Chapter 9
The Hip Joint and Pelvic Girdle

The Hip Joint and Pelvic Girdle

• Hip joint (acetabular femoral)
  – relatively stable due to
    • bony architecture
    • strong ligaments
    • large supportive muscles
  – functions in weight bearing & locomotion
    • enhanced significantly by its wide range of motion
    • ability to run, cross-over cut, side-step cut, jump, & many other directional changes

Bones

• Ball & socket joint
  – Head of femur connecting with acetabulum of pelvic girdle
  – Pelvic girdle
    • right & left pelvic bone joined together posteriorly by sacrum
    • pelvic bones are ilium, ischium, & pubis
  – Femur
    • longest bone in body

Bones

• Sacrum
  • extension of spinal column with 5 fused vertebrae
  • extending inferiorly is the coccyx
• Pelvic bone - divided into 3 areas
  • Upper two fifths = ilium
  • Posterior & lower two fifths = ischium
  • Anterior & lower one fifth = pubis
Bones

• Bony landmarks
  – Anterior pelvis - origin for hip flexors
    • tensor fasciae latae - anterior iliac crest
    • sartorius - anterior superior iliac spine
    • rectus femoris - anterior inferior iliac spine

• Bony landmarks
  – Lateral pelvis - origin for hip abductors
    • gluteus medius & minimus - just below iliac crest

• Bony landmarks
  – Medially - origin for hip adductors
    • adductor magnus, adductor longus, adductor brevis, pectineus, & gracilis - pubis & its inferior ramus

• Bony landmarks
  – Posteriorly – origin for hip extensors
    • gluteus maximus - posterior iliac crest & posterior sacrum & coccyx
    – Posteroinferiorly - origin for hip extensors
      • hamstrings - ischial tuberosity
Bones

- **Bony landmarks**
  - Proximal thigh - insertion for short muscles of hip
    - gluteal muscles & most of the six deep external rotators - greater trochanter
    - iliopsoas - lesser trochanter
  - Proximal thigh - origin for 3 knee extensors
    - three vasti muscles of quadriceps – anteriorly
    - hip adductors - linea aspera

- **Bony landmarks**
  - Patella – insertion for all 4 quadriceps muscles
  - Proximal tibia or fibula – insertion for remainder of hip muscles
    - sartorius, gracilis, & semitendinosus - upper anteromedial tibial surface just below medial condyle after crossing knee posteromedially
    - semimembranosus - posteromedially on medial tibial condyle

Bones

- **Bony landmarks**
  - Proximal tibia or fibula – insertion for remainder of hip muscles
    - biceps femoris – laterally, primarily on fibula head with some fibers attaching on lateral tibial condyle
    - iliotibial tract of tensor fasciae latae – anterolaterally on Gerdy's tubercle of tibia

Joints

- **Anteriorly**
  - Two pelvic bones join to form symphysis pubis, amphiarthrodial

- **Posteriorly**
  - Sacrum is between the 2 pelvic bones & forms the sacroiliac joints
  - Strong ligaments unite these bones to form rigid, slightly movable joints
Joints

- Large & heavy bones covered by thick, heavy muscles
- Very minimal oscillating-type movements occur in sacroiliac joints, as in walking
- Body movements usually involve entire pelvic girdle & hip joints
- In walking, hip flexion & extension occur with pelvic girdle rotation, forward in hip flexion & backward in hip extension

Joints

- Jogging & running result in faster movements & greater range of movement
- Pelvic rotation increases the length of stride in running; in kicking it results in a greater distance or more speed to the kick

Joints

- Acetabulofemoral joint - most mobile joints of body (except glenohumeral)
  - Multiaxial arrangement
  - Bony architecture provides stability
    - relatively few hip joint subluxations & dislocations
  - Enarthrodial-type joint
  - Femoral head inserting into acetabulum
  - Reinforced by extremely strong & dense ligamentous capsule, especially anteriorly

Joints

- Acetabulofemoral joint
  - Iliofemoral or Y ligament – located anteriorly, prevents hyperextension
  - Pubofemoral ligament - located anteromedially & inferiorly, limits excessive extension & abduction
Joints

- Acetabulofemoral joint
  - Teres ligament - attaches from deep in acetabulum to a depression in femoral head, slightly limits adduction
  - Ischiofemoral ligament – located posteriorly, extends from ischium to trochanteric fossa of femur, limits internal rotation

Joints

- Some disagreement about exact possible range of each movement in hip joint
  - 0 to 130 degrees of flexion
  - 0 to 30 degrees of extension

Joints

- 0 to 35 degrees of abduction
- 0 to 30 degrees of adduction

Joints

- 0 to 45 degrees of internal rotation
- 0 to 50 degrees of external rotation
Joints

- Pelvic girdle moves back & forth within 3 planes for a total of 6 different movements
  - All pelvic girdle rotation results from motion at one or more locations
    - right hip
    - left hip
    - lumbar spine

Motions accompanying pelvic rotation

<table>
<thead>
<tr>
<th>Pelvic Rotation</th>
<th>Lumbar Spine Motion</th>
<th>Right Hip Motion</th>
<th>Left Hip Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior rotation</td>
<td>Extension</td>
<td>Flexion</td>
<td>Flexion</td>
</tr>
<tr>
<td>Posterior rotation</td>
<td>Flexion</td>
<td>Extension</td>
<td>Extension</td>
</tr>
<tr>
<td>Right lateral rotation</td>
<td>Right lateral flexion</td>
<td>Adduction</td>
<td>Abduction</td>
</tr>
<tr>
<td>Left lateral rotation</td>
<td>Left lateral flexion</td>
<td>Abduction</td>
<td>Adduction</td>
</tr>
<tr>
<td>Right transverse rotation</td>
<td>Left transverse rotation</td>
<td>Internal rotation</td>
<td>External rotation</td>
</tr>
<tr>
<td>Left transverse rotation</td>
<td>Right transverse rotation</td>
<td>External rotation</td>
<td>Internal rotation</td>
</tr>
</tbody>
</table>

Movements

- Anterior & posterior pelvic rotation
  - sagittal or anteroposterior plane
- Right & left lateral rotation
  - lateral or frontal plane
- Right transverse (clockwise) rotation & left transverse (counterclockwise) rotation
  - horizontal or transverse plane of motion

- Hip flexion
  - movement of femur straight anteriorly toward pelvis
- Hip extension
  - movement of the femur straight posteriorly away from the pelvis; sometimes referred to as hyperextension
Movements

• Hip abduction
  – movement of femur laterally to side away from midline

• Hip adduction
  – movement of femur medially toward midline

• Hip external rotation
  – rotary movement of femur laterally around its longitudinal axis away from midline; lateral rotation

• Hip internal rotation
  – rotary movement of femur medially around its longitudinal axis toward midline; medial rotation

• Hip diagonal abduction
  – movement of femur in a diagonal plane away from midline of body

• Hip diagonal adduction
  – movement of femur in a diagonal plane toward midline of body

• Anterior pelvic rotation
  – anterior movement of upper pelvis; iliac crest tilts forward in a sagittal plane; anterior tilt

• Posterior pelvic rotation
  – posterior movement of upper pelvis; iliac crest tilts backward in a sagittal plane; posterior tilt
Movements

- **Left lateral pelvic rotation**
  - In frontal plane, left pelvis moves inferiorly in relation to right pelvis; either left pelvis rotates downward or right pelvis rotates upward; left lateral tilt
- **Right lateral pelvic rotation**
  - In frontal plane, right pelvis moves inferiorly in relation to left pelvis; either right pelvis rotates downward or left pelvis rotates upward; right lateral tilt

Movements

- **Left transverse pelvic rotation**
  - In horizontal plane, pelvis rotates to body’s left; right iliac crest moves anteriorly in relation to left iliac crest, which moves posteriorly
- **Right transverse pelvic rotation**
  - In horizontal plane, pelvis rotates to body’s right; left iliac crest moves anteriorly in relation to right iliac crest, which moves posteriorly

Muscles

- **Seven two-joint muscles have one action at hip & another at knee**


Muscles

- **Muscles involved in hip & pelvic girdle motions depend largely on direction of movement and position of body in relation to earth & gravitational forces**
- **Body part that moves most will be the part least stabilized**
  - Standing on both feet & contracting hip flexors, the trunk & pelvis rotate anteriorly
  - Lying supine & contracting hip flexors, the thighs move forward into flexion on the stable pelvis
Muscles

- Hip flexor muscles used in moving thighs up toward trunk
- Hip extensor muscles used eccentrically when pelvis & trunk move downward slowly on the femur and concentrically when trunk is raised on femur (rising to standing position)
- In downward phase of knee-bend exercise, movement at hips & knees is flexion
  - muscles primarily involved - hip & knee extensors in eccentric contraction

Muscles

- Hip joint & pelvic girdle muscles
  - Anterior - primarily hip flexion
    - Iliopsoas
    - Pectineus
    - Rectus femoris
    - Sartorius

Muscles

- Medial - primarily hip adduction
  - Adductor brevis
  - Adductor longus
  - Adductor magnus
  - Gracilis

Muscles

- Posterior - primarily hip extension
  - Gluteus maximus
  - Biceps femoris
  - Semitendinosus
  - Semimembranosus
  - External rotators
Muscles

- Lateral - primarily hip abduction
  - Gluteus medius
  - Gluteus minimus
  - External rotators
  - Tensor fasciae latae

Muscles

- Pelvic muscles acting on hip joint
  - Iliac region - iliopsoas muscle flexes hip
    - Iliacus
    - Psoas major
    - Psoas minor

Muscles

- Pelvic muscles acting on hip joint
  - Gluteal region - extend & rotate hip
    - Gluteus maximus
    - Gluteus medius
    - Gluteus minimi
    - Tensor fascia latae
    - Six deep external rotators - piriformis, obturator externus, obturator internus, gemellus superior, gemellus inferior, & quadratus femoris

Muscles

- Thigh - divided into 3 compartments by intermuscular septa
Muscles

– Anterior compartment – primarily knee extensors
  • Rectus femoris
  • Vastus medialis
  • Vastus intermedius
  • Vastus lateralis
  • Sartorius
– Posterior compartment - hamstring group
  • Biceps femoris
  • Semitendinosus
  • Semimembranosus

Muscles

– Medial compartment - primarily adductors
  • Adductor brevis
  • Adductor longus
  • Adductor magnus
  • Pectineus
  • Gracilis

Nerves

• All hip & pelvic girdle muscles - innervated from lumbar & sacral plexus (lumbosacral plexus)

Nerves

– Lumbar plexus - formed by anterior rami of spinal nerves L1 through L4 & some fibers from T12
  • Lower abdomen and the anterior & medial portions of lower extremity
Nerves

- Sacral plexus - formed by anterior rami of L4, L5, & S1 through S4
  - Lower back, pelvis, perineum, posterior surface of thigh & leg, and dorsal & plantar surfaces of foot

Nerves

- Lumbar plexus - major nerves
  - Femoral n. - anterior muscles
    - Arises from posterior division of lumbar plexus
    - Iliopsoas
    - Rectus femoris
    - Vastus medialis
    - Vastus intermedius
    - Vastus lateralis
    - Pectineus
    - Sartorius
    - Sensation to anterior & lateral thigh and medial leg & foot

Nerves

- Lumbar plexus - major nerves
  - Obturator nerve
    - Arises from anterior division of lumbar plexus
    - Adductor brevis
    - Adductor longus
    - Adductor magnus
    - gracilis
    - Obturator externus
    - Sensation to medial thigh

Nerves

- Sacral plexus
  - Superior gluteal nerve
    - arises from L4, L5, & S1 to innervate gluteus medius, gluteus minimus, & tensor fasciae latae
  - Inferior gluteal nerve
    - arises from L5, S1, & S2 to supply gluteus maximus
  - Branches from sacral plexus
    - piriformis (S1, S2), gemellus superior (L5, S1, S2), gemellus inferior & obturator internus (L4, L5, S1, S2), & quadratus femoris (L4, L5, S1)
Nerves

- Sacral plexus
  - Sciatic nerve
    - Tibial division
      - Semitendinosus, semimembranosus, biceps femoris (long head) & adductor magnus
      - Sensation for posterolateral lower leg & plantar aspect of foot
    - Common peroneal (fibular) division
      - Sensation to anterolateral lower leg & dorsum of foot

Iliopsoas Muscle

- Flexion of hip
- External rotation of femur
- Transverse pelvic rotation contralaterally when ipsilateral femur is stabilized

Sartorius Muscle

- Flexion of hip
- Flexion of knee
- External rotation of thigh as it flexes hip & knee
- Abduction of hip
- Anterior pelvic rotation

Rectus Femoris Muscle

- Flexion of hip
- Extension of knee
- Anterior pelvic rotation
**Tensor Fasciae Latae Muscle**
- Abduction of hip
- Flexion of hip
- Tendency to rotate hip internally as it flexes
- Anterior pelvic rotation

**Gluteus Maximus Muscle**
- Extension of hip
- External rotation of hip
- Upper fibers assist in abduction
- Lower fibers assist in adduction
- Posterior pelvic rotation

**Gluteus Medius Muscle**
- Abduction of hip
- Internal rotation & flexion (anterior fibers)
- External rotation & extension (posterior fibers)

**Gluteus Minimus Muscle**
- Abduction of hip
- Internal rotation as femur abducts
- Flexion of hip
**Six Deep Lateral Rotator Muscles**

- Piriformis
- Gemellus superior
- Gemellus inferior
- Obturator externus
- Obturator internus
- Quadratus femoris

**Semitendinosus Muscle**

- Flexion of knee
- Extension of hip
- Internal rotation of hip
- Internal rotation of flexed knee
- Posterior pelvic rotation

**Semimembranosus Muscle**

- Flexion of knee
- Extension of hip
- Internal rotation of hip
- Internal rotation of flexed knee
- Posterior pelvic rotation

**Biceps Femoris Muscle**

- Flexion of knee
- Extension of hip
- External rotation of hip
- External rotation of flexed knee
- Posterior pelvic rotation
Adductor Brevis Muscle
- Adduction of hip
- External rotation as it adducts hip
- Assists in flexion of hip

Adductor Longus Muscle
- Adduction of hip
- Assists in flexion of hip

Adductor Magnus Muscle
- Adduction of hip
- External rotation as hip adducts
- Extension of hip

Pectineus Muscle
- Flexion of hip
- Adduction of hip
- External rotation of hip
Gracilis Muscle

- Adduction of hip
- Weak flexion of knee
- Internal rotation of hip
- Assists with flexion of hip

Hip Flexion

- Agonists
  - Psoas
  - Iliacus (Iliopsoas)
  - Rectus Femoris
  - Pectineus
    - Sartorius
    - Tensor Fasciae Latae

Hip Extension

- Agonists
  - Gluteus Maximus
  - Biceps Femoris (Long Head)
  - Semitendinosus
  - Semimembranosus

Hip Abduction

- Agonists
  - Gluteus Medius
  - Tensor Fasciae Latae
  - Gluteus Maximus
  - Gluteus Minimus
Hip Adduction
- Agonists
  - Adductor Brevis
  - Adductor Longus
  - Adductor Magnus
  - Gracilis

Hip Internal Rotation
- Agonists
  - Gluteus Minimus
  - Gluteus Medius
  - Tensor Fasciae Latae

Hip External Rotation
- Agonists
  - Gluteus Maximus
  - Six Deep External Rotators