Clinical Anatomy of the Lower Limb

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Joint Classification (Structure)

- **Fibrous**
  - Synostosis (Cranial Sutures)
  - Gomphoses (Dentoalveolar syndesmosis)
  - **Syndesmosis** (Distal Tibiofibular joint)

- **Cartilaginous**
  - Primary/Synchondrosis (costochondral, physis)
  - **Secondary/ Symphysis** (Pubic symphysis)

- **Synovial**
  - Plane/Gliding (Prox. Tibio fibular, most Intertarsal joints, Tarsometatarsal, Sacroiliac, Patellofemoral)
  - **Hinge** (Talocrural, Interphalangeal, Knee*)
  - Ellipsoid (Metatarsophalangeal)
  - **Ball & Socket** (Hip, Talonavicular)
  - Pivot (Prox. Radio-ulnar, median atlanto-axial)
  - Saddle (1st Metacarpopophalangeal, sternoclavicular)
Joint Classification (Function)

• Synarthrosis
  – Permits very little or no movement

• Amphiarthrosis
  – Slight movement

• Diarthrosis
  – Freely moveable
    • Uniaxial
    • Biaxial
    • Multiaxial
Bone Development

- **Osteogenesis** is a process where the osteoblasts produce bone matrix = osteoid, a substrate that becomes mineralised.

- Derived from **mesenchyme** (primitive fibrous connective tissue).

- All bones form via either of 2 mechanisms of ossification:
  
  - **Intramembranous** (directly from mesenchyme)
    - Flat bones of the skull, mandible and clavicle
  
  - **Endochondral** (mesenchyme $\rightarrow$ cartilage $\rightarrow$ bone)
    - Bone replaces an existing hyaline cartilage model
    - All other bones of the skeleton (including the cranial base)
Osgood-Schlatter Disease

- Tibial tubercle physis closes around 13-15 in girls and 15-19 in boys
- Strong fibrocartilage $\rightarrow$ weaker columnar cartilage
- Stress leads to inflammation (osteochondritis) (left)
- Further injury may lead to avulsion (right)
Apophysitis and Avulsion

- Typical sites of avulsion fracture in the pelvic region (Below Left)
- **Sever's Disease** (Calcaneal apophysitis -below right)
  - Most common source of heel pain (8-13 yrs)
  - Possible avulsion (although rare) can occur at the site of insertion of the tendocalcaneus
Os Coxae

[Diagram showing os coxae with labeled parts such as acetabulum, iliac crest, and sacrotuberous ligament]
Gluteus medius
Gluteus minimus
Greater sciatic foramen above piriformis
Piriformis muscle
Gemellus superior
Obturator internus
Greater sciatic foramen below piriformis
Gemellus inferior
Quadratus femoris
Superficial branch
Deep branch
Superior gluteal artery and vein
Piriformis muscle
Lateral femoral circumflex artery
Medial femoral circumflex artery
Inferior gluteal artery and vein
Fractures of the Femoral Neck

- Common sites of fracture in the elderly
  - Reduced bone density
  - Decreased angle of inclination

Common Sites
- Subcapital
- Cervical
- Basal
- Pertrochanteric

See - Moore, Dalley & Agur p. 659
Blood Supply

- Retinacular arteries
- Diaphysis (nutrient artery)
- Artery to head of femur (negligible in adult)

Medial Circumflex Femoral
- Provides most of retinacular arteries
- Travels posteriorly between Pectineus and Iliopsoas

Lateral Circumflex Femoral
- Provides fewer retinacular arteries due to thick section of joint capsule
- Deep to Sartorius and Rectus Femoris
Avascular Necrosis of Femoral Head

• (a) **Pertrochanteric fracture** does not inhibit retinacular blood supply - avascular necrosis does not occur

• (b) **Subcapital fracture** cuts off most of the retinacular supply to the femoral head - avascular necrosis is common
Femur

Head & Neck
Greater and Lesser Trochanters
Gluteal Tuberosity
Linea Aspera
Femoral Condyles
Anterior - Hip Flexion, Knee Extension
Femoral Nerve (L2-L4)

Medial - Hip Adduction
Obturator Nerve (L2-L4)
• **Posterior Compartment**
  - Hip Extension
  - Knee Flexion
  - Sciatic Nerve (L4-S3)
    - By Tibial division except for Short Head of BF (Common Fibular Division)
Distal Femoral Fracture

- Fracture immediately superior to the femoral condyles can be dangerous and difficult to treat
- **Gastrocnemius** draws the bone posteriorly
- The sharp proximal edge of this distal fragment may rupture the **popliteal artery** which lies directly posterior to it.

See - Moore, Dalley & Agur p. 527
Periarticular Genicular Anastamosis

Lateral Circumflex Femoral
- Descending branch

Femoral
- Descending Genicular
  - Musculoarterial branch
  - Saphenous branch

Popliteal
- Superior Lateral Genicular
- Superior Medial Genicular
- Inferior Lateral Genicular
- Inferior Medial Genicular
- Middle Genicular

Anterior Tibial
- Recurrent branch
The Knee Joint Complex

• Modified Hinge, synovial joint

• Comprised of three articulations
  – Two femorotibial articulations (lateral & medial)
  – Femoropatellar articulation (plane, synovial)

• Joint stability due to
  – Surrounding muscles & their tendons
  – Ligaments connecting femur & tibia
Structure of the Knee Joint

- Patellar surface
- Groove for lateral meniscus
- Groove for meniscus
- Notch for anterior cruciate ligament
- Posterior cruciate ligament
- Anterior cruciate ligament
- Medial meniscus
- Coronary ligament (cut edge)
- Tibial collateral ligament
- Sartorius tendon
- Biceps femoris, extension to deep fascia of leg
- Superior facets
- Middle facets
- Inferior facets
- Apex of patella
- Nonarticular area
- Medial vertical facet
- Base of patella
- Quadriceps tendon
- Lateral meniscus
- Fibular collateral ligament
- Anterior ligament of fibular head
- Medial meniscus
- Transverse ligament of knee
- Posterior ligament of fibular head
- Posterior meniscofemoral ligament
- Quadriceps tendon
- Patellar ligament
- Lig. patellar
Movement at the Knee

- Extension
- Flexion
- Medial rotation of leg, knee joint flexed
- Lateral rotation of leg, knee joint flexed
“Unhappy Triad”

- Ruptured ACL
- Ruptured TCL (MCL)
- Torn medial meniscus

See - Moore, Dalley & Agur p. 662
ACL - Mechanism of injury

• Noncontact mechanism — The typical mechanism for a noncontact ACL injury involves a running or jumping athlete who suddenly decelerates and changes direction (eg, cutting) or pivots in a way that involves rotation or lateral bending (ie, valgus stress) of the knee.

• Contact mechanism — Contact-related ACL injuries usually occur from a direct blow causing hyperextension or valgus stress to the knee.
ACL Rupture

- Related to hyperextension or medial rotation of the femoral condyles on the tibial plateau

See - Moore, Dalley & Agur p. 663
ACL Reconstruction

- **Autograft**
  - Semitendinosus
    (sometimes with Gracilis)
  - Patellar tendon

- **Grafts are inserted through drilled tunnels in the tibia and femur**

- **Fixation with screws**
Posterior Compartment of Leg

Plantar Flexion
Inversion

Tibial Nerve

Posterior Tibial artery
Fibular Artery
Anterior Compartment

Dorsiflexion

Anterior Tibial Artery

Deep Fibular Nerve
• Lateral Compartment

• Eversion

• Plantar Flexion

• Superficial Fibular Nerve
Common Fibular Nerve

- Common fibular nerve is vulnerable to injury as it winds around the head of the fibula.
- Foot drop and inversion result.
- Loss of sensation over the anterior and lateral aspects of the leg and foot.

See - Moore, Dalley & Agur p. 605
Ankle Sprains

- Lateral ligament sprains are much more common due to the weaker ligament in comparison the medial (deltoid) ligament.

- The anterior talofibular ligament is vulnerable with forced inversion of the foot during plantar flexion.

See - Moore, Dalley & Agur p. 665
Great Saphenous Vein

• Varicose Veins
  • dilation of the vessel accompanied by valvular insufficiency
  • Blood allowed to flow inferiorly

• Saphenous Vein Grafts
  • Often used for CABG surgery

  1. Readily accessible
  2. Distance between tributaries and perforating veins allow usable lengths to be harvested
  3. High percentage of muscular & elastic fibres

See - Moore, Dalley & Agur p. 540
References


