal, descending genicular, saphenous and muscular.
  - Superficial branches: Superficial external pudendal, superficial epigastric and superficial circumflex iliac.
- Femoral vein (medial to artery) and its tributaries
- Femoral sheath
- Femoral nerve (lateral to artery)
- Nerve to pectineus
- Femoral branch of genitofemoral nerve
- Lateral cutaneous nerve of thigh and
- Deep inguinal lymph nodes.

Q.147 What is femoral sheath?
It is a funnel shaped fascial sleeve enclosing the upper 1½ inches of the femoral vessels (Fig. 3.19).

Q.148 How is femoral sheath formed?
It is formed by the downward extension of the abdominal fasciae. The anterior wall is formed by fascia transversalis and posterior wall by fascia iliaca.

Q.149 What are the relations of femoral sheath?
Anterior:
- Skin
- Superficial fascia and
- Deep fascia with saphenous opening and great saphenous vein.

Posterior:
- Iliopectineal fascia
- Pectineus and
- Iliopsoas.

Lateral:
- Femoral nerve and
- Iliacus.

Medial:
- Lacunar ligament
- Pectineus and
- Pubic bones.

Q.150 What are the parts of femoral sheath?
The cavity within femoral sheath is divisible in three parts. Lateral part contains femoral artery and femoral branch of genitofemoral nerve. Middle part contains femoral vein and medial part is called femoral canal.

Q.151 What is femoral canal?
It is the medial compartment of the femoral sheath. It is conical and ½ inch wide at base and ½ inch long.

Q.152 What is femoral ring?
The base or upper end of the femoral canal is called the femoral ring.

The femoral ring is filled by condensed extraperitoneal tissue, the *femoral septum*, containing a lymph node and covered by parietal peritoneum.

Q.153 What are the boundaries of the femoral ring?
- *Anterior*: Inguinal ligament.
- *Posterior:* Pectineus and its fascia.
- *Lateral:* Septum separating it from the femoral vein.
- *Medial:* Concave margin of lacunar ligament.

Q.154 What are the contents of femoral canal?
- Lymph node (of Cloquet or of Rosenmuller).
- Lymphatics.
- Areolar tissue.

Q.155 What are the functions of femoral canal?
- It serves as a dead space for expansion of the femoral vein.
- It allows a lymphatic pathway from the lower limb to the external iliac lymph nodes.

Q.156 What structure is drained by lymph node of femoral canal?
Glans penis in the male and clitoris in female.

Q.157 What is the clinical importance of the femoral canal?
The femoral canal is a potential point of weakness in the lower abdominal wall through which a viscus (intestines or urinary bladder) may protrude and give rise to a femoral hernia.

Q.158 Why is a femoral hernia commoner in females?
Because the femoral canal is larger in the females due to the greater width of the pelvis and smaller size of the femoral vessels. In the females, there is a rise in intra-abdominal pressure due to pregnancy predisposing to femoral hernia.

Q.159 Why is strangulation more common in femoral hernia?
Because the neck of the femoral canal is narrow.

Q.160 What is the risk of enlarging the opening of the femoral canal in releasing the strangulation of a femoral hernia?
In order to enlarge the opening of the femoral canal the sharp lateral edge of the lacunar (Gimbernat's) ligament may

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require incision. An abnormal obturator artery may occasionally be present, which passes behind the lacunar ligament and is then in danger of being cut.

Q.161 What are the coverings of femoral hernia?
From within outwards:
- Peritoneum
- Femoral septum
- Femoral sheath
- Cribriform fascia
- Superficial fascia
- Skin.

Adductor Canal

Q.162 What are the boundaries of the adductor canal?
Posteriorly:
- Adductor longus above and
- Adductor magnus below.

Anteriorly: Vastus medialis.

Medially: Sartorius which lies on a fascial sheet extending across the anterior and posterior walls.

Q.163 What is the extent of the adductor canal?
It extends from the apex of the femoral triangle to the tendinous opening in the adductor magnus.

Q.164 What are the contents of the adductor canal?
- Femoral artery
- Femoral vein
- Descending genicular branch of the femoral artery
- Saphenous nerve
- Nerve to vastus medialis
- Obturator nerve.

Popliteal Fossa

Q.165 What are the boundaries of the popliteal fossa?

Superolaterally:	Biceps femoris tendon.
Superomedially:	Semimembranosus and semitendinosus.
Inferomedially:	Medial head of gastrocnemius.
Inferolaterally:	Lateral head of gastrocnemius and plantaris.

See Figure 3.20.

Q.166 Which structures form the floor of the popliteal fossa?
From above downwards:
- The popliteal surface of the femur
- The capsule of the knee joint
- Popliteal fascia.

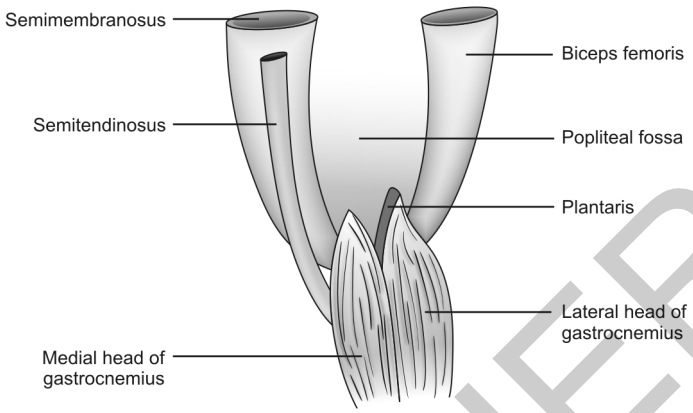


Fig. 3.20: Boundaries of the popliteal fossa

Q.167 What is the relationship between the tibial nerve and popliteal vessels in the popliteal fossa?
From superficial to deep lie, the tibial nerve, popliteal vein and popliteal artery. The popliteal artery is crossed by the popliteal vein and tibial nerve posteriorly from the lateral to medial side.

Q.168 What are the contents of popliteal fossa?
- Popliteal artery and its branches
- Popliteal vein and its tributaries
- Tibial nerve and its branches
- Common peroneal nerve and its branches
- Genicular branch of obturator nerve
- Posterior cutaneous nerve of thigh
- Popliteal lymph nodes
- Fat.

Gluteal Region

Q.169 Name the structures passing through greater sciatic foramen.
- Piriformis
- Structures passing above piriformis
  - Superior gluteal nerve
  - Superior gluteal vessels
- Structures passing below piriformis
  - Inferior gluteal vessels
  - Internal pudendal vessels
  - Inferior gluteal nerve
  - Sciatic nerve
  - Posterior cutaneous nerve of thigh
  - Nerve to quadratus femoris
  - Pudendal nerve
  - Nerve to obturator internus.

Q.170 Name the structures passing through lesser sciatic foramen.
- Tendon of obturator internus
- Internal pudendal vessels
- Pudendal nerve
- Nerve to obturator internus.

Q.171 Name the structures lying under cover of gluteus minimus.
- Reflected head of rectus femoris
- Capsule of hip joint.

Q.172 What are the structures lying under cover of gluteus medius?
- Superior gluteal nerve
- Deep branch of superior gluteal artery
- Gluteus minimus
- Trochanteric bursa of gluteus medius.

Q.173 Name the structures lying under the cover of gluteus maximus.
- *Ligaments*
  - Sacrotuberous
  - Sacrospinous and
  - Ischiofemoral
- *Bones and joints*
  - Ilium
  - Ischium with ischial tuberosity
  - Upper end of femur with greater trochanter
  - Sacrum
  - Coccyx
  - Hip joint
  - Sacroiliac joint.
- *Bursae*
  - Trochanteric bursa of gluteus maximus
  - Bursa over ischial tuberosity and
  - Bursa between gluteus maximus and vastus lateralis.
- *Muscles*
  - Gluteus medius
  - Gluteus minimus
  - Reflected head of rectus femoris
  - Piriformis
  - Obturator internus
  - Superior and inferior gemelli
  - Quadratus femoris
  - Obturator externus
  - Origin of hamstrings
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ISBN 978-93-5152-599-8

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