Chapter 6: Lower Extremity
Hip Joint

I. Osteology

A. Acetabulum
  - Cup shaped bony structure formed by the fusion of the ileum, pubis and ischium
  - Socket portion of the ball-and-socket hip joint
  - Outer rim covered with a fibrocartilage labrum that deepens the articular socket and helps stabilize the joint
    - Does not completely encircle the rim of the acetabulum
    - Inferiorly creates an acetabular notch, which is bridged by the transverse acetabular ligament forming a foramen for vessels and nerves

B. Femur
  - Head forms the ball portion of the ball-and-socket joint
  - Articulates with the acetabulum
  - Both femoral head and acetabulum are covered with articular cartilage
  - Provides insertion points for many muscles that move the hip joint
  - Femoral neck angle
    - Formed between the longitudinal axes of the shaft and neck of the femur
    - Normally 150° in newborns and 120°-135° in adults (AKA coxa norma)
    - Angle > 135° is called coxa valga and results in a more upward straight femoral neck
    - Angle < 120° is called coxa vara and results in a horizontal femoral neck
    - Changes in this angle can result from a variety of pathologies such as a hip dislocation or changes to trabecular pattern within the bone

II. Joint Capsule and Ligaments

A. Fibrous Joint Capsule
  - Attachments
    - Proximal: outer rim of the acetabulum and the transverse acetabular ligament
    - Distal: neck of the femur
    - Anterior: intertrochanteric line and the base of the greater trochanter
    - Posterior: intertrochanteric crest
  - Reinforced by the following ligaments:
    - Iliofemoral ligament anteriorly
    - Ischiofemoral ligament posteriorly
    - Pubofemoral ligament inferiorly
B. Iliofemoral Ligament
   ▪ Arises from the anterior inferior iliac spine and the acetabular rim
   ▪ Attaches distally to the intertrochanteric line of the femur
   ▪ Inverted Y-shape
   ▪ Prevents hyperextension and lateral rotation of the hip joint while standing

C. Ischiofemoral Ligament
   ▪ Attaches to the body of the ischium and the greater trochanter of the femur
   ▪ Limits extension and medial rotation of the thigh

D. Pubofemoral Ligament
   ▪ Attaches to the superior pubic rami and the intertrochanteric line of the femur
   ▪ Triangular shape
   ▪ Limits extension and abduction of the hip joint

E. Ligamentum Teres
   ▪ Attaches to the floor of the acetabular fossa and the fovea capitis femoris on the femoral head
   ▪ Carries the artery of the head of the femur (foveolar artery)
     - Originates from the acetabular branch of the posterior branch of the obturator artery
     - Provides a significant percentage of blood supply to the femoral head in children

III. Muscle Movements

Table 6.3: Muscles that Move the Hip Joint

<table>
<thead>
<tr>
<th>Movements</th>
<th>Muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>Iliopsoas, rectus femoris and sartorius</td>
</tr>
<tr>
<td>Extension</td>
<td>Gluteus maximus, semimembranosus, semitendinosus and biceps femoris</td>
</tr>
<tr>
<td>Abduction</td>
<td>Gluteus medius, gluteus minimus and deep gluteals</td>
</tr>
<tr>
<td></td>
<td>(piriformis, superior and inferior gemelli)</td>
</tr>
<tr>
<td>Adduction</td>
<td>Adductors longus, brevis and magnus; pectineus and gracilis</td>
</tr>
<tr>
<td>Lateral Rotation</td>
<td>Biceps femoris, gluteus maximus and deep gluteals</td>
</tr>
<tr>
<td></td>
<td>(piriformis, superior and inferior gemelli)</td>
</tr>
<tr>
<td>Medial Rotation</td>
<td>Gluteus medius and minimus, semitendinosus and semimembranosus</td>
</tr>
</tbody>
</table>
**IV. Blood Supply**

A. **Medial Circumflex Femoral Artery**
   - Branch of femoral or profunda femoris artery
   - Provides majority of the blood supply to the femoral head and hip joint
   - Damage can result in serious risk of ischemia and eventual osteonecrosis of the femoral head
   - Forms an anastomosis with branches of the superior and inferior gluteal arteries

B. **Lateral Circumflex Femoral Artery**
   - Branch of femoral or profunda femoris artery
   - Must penetrate through the thick iliofemoral ligament, which limits the amount of blood supply it provides to the femoral head and hip joint
   - Ascending branches form a vascular ring with branches of the medial femoral circumflex artery around the femoral neck
   - Forms an anastomosis with branches of superior gluteal artery

C. **Additional Vessels**
   - Artery of the head of the femur
   - Superior and inferior gluteal arteries

**V. Clinical Pearls**

A. **Hip Dislocation**
   - Femoral head dissociates from the acetabular cup
   - Mechanism of injury: high energy trauma, commonly in motor vehicle accidents (dashboard injury)
   - Presentation: acute hip pain, inability to bear weight and physical deformity of the hip
   - Posterior dislocation most commonly presents with the thigh in the following position: adducted, flexed and internally rotated
   - Often occurs with associated injuries such as fractures of the head and/or neck of the femur
   - Complications: sciatic nerve injuries, arterial injury and osteonecrosis
   - Diagnosis: X-ray
   - Treatment: emergent closed reduction or surgical reduction
B. **Osteoarthritis**
- Loss of articular cartilage at the hip joint
- Increased risk in elderly individuals and those with previous trauma to the hip joint
- Presentation: chronic hip and/or groin pain that increases with activity
- Physical exam: decreased range of motion of the hip, especially internal rotation
- Diagnosis: X-ray showing joint space narrowing, sclerosis, subchondral cysts and osteophyte formation
- Treatment: NSAIDs, corticosteroid injections and total hip arthroplasty

C. **Femoral Neck Fracture**
- Mechanism of injury: high energy trauma in young adults and falls in elderly
- Presentation: pain in the groin and/or hip regions that can radiate along the medial thigh
- Risk of osteonecrosis to the femoral head
- Diagnosis: X-ray
- Treatment: surgery

D. **Osteonecrosis (AVN)**
- Ischemic necrosis of the bone
- Presentation: acute onset of hip pain that is exacerbated by weight bearing
- Physical exam: no signs of inflammation (swelling, erythema and temperature change), limited internal rotation and abduction
- Labs: normal inflammatory markers (ESR, CRP)
- Associated conditions: femoral head fractures, sickle cell disease (thrombotic occlusion), prolonged steroid therapy, Systemic Lupus Erythematosus (vasculitis) and alcoholism
- Diagnosis: normal X-ray, confirmed with MRI
- Treatment: observation and limited activity, or surgery including total hip arthroplasty

E. **Septic Hip**
- Intra-articular infection that most commonly occurs in children and is a surgical emergency
- Most common pathogens: *Staphylococcus aureus*
- Presentation: acute onset hip pain, inability to bear weight and fever
- Physical exam: severe pain with passive range of motion, signs of inflammation including swelling, erythema and increased skin temperature
  - Hip rests in a position of flexion, abduction and external rotation because this produces the maximum hip capsular volume
- Diagnosis: X-ray, ultrasound, elevated WBC, elevated ESR and CRP, confirmed with hip aspiration
  - Send aspirate for gram stain, culture and WBC
- Treatment: antibiotics and/or surgical irrigation and debridement

F. **Legg-Calve-Perth Disease**
- Impaired blood flow to the head of the femur resulting in ischemia and eventually osteonecrosis that halts bone growth
- Common patient: boys ages three to ten years old
- Presentation: hip, thigh or knee pain; limping; antalgic gait
- Physical exam: decreased range of motion, especially internal rotation and abduction
- Diagnosis: X-ray
- Treatment: traction, reduced weight-bearing and surgery
G. Slipped Capital Femoral Epiphysis

- Fracture through the physis (growth plate) of the proximal femur causing the top of the femoral head (epiphysis) to slip along the growth plate
- Common patient: adolescent obese boys
- Associated with endocrine disorders (e.g. thyroid, pituitary)
- Presentation: hip, groin or knee pain; limping; antalgic gait
- Physical exam: decreased range of motion especially internal rotation and abduction, the hip externally rotates when flexed
- Diagnosis: X-ray
- Treatment: percutaneous pinning of the femoral head