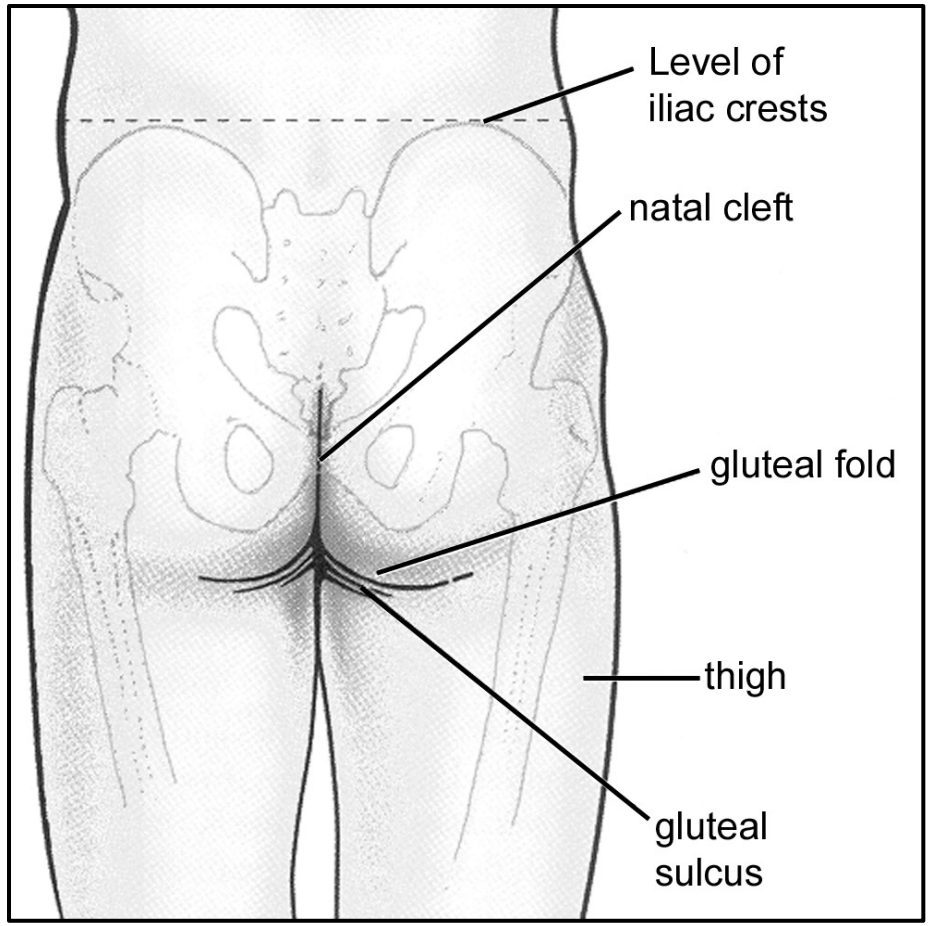
PowerPoint Handout: Lab 4, Gluteal Region, Posterior Thigh, and Hip

Gluteal Region: Boundaries

The gluteal region is a large transition zone between the trunk and lower extremity. Several important branches of the sacral plexus supply or pass through the gluteal region, including the sciatic nerve. The gluteal region is defined by the following boundaries.

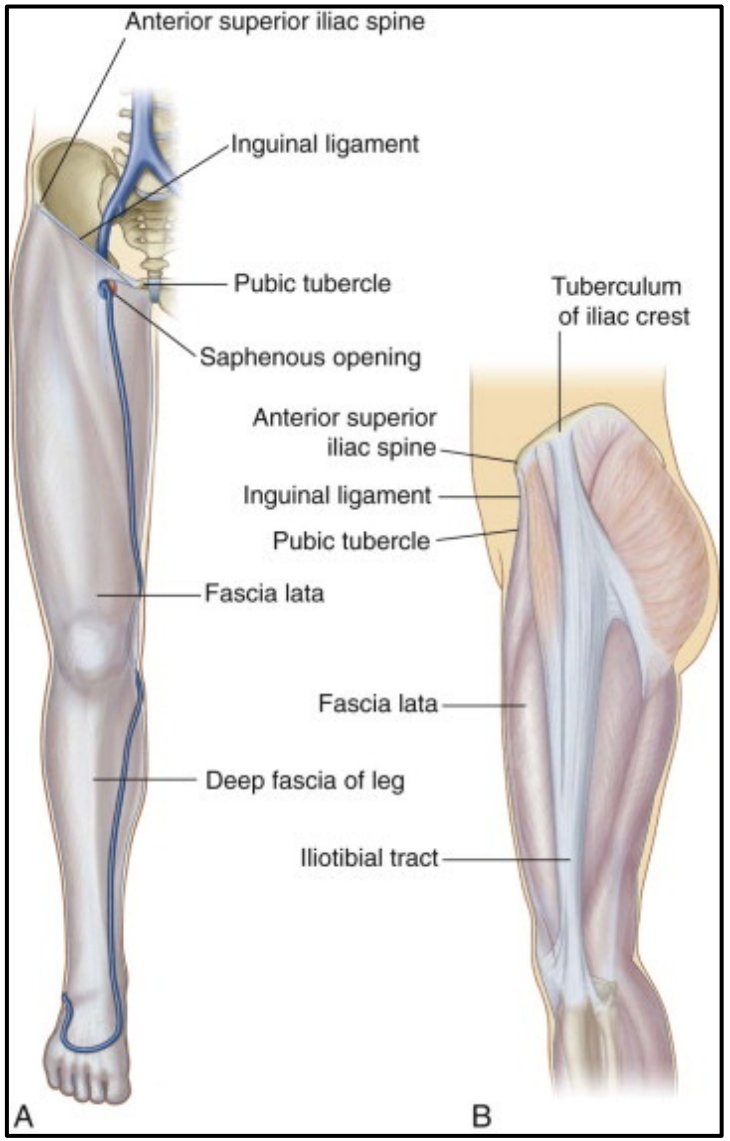
- Superiorly: **iliac crest**
- Medially: the **natal cleft** (cleft between the buttocks sometimes called intergluteal cleft),
- Inferiorly : the **gluteal sulcus** (crease inferior to the gluteal fold).

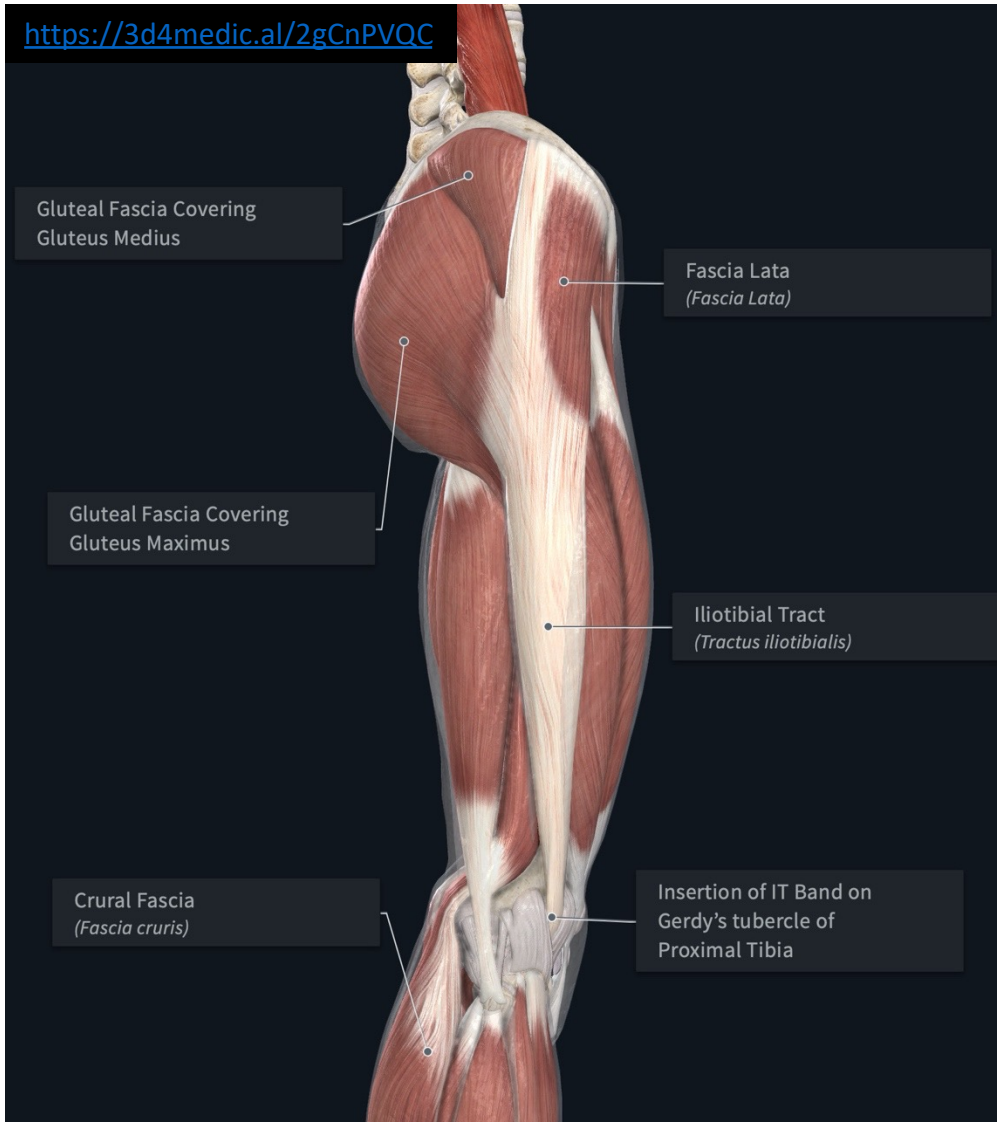
The **gluteal fold** is formed by the inferior border of the gluteus maximus muscle.



Gluteal Fascia

- The superficial fascia of the gluteal region is typical fatty fascia that is continuous with the superficial fascia of the abdomen and thigh.
- The deep fascia of the gluteal region is called **gluteal fascia, which**, is continuous inferiorly with the fascia lata. Gluteal fascia splits to cover the superficial and deep surfaces of the gluteus maximus muscle, which encloses the muscle in fascia. The gluteal fascia covering the deep surface of gluteus maximus muscle also covers the superficial surface of the gluteus medius muscle.





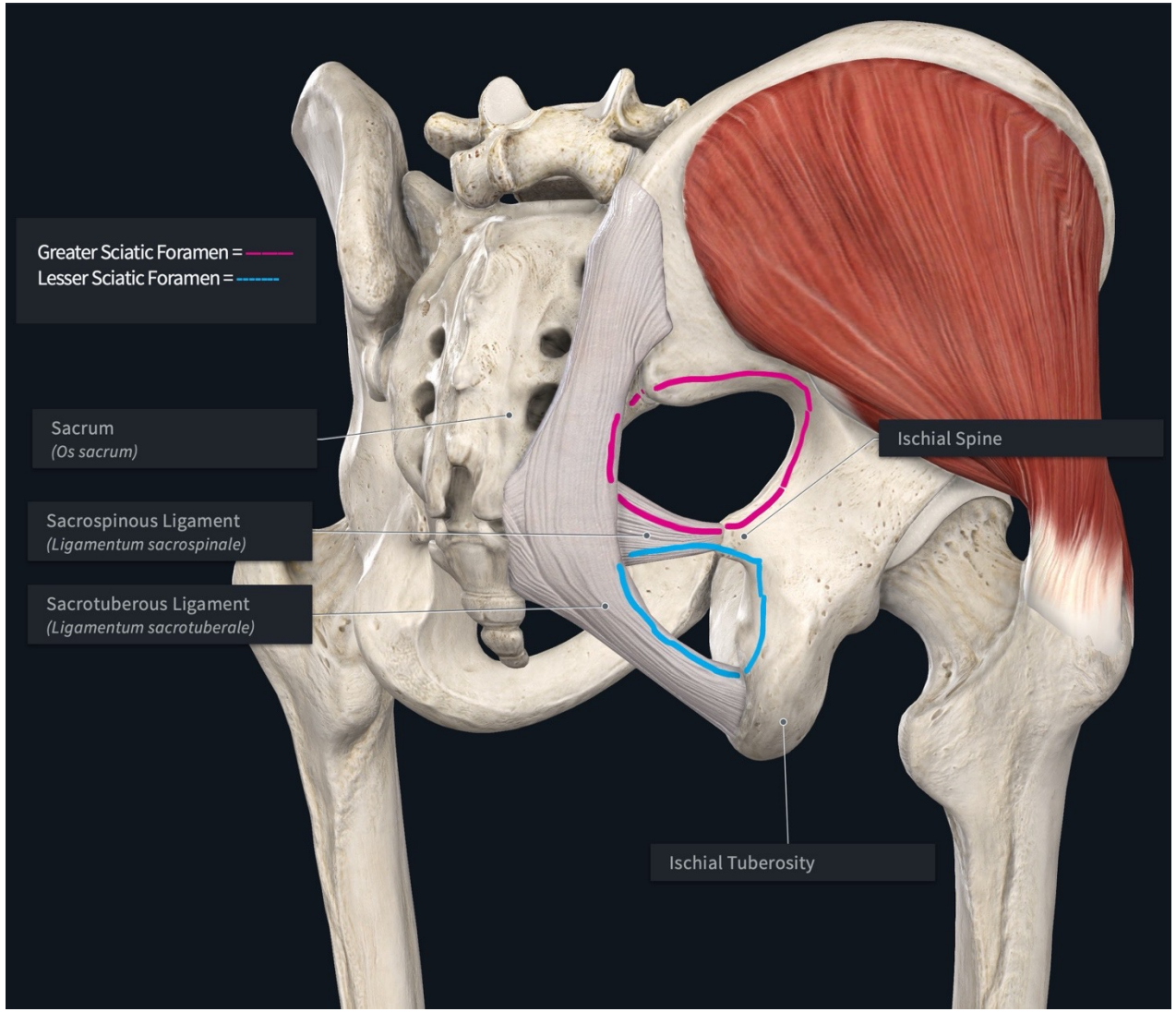
Sacrotuberous and Sacrospinous Ligaments

Deep in the gluteal region, two ligaments project from the sacrum to the hip (coxal) bones forming a major component of the lateral pelvic walls.

- The **sacrotuberous** passes from the sacrum to the ischial tuberosity.
- The **sacrospinous ligament** projects from the sacrum to the ischial spine.

Along with osseous structures of the pelvis, the sacrotuberous and sacrospinous ligaments define the borders of two foramina through which structures course to pass between the pelvis and the lower extremity. On a later slide you will be introduced to the structures passing through each foramen.

- **Greater sciatic foramen**
- **Lesser sciatic foramen**



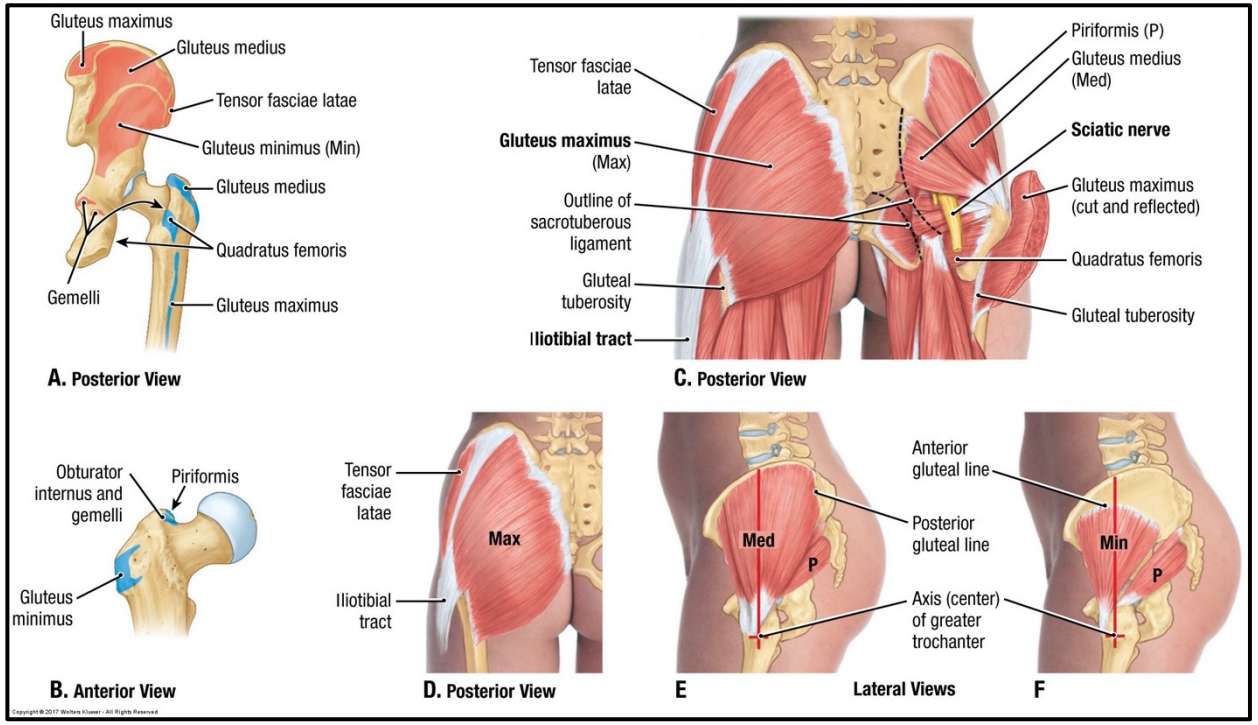
Gluteal Muscles

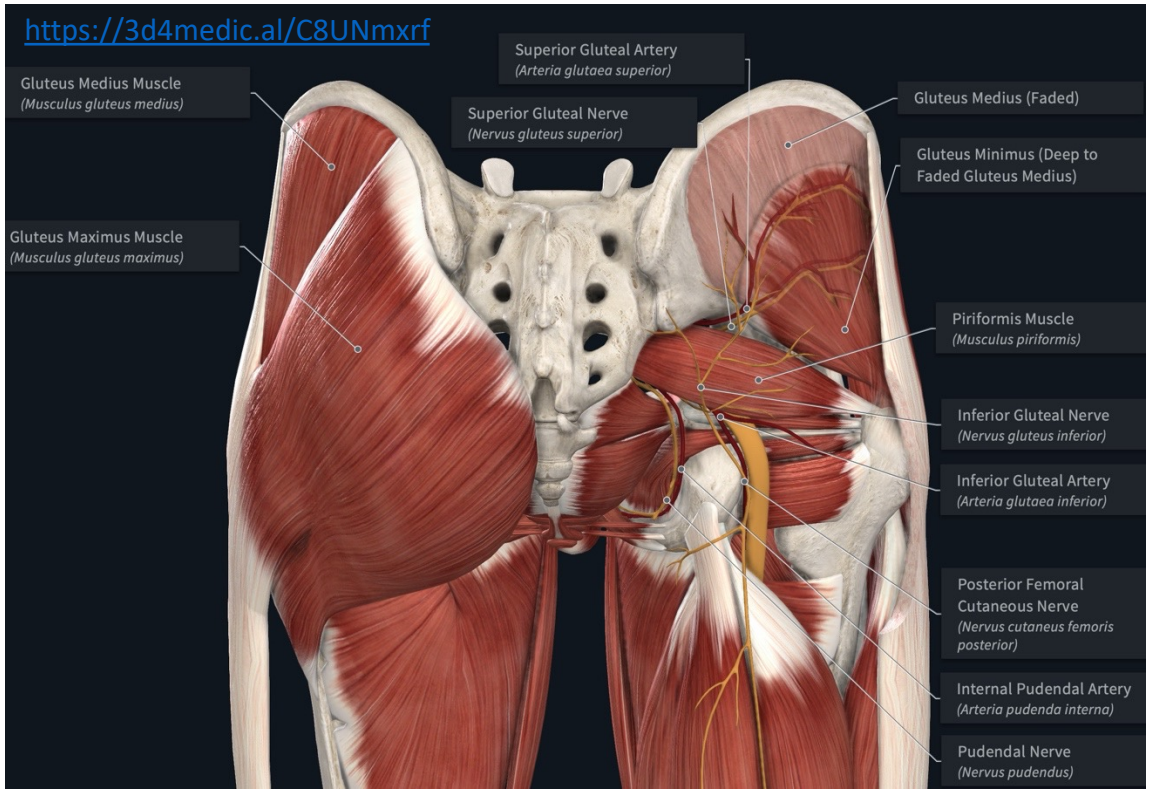
The muscles in this region are typically divided into two groups, the **gluteal muscles** and the **lateral hip (thigh) rotators.**

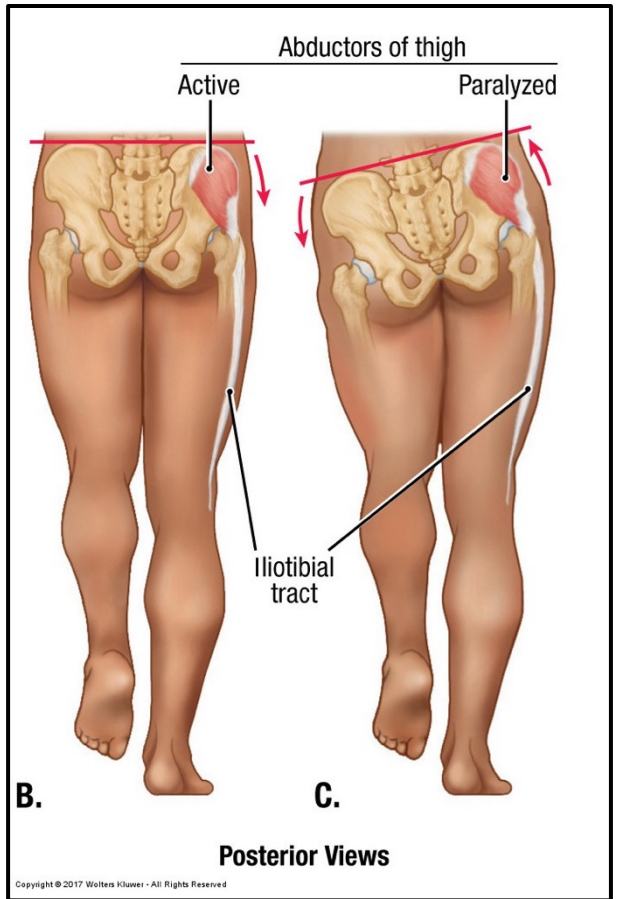
Gluteal Muscles

- The **gluteus maximus** is the most powerful extensor of the thigh. It is used primarily when force is required to extend the thigh from a flexed position (as opposed to extending from a straight position). Therefore, the gluteus maximus is used for activities such as standing up from a chair or climbing stairs; it also plays a role in walking, which will be shown in more detail on the next slide. The gluteus maximus also laterally rotates the thigh.
- The **gluteus medius** and **minimus** work together to abduct the thigh. They also hold the pelvis in a level position during walking or standing on one foot. Less important is their ability to medially rotate the thigh.

MUSCLE	INNERVATION	BLOOD SUPPLY	ACTION
Gluteus maximus	Inferior gluteal nerve	Superior and Inferior gluteal arteries	Extends thigh
Gluteus medius	Superior gluteal nerve	Superior gluteal artery	Abducts and medially rotates thigh; steadies pelvis on leg when opposite leg is raised
Gluteus minimus			
Tensor fascia latae	Superior gluteal nerve	Superior gluteal artery	Flex, abduct, and medially rotate thigh







Gluteal Muscles: Clinical Anatomy

FUNCTIONAL ANATOMY: The gluteus maximus muscle is an extensor of the hip and is often described as important in climbing stairs and rising from a seated position. While this characterization of the function of the muscle is correct, it plays a major role during walking. At heel strike, the gluteus maximus slows forward motion of the trunk by arresting flexion of the hip. If the gluteus maximus is weak, a person will lurch their trunk in a backward direction to interrupt the forward motion of the trunk. This lurching occurs during the heel strike on the weak side to compensate for the lack of hip extension.

FUNCTIONAL ANATOMY: The gluteus medius, gluteus minimus, and tensor fasciae latae are hip abductors. Contraction of the hip abductors during walking or running prevents the pelvis from dropping or sagging on the unsupported side (contralateral side) (Picture B). In addition to hip abduction, the tensor fasciae latae functions to stabilize the extended knee.

CLINICAL ANATOMY: A **Trendelenburg gait** is an obvious alteration in gait due to a weakness of hip abductors.

- A compensated gait is when the patient leans toward the weak side (opposite side wanting to sag) to compensate for weakness
- An uncompensated gait is when the pelvis sags on the contralateral side of the weakness.

CLINICAL ANATOMY: A **Trendelenburg test** is used to determine if the gluteus medius and minimus are functioning properly to stabilize the pelvis. When weight is on both feet, the pelvis is supported evenly and doesn't sag (Picture B). When one foot is lifted from the floor, the gluteus medius and minimus immediately contract to prevent the pelvis from sagging towards the unsupported side (Picture B). If the pelvis sags to the unsupported side, the Trendelenburg test is positive (picture C). A positive Trendelenburg test indicates functional impairment, which is often due to a superior gluteal nerve lesion, or a fracture of the femur.

Lateral Hip Rotators

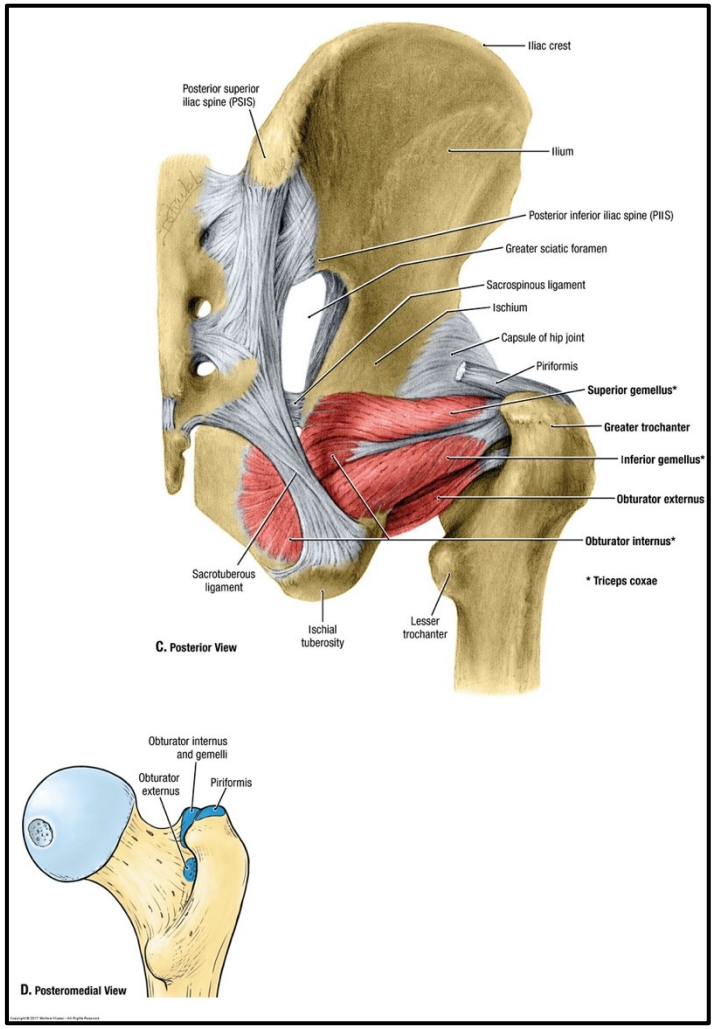
The **lateral rotators** function collaboratively to rotate the thigh.

- From superior to inferior, they are:
  - **piriformis**
  - **superior gemellus**
  - **obturator internus**
  - **inferior gemellus**
  - **quadratus femoris**

Because of the merging tendons, this group is sometimes called the triceps coxae.

- The most significant function of these small muscles is to dynamically stabilize the hip joint. They work with the medial rotators of the hip (gluteus medius and minimus primarily) to “hold” the head of the femur in the acetabulum. “Passive” or “static” stabilization of joints or structures is stabilization that is achieved without the aid of contractile energy. “Dynamic” stabilization of joints is achieved through the contraction of muscles that cross them. For some muscles, providing dynamic stabilization to joints is their most significant (and clinically relevant) function.

- The external rotators are landmarks for orthopedic surgery on the hip joint.



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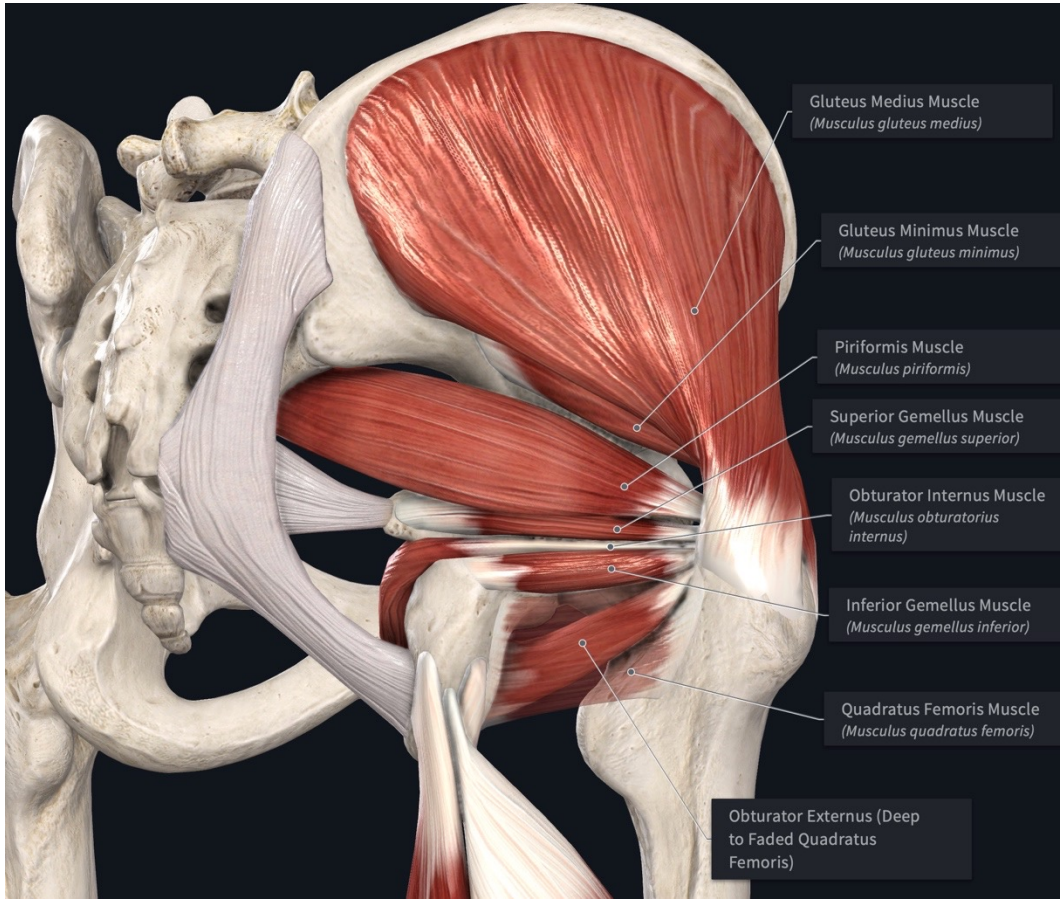
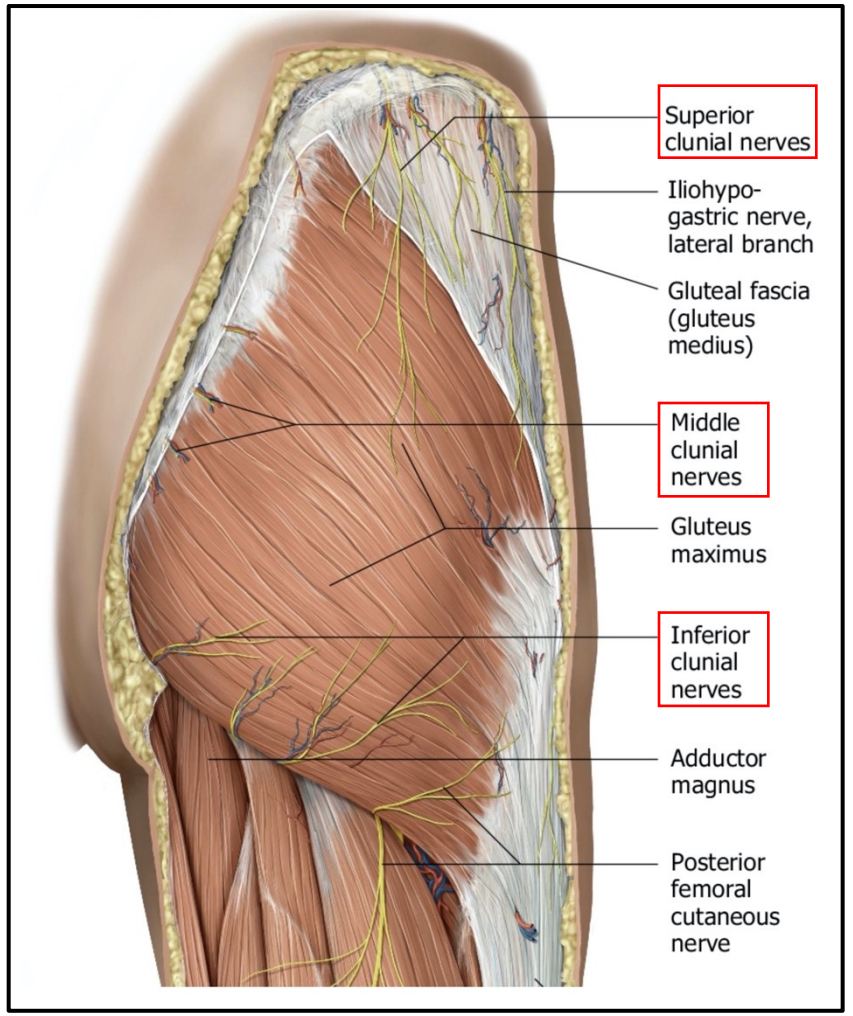


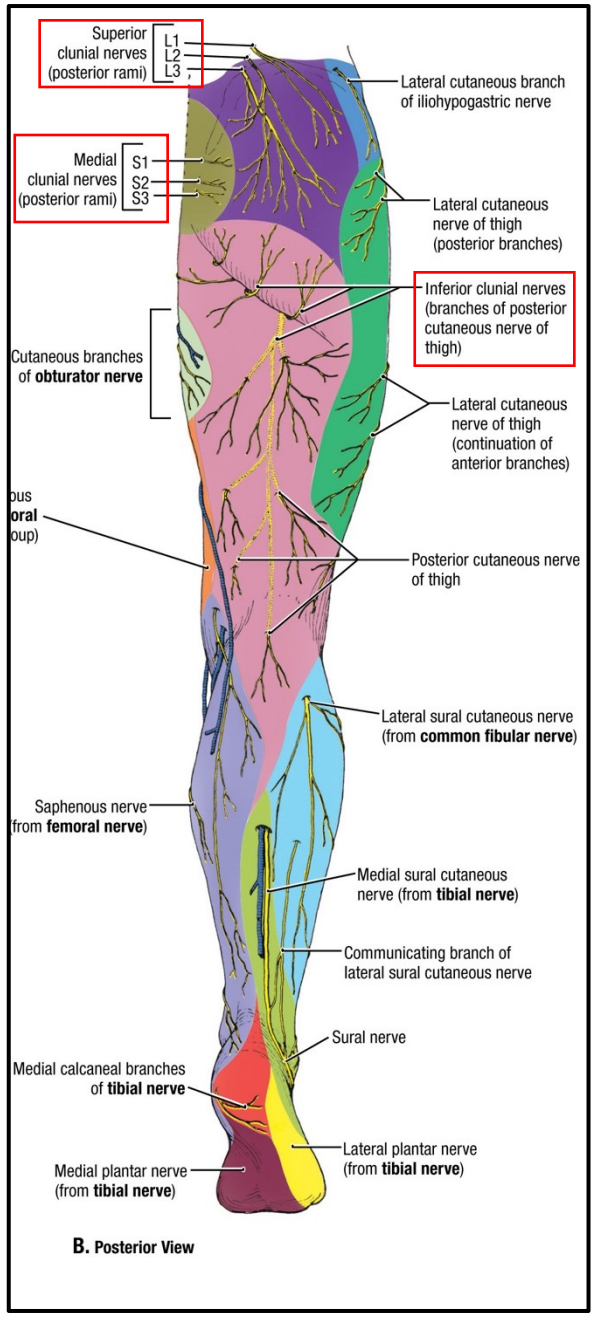
NOTE: Quadratus Femoris is Faded to Make Obturator Externus Visible

Gluteal Region: Cutaneous Innervation

The cutaneous innervation of the gluteal region is provided by the superior, middle, and inferior cluneal (sometimes spelled clunial) nerves.

- The superior and middle cluneal nerves are branches of dorsal primary rami.
- The inferior cluneal nerves are branches of the **posterior femoral cutaneous nerve**. The posterior femoral cutaneous nerve also supplies part of the perineum, and the majority of the posterior thigh.





Gluteal Region: Motor Innervation

The motor innervation to the gluteal region.
Gluteal Muscles

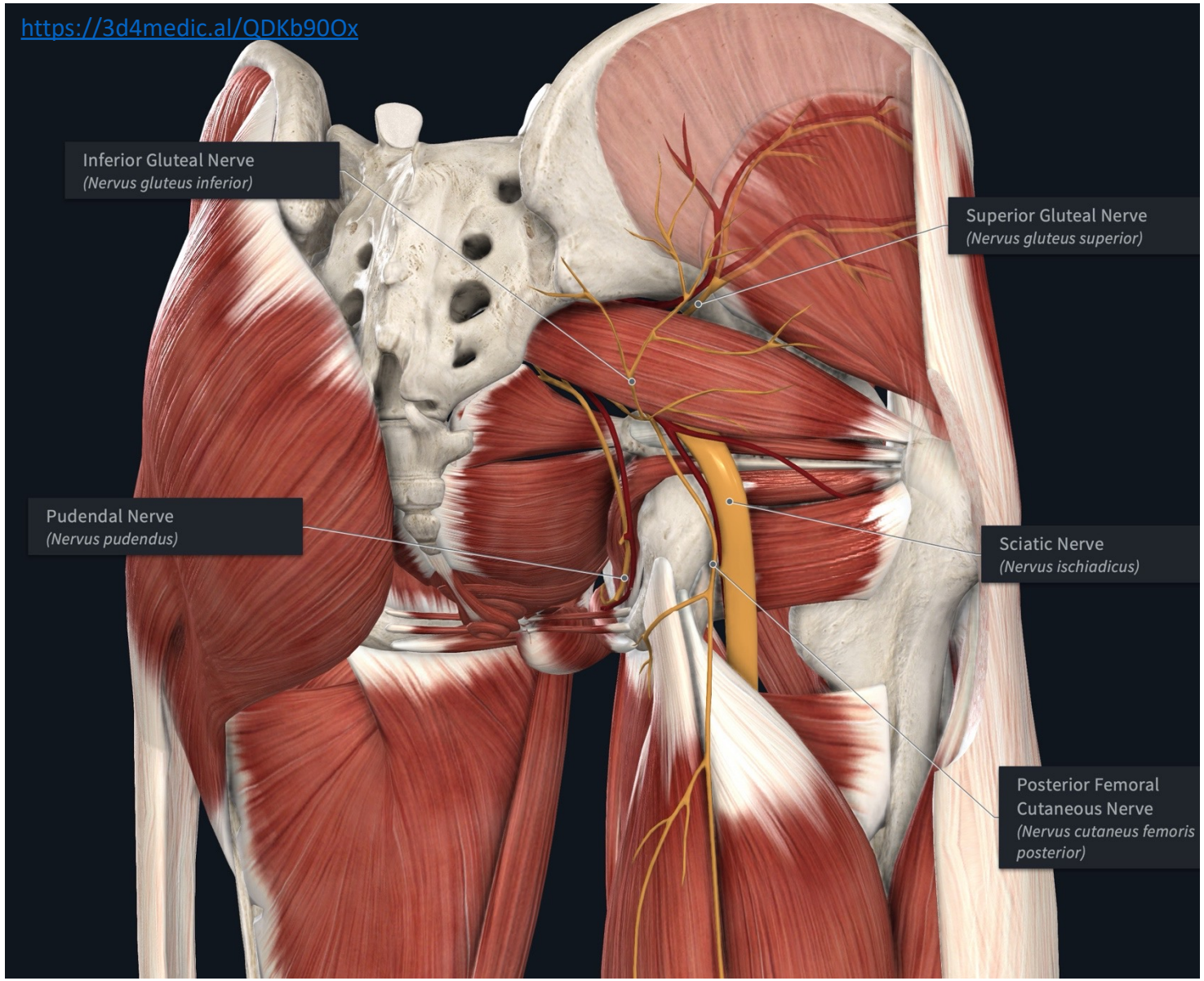
- **Superior gluteal nerve**: gluteus medius and minimus
- **Inferior gluteal nerve**: gluteus maximus

Lateral hip rotators

- Direct branches from the sacral plexus.

Two additional nerves pass through the gluteal region without innervating any structures.

- The **pudendal nerve** travels toward the perineum.
- The **sciatic nerve** innervates structures in the posterior thigh and leg.

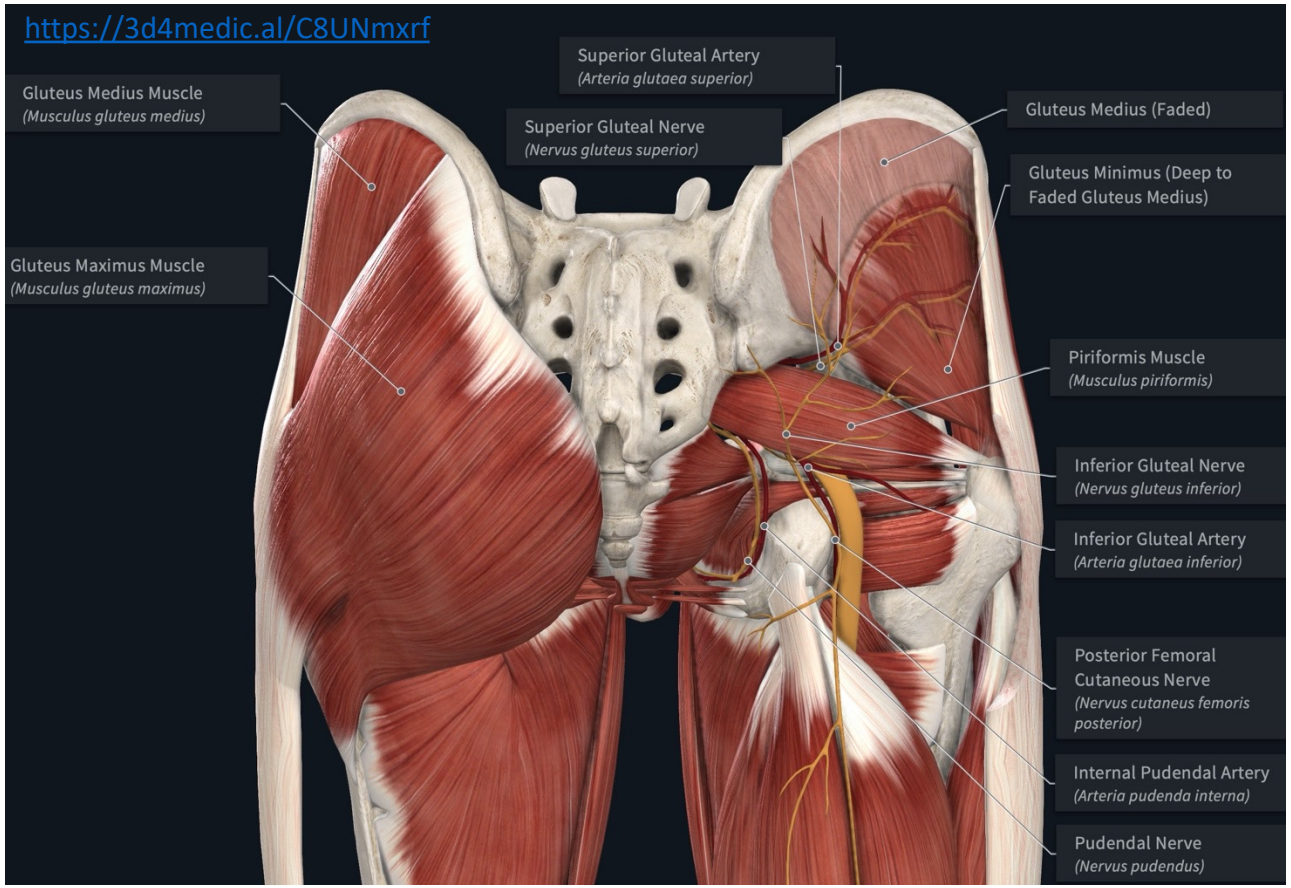


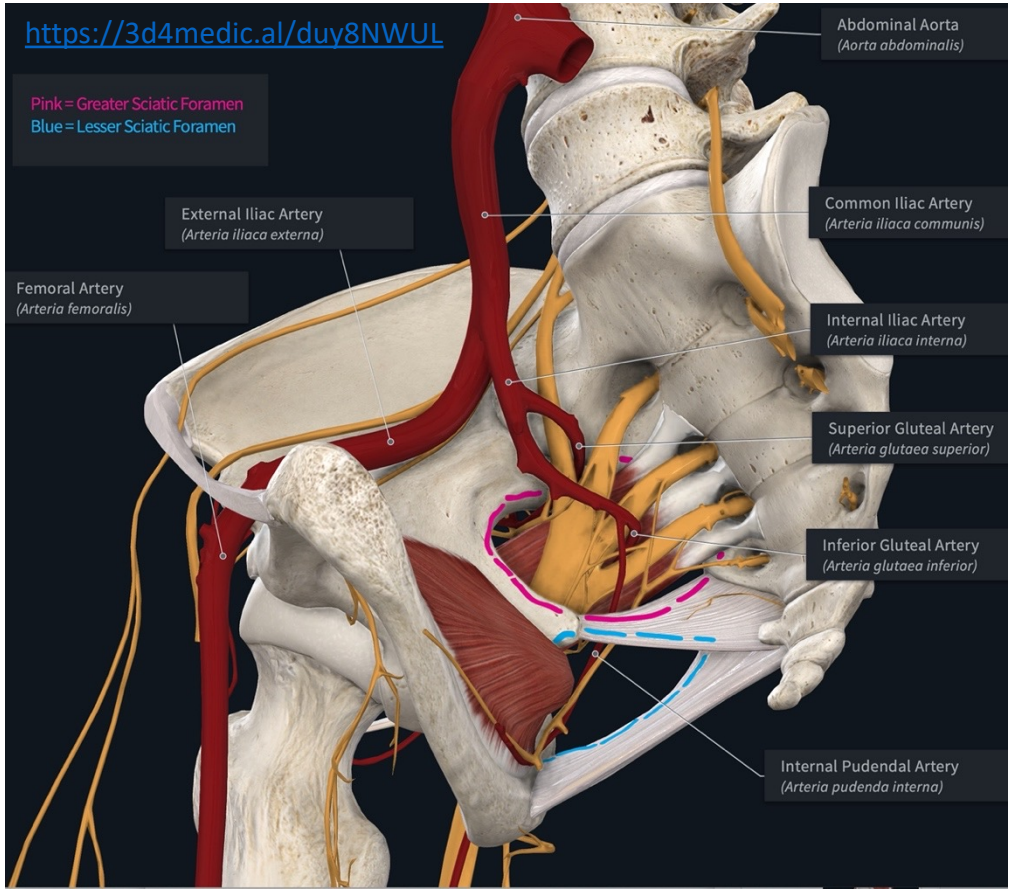
Gluteal Region: Blood Supply

The blood supply to the gluteal region is provided by the superior and inferior gluteal arteries; both are branches of the **internal iliac artery**.

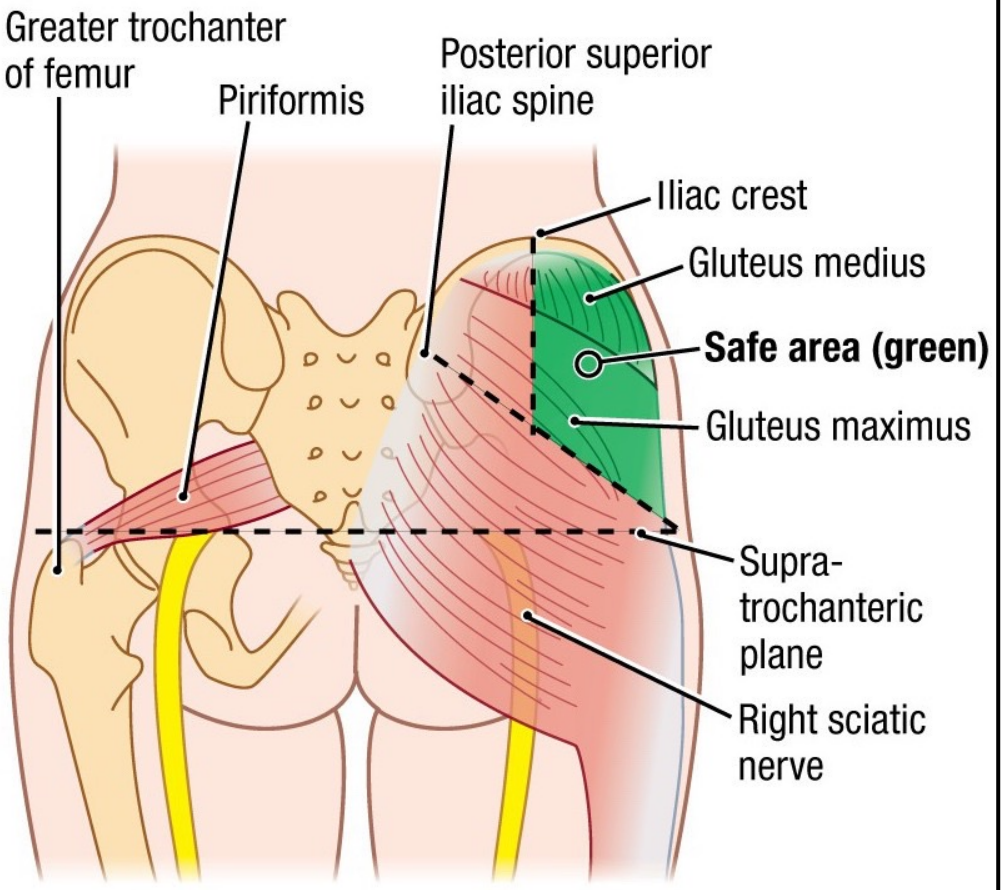
- The **superior gluteal artery** exits the pelvis through the greater sciatic foramen *superior* to piriformis. It supplies the more superiorly located muscles, specifically the three gluteal muscles and tensor fasciae latae.
- The **inferior gluteal artery** exits the pelvis through the greater sciatic foramen *inferior* to piriformis. It supplies the more inferiorly located muscles, specifically the gluteus maximus and the lateral rotators. It also supplies the superior portions of the muscles in the posterior compartment of the thigh.

Note that the **internal pudendal artery** is also in this region. It exits the greater sciatic foramen inferior to piriformis, travels around the ischial spine, and passes through the lesser sciatic foramen to enter the perineum. It does not have any branches in the gluteal region.





Gluteal Intramuscular Injections



B. Posterior View, Intragluteal Injection

CLINICAL ANATOMY: Gluteal intramuscular injections are commonly performed to administer drugs. Due to the numerous neurovascular structures lying deep to the gluteus maximus muscle, intragluteal injections should only be performed in the "safe area" for injections. This area is defined by drawing an imaginary line between the posterior superior iliac spine and the superior aspect of the greater trochanter. Injections are safe *superior* to this line; inferior to the line the sciatic nerve could be damaged (especially if the patient has one of the sciatic nerve anatomical anomalies).

Greater and Lesser Sciatic Foramina

Below is a summary of the most important structures that pass through the foramina to enter and exit the lower extremity. Note: The list below DOESN'T include every structure passing through the foramina.

- **Greater sciatic foramen**:
  - **Piriformis muscle:** Piriformis is the key anatomical landmark in the gluteal region due to its location in the greater sciatic foramen. Structures that pass through greater sciatic foramen are described as exiting *superior* or *inferior* to piriformis.
    - Superior to piriformis:
      - **Superior gluteal artery, vein, and nerve**
    - Inferior to piriformis
      - **Inferior gluteal artery, vein, and nerve**
      - **Sciatic nerve**
      - **Posterior femoral cutaneous nerve**
- **Lesser sciatic foramen**
  - **Obturator internus muscle**

Note: The internal pudendal a. and pudendal n. both exit the pelvis via the greater sciatic foramen and re-enter the pelvis via the lesser sciatic foramen. We will focus more on this artery/nerve pair when we study pelvic anatomy.

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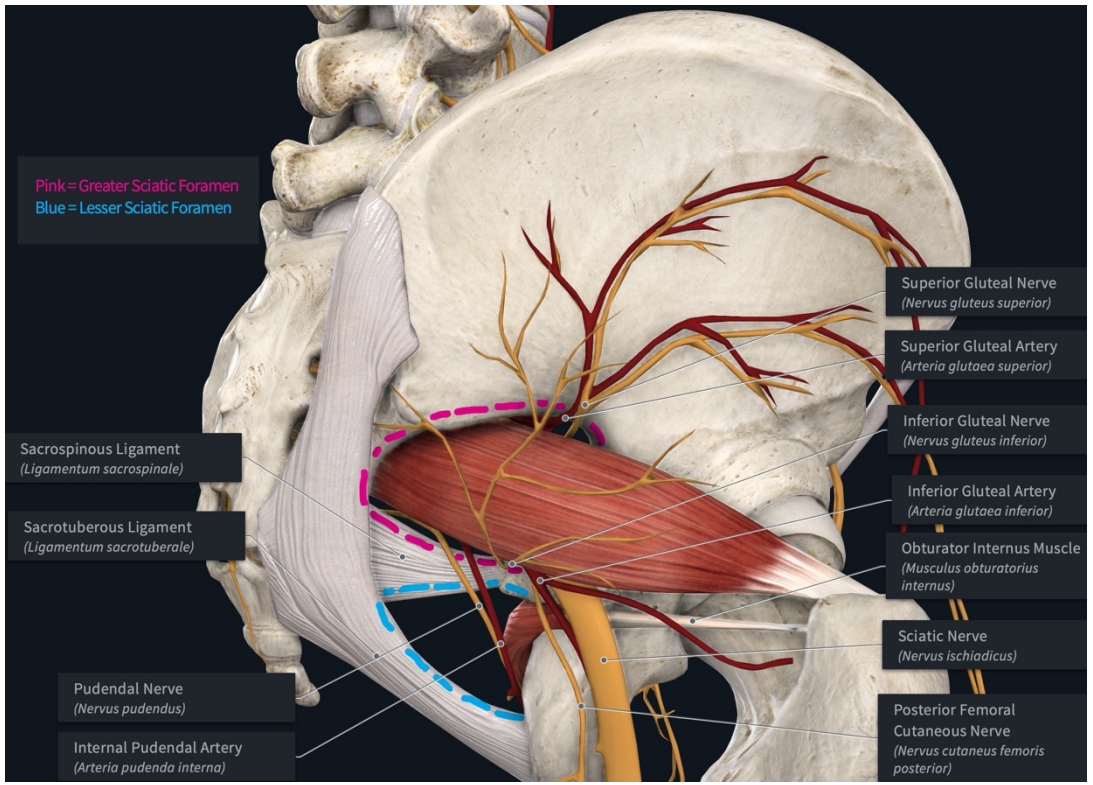

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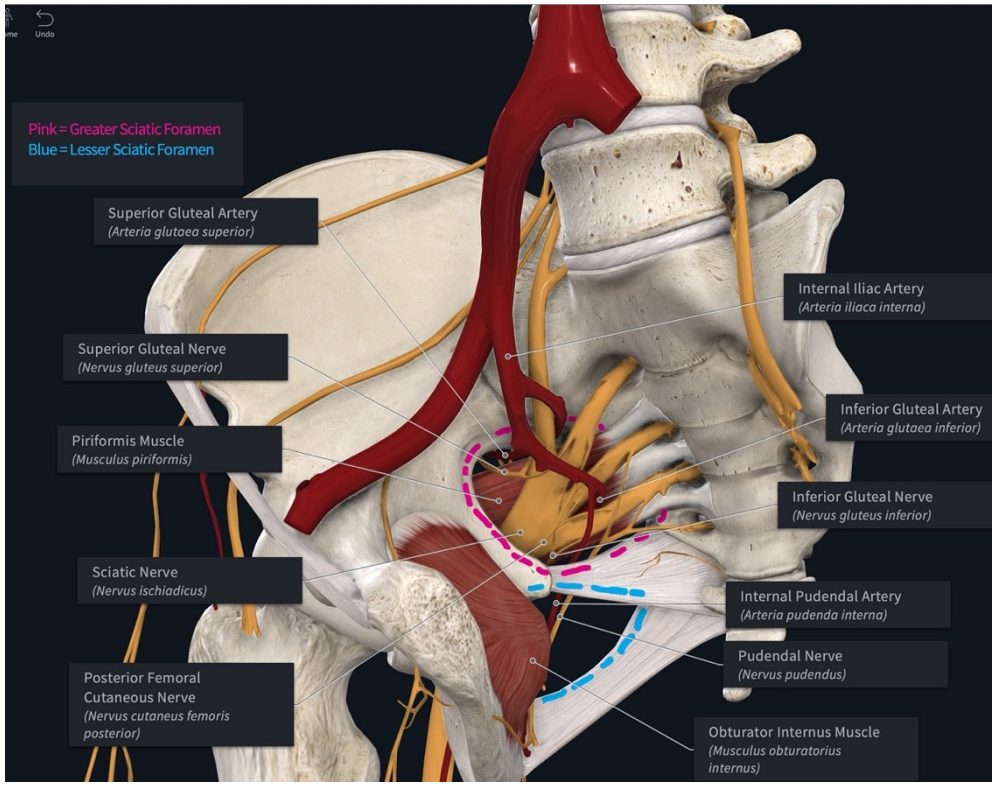


Muscles: Posterior Compartment of Thigh

The posterior compartment contains muscles that primarily extend the thigh at the hip joint and flex the leg at the knee joint. They are innervated by branches of the sciatic nerve.

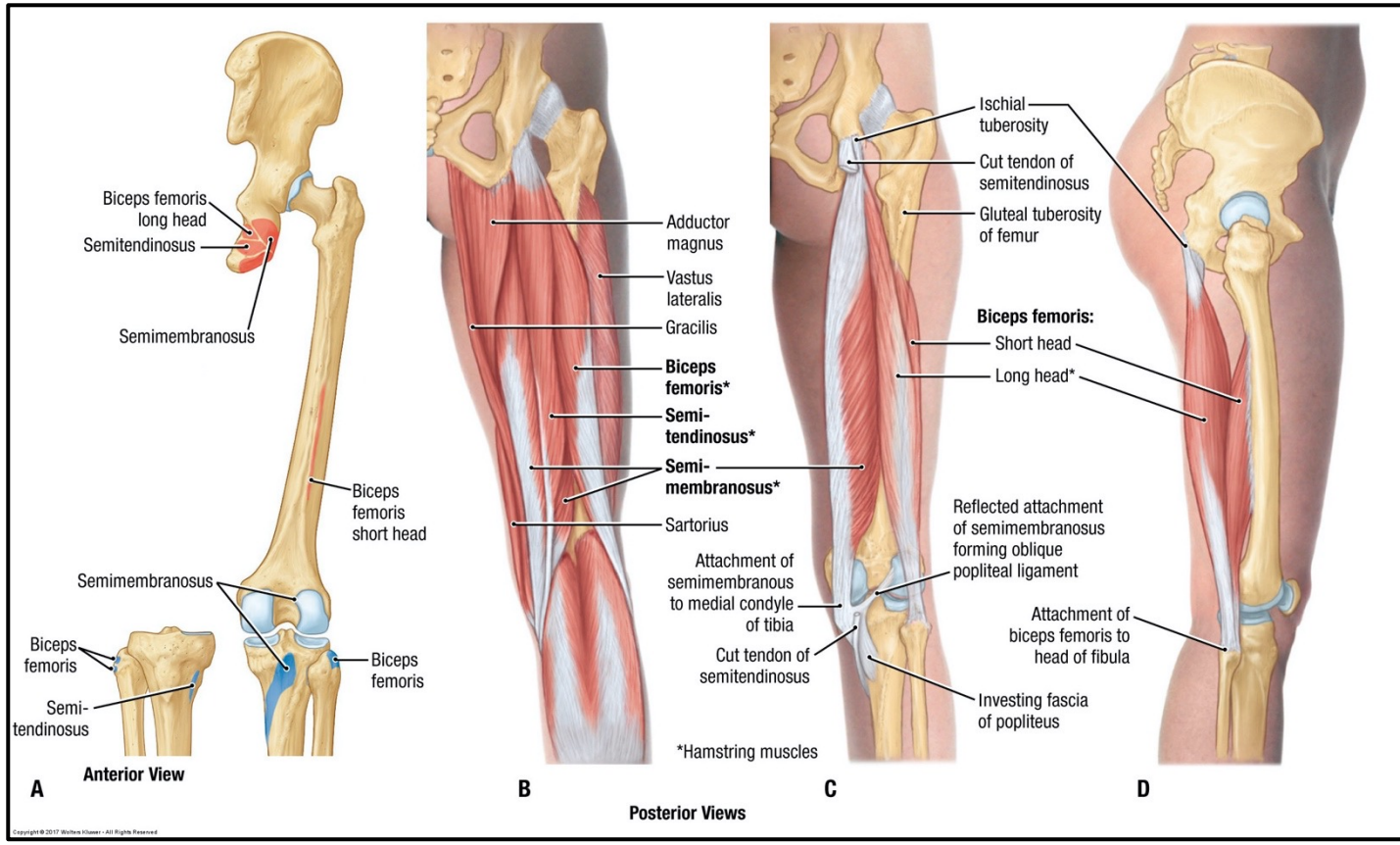
MUSCLE	INNERVATION	BLOOD SUPPLY	ACTION
Semitendinosus	Tibial n. (division of sciatic n.)	Deep femoral a. Inferior gluteal a.	Extends thigh, flexes leg
Semimembranosus	Tibial n. (division of sciatic n.)		
Biceps femoris	• Long head: *tibial n. (*division of sciatic n.) • Short head: *common fibular n. (*division of sciatic n.)		

FUNCTIONAL ANATOMY: Muscles that have their origin on the ischial tuberosity and cross both the hip joint and the knee joint are collectively referred to as "hamstring" muscles. All hamstring muscles are innervated by the tibial nerve. The "true" hamstring muscles include the following muscles.

- Semitendinosus
- Semimembranosus
- *Long head* biceps femoris

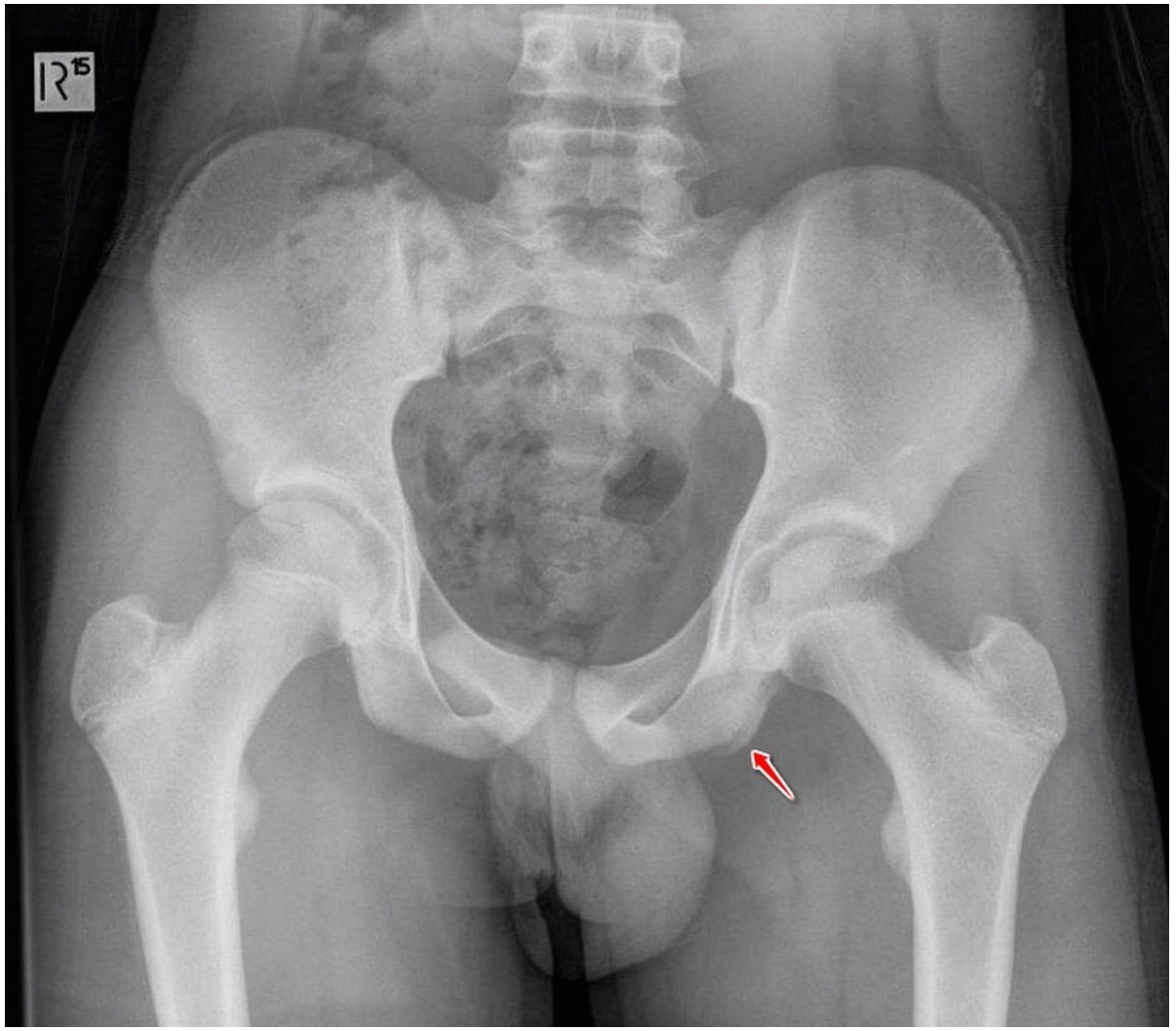
Notes

- The portion of the adductor magnus that takes its origin from the ischial tuberosity is referred to as the "hamstring portion" of the muscle. Like the hamstring muscles, this portion of the adductor magnus is innervated by the tibial nerve. It doesn't fit the true definition of a hamstring muscle because it doesn't cross the knee joint. The remaining portion of the muscle is the "adductor portion," which is innervated by the obturator nerve.
- The short head of the biceps femoris is *not* considered a hamstring muscle since it doesn't cross the hip joint. In addition, it is innervated by the common fibular nerve.



Ischial Tuberosity Avulsion Fracture

CLINICAL ANATOMY: Avulsion fracture of the ischial tuberosity (AFIT) is a rare adolescent sports injury. The underlying mechanism involves damage to the epiphyseal plate before epiphyseal arrest. This is usually caused by sudden and forceful eccentric contraction of the hamstrings and is attributed to sprinting or jumping. Bone union, range of motion (ROM), and muscle strength should be restored before full return to sports activities.



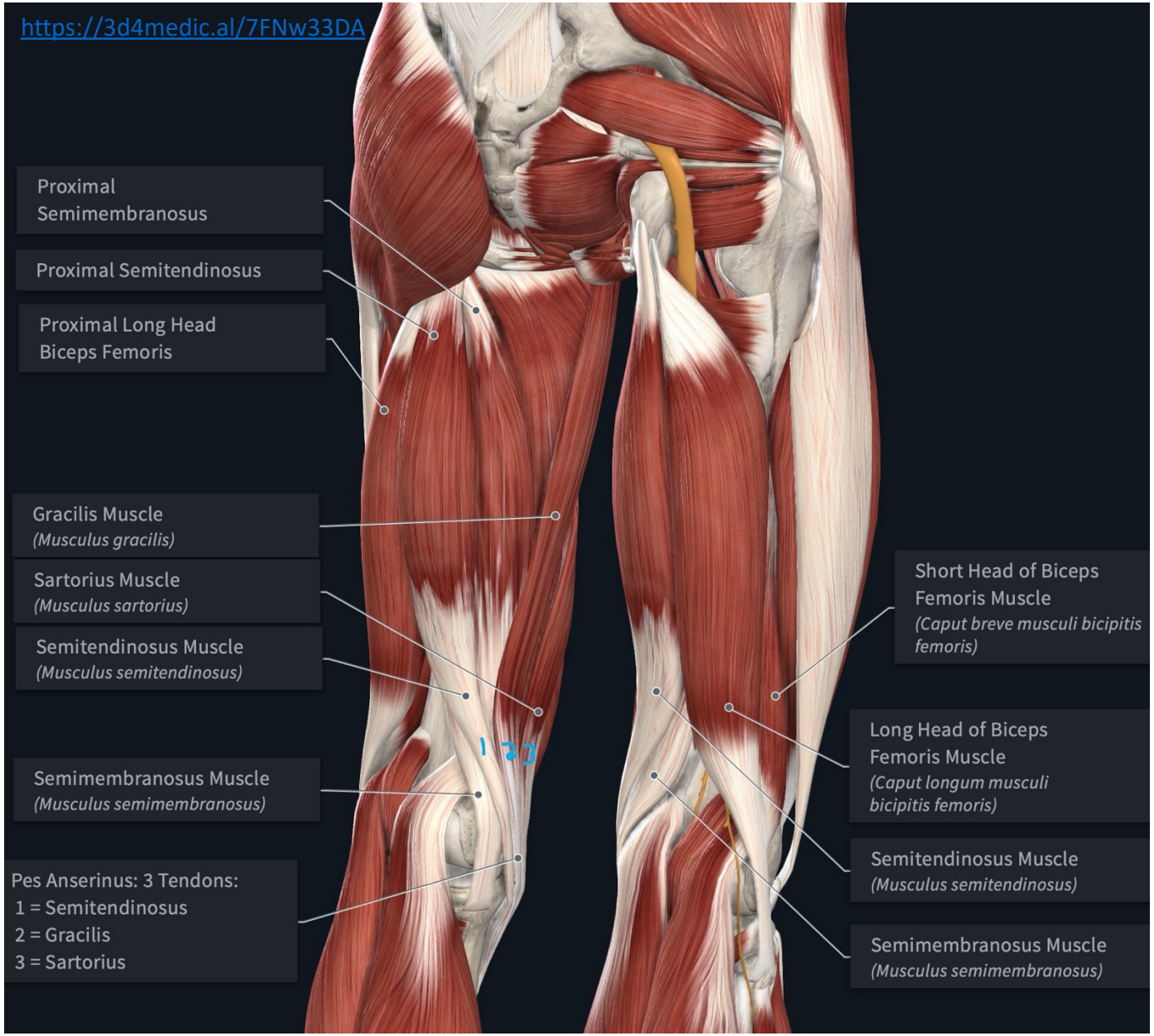
The left ischial tuberosity apophysis is displaced inferiorly from its normal position consistent with an avulsion fracture. Radiopedia (https://radiopaedia.org/cases/ischial-tuberosity-avulsion)

Muscles: Posterior Compartment of Thigh (Continued)

The pes anserinus (“goose foot”) refers to the conjoined tendons of 3 muscles that insert on the medial aspect of the proximal tibia:

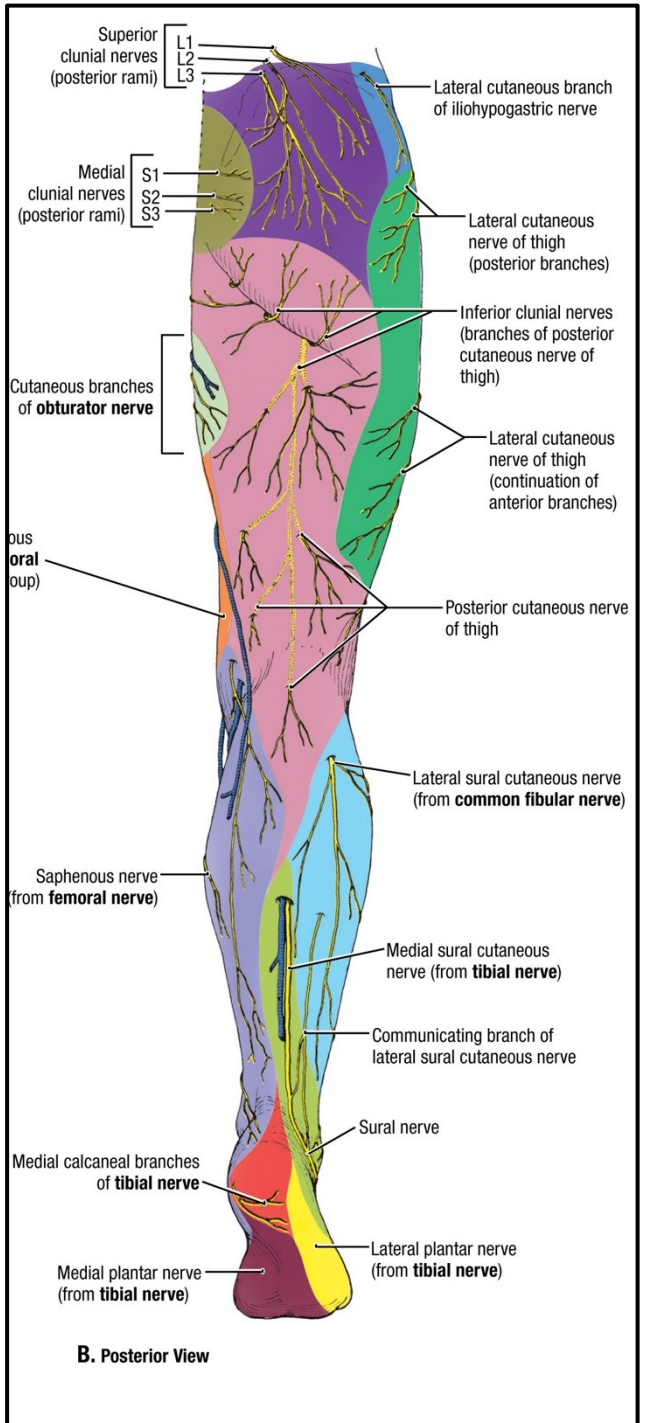
- Sartorius
- Gracilis
- Semitendinosus.

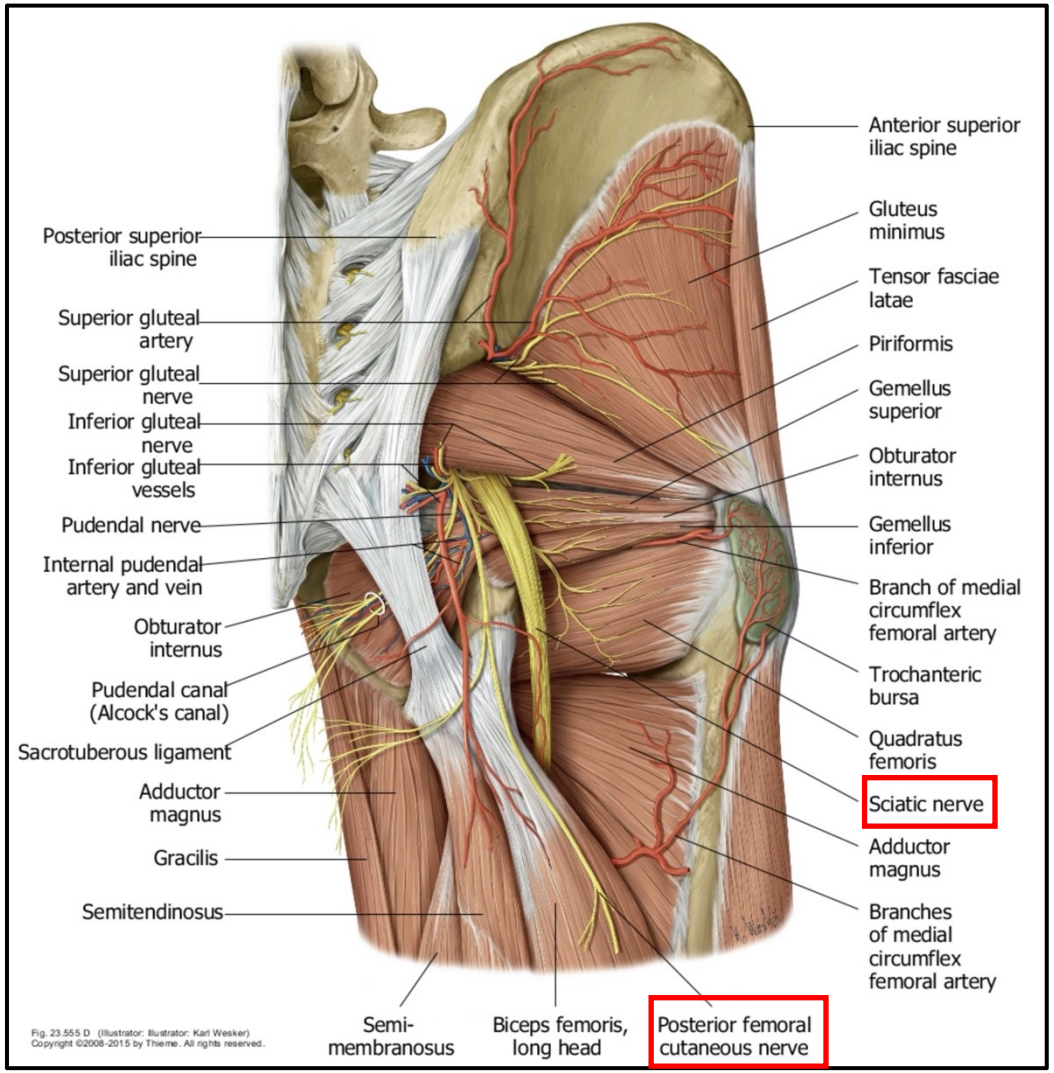
These three muscles help to stabilize the knee joint medially. The order of their insertion from anterior to posterior is **S**artorius, **G**racilis, and semi**T**endinosus, which can be remembered by the mnemonic “**S**ay **G**race before **T**ea”. Another mnemonic is “sergeant” muscles (SGT).



Posterior Thigh: Cutaneous Innervation

Sensory innervation of the posterior thigh is provided by the **posterior femoral cutaneous nerve**.



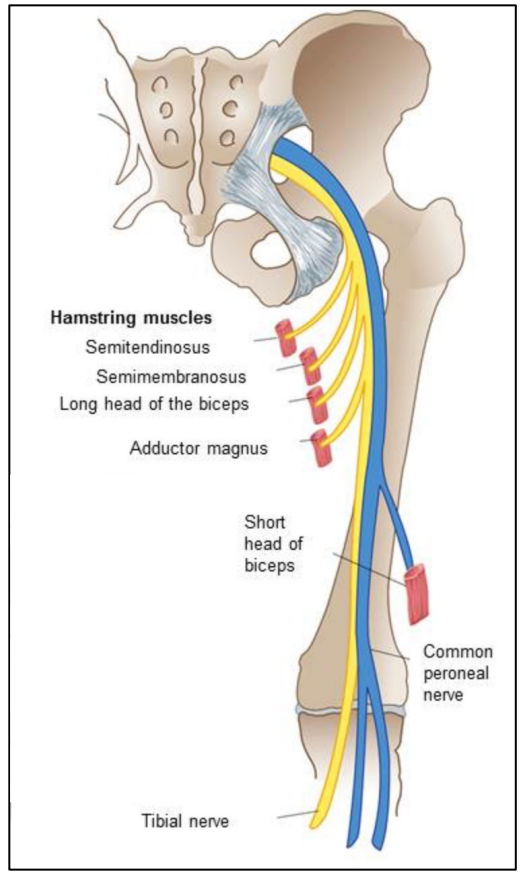


Posterior Thigh: Motor Innervation

Motor innervation to the posterior thigh muscles is provided by the nerves composing the sciatic nerve. The sciatic nerve is a branch of the sacral plexus (VPR of L4-S3) and contains the tibial nerve and common fibular nerve bundled together in one connective tissue sheath (Figure 1).

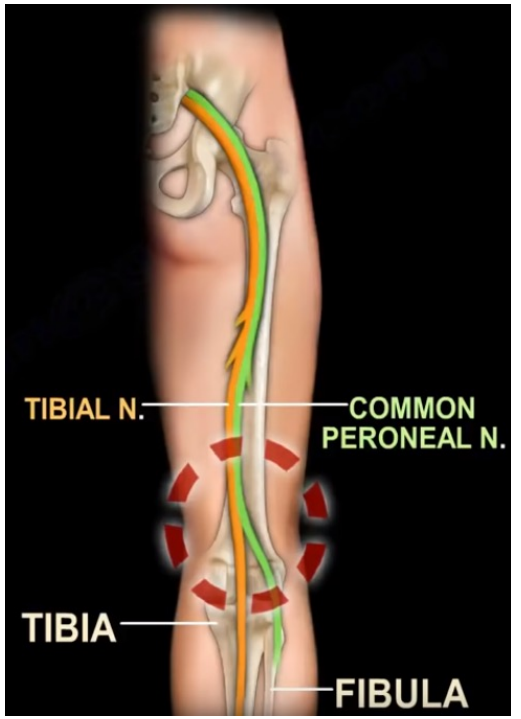
- In the posterior thigh, the **tibial nerve innervates the** hamstring muscles (semitendinosus, semimembranosus, and long head biceps femoris).
- In the posterior thigh, the **common fibular** nerve innervates the **short head of the biceps femoris muscle.** (Note that clinicians typically use the name "common *peroneal* nerve" when referring to this nerve.)

Figure 1



The sciatic nerve typically emerges from the greater sciatic foramen inferior to the piriformis muscle and splits into its two divisions at the superior aspect of the popliteal fossa (inferior region of the posterior thigh) (Figure 2).

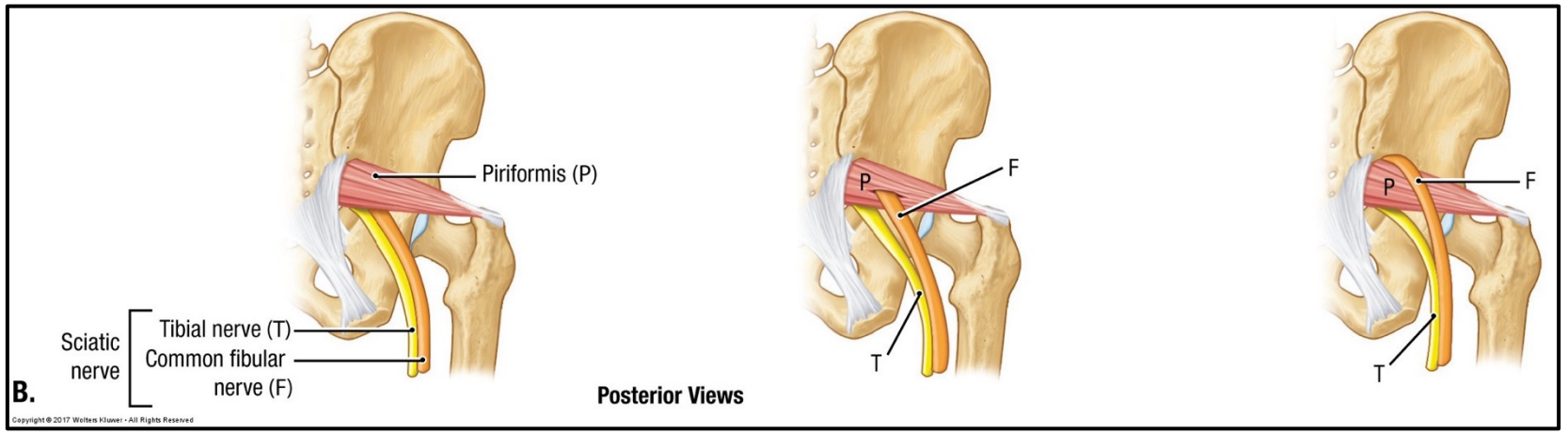
Figure 2



Sciatic Nerve

CLINICAL ANATOMY: The two divisions of the sciatic nerve (tibial nerve and common fibular nerve) may emerge separately through the greater sciatic foramen. Variations in the pattern of exit of these nerves occur in approximately 16% of limbs (Figure 1).

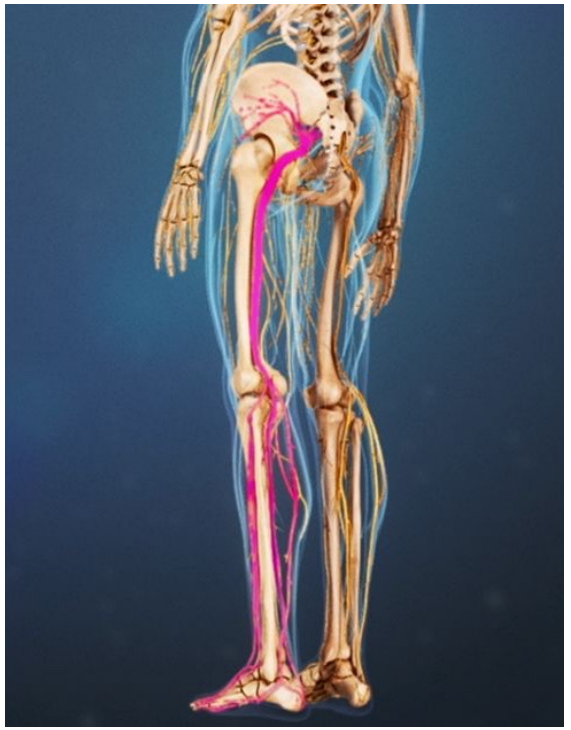
Figure 1



CLINICAL ANATOMY: The older term for the word "fibular" is "peroneal." Be prepared to hear this term a clinical setting.

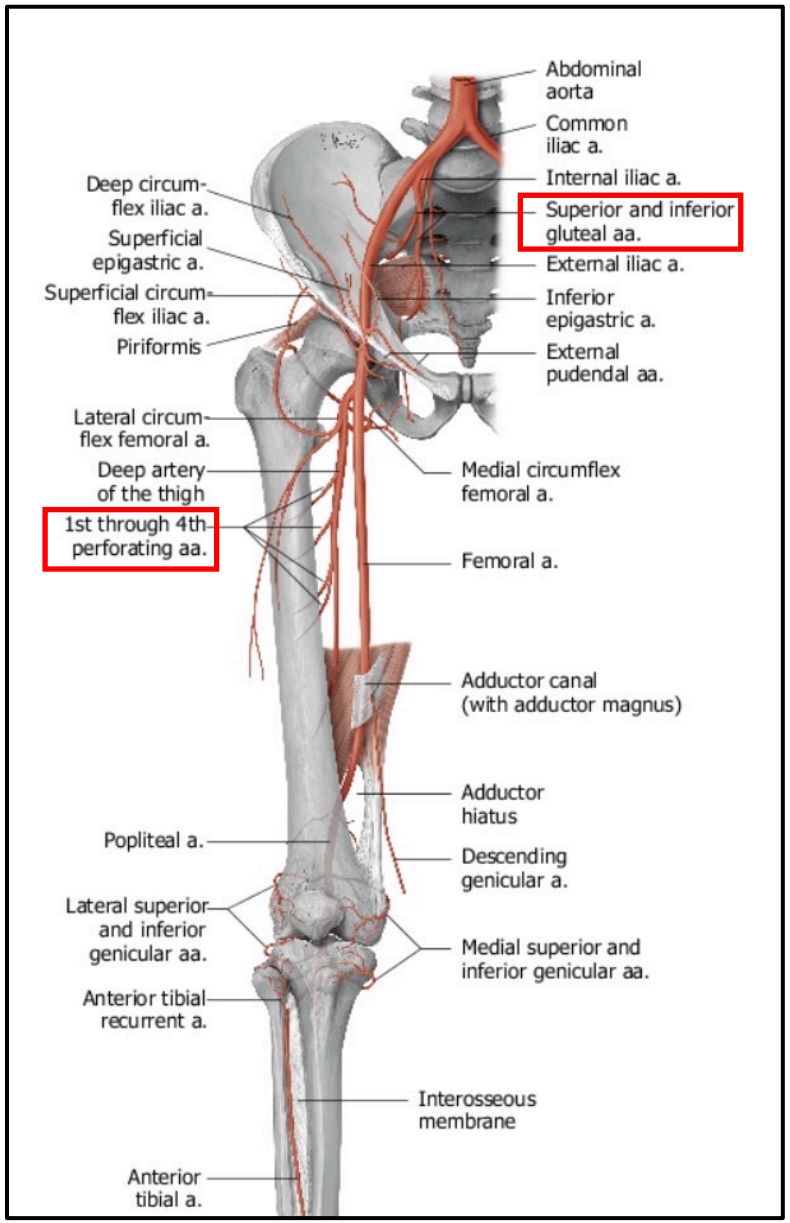
CLINICAL ANATOMY: Sciatica (sciatic neuritis) is one of the most common forms of radiculopathy. The term itself refers to a set of symptoms that results from general compression and/or irritation of one or more of the nerve roots that give rise to the sciatic nerve (L4-S3). These symptoms include pain (sometimes severe) in the lower back, buttock and/or various parts of the leg and foot, numbness, muscular weakness, pins and needles or tingling and difficulty in moving or controlling the leg (Figure 2). These symptoms are typically felt on only one side of the body. Common causes of sciatica include compression of the L4-S1 nerves by disc herniation, spondylolisthesis or degenerated IV discs. Treatment for sciatica depends on the underlying cause. **Pseudosciatica** refers to symptoms resembling sciatica that are caused by compression (usually muscular in origin, i.e., piriformis syndrome) of more peripheral sections of the sciatic nerve.

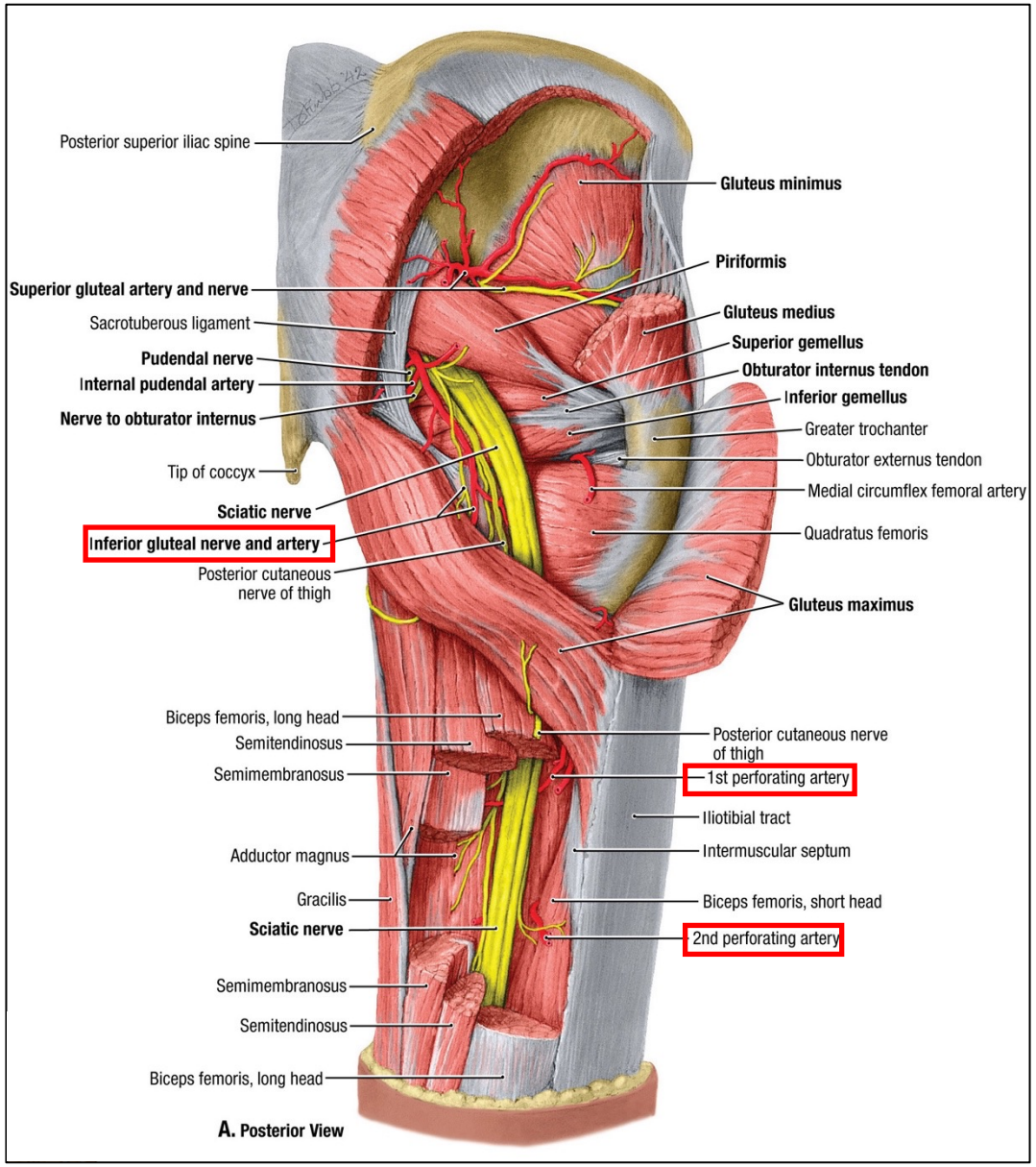
Figure 2



Posterior Thigh: Blood Supply

The blood supply to the posterior compartment is from the **perforating branches** of the deep femoral artery, and the **inferior gluteal artery**.





Hip Joint: Osteology

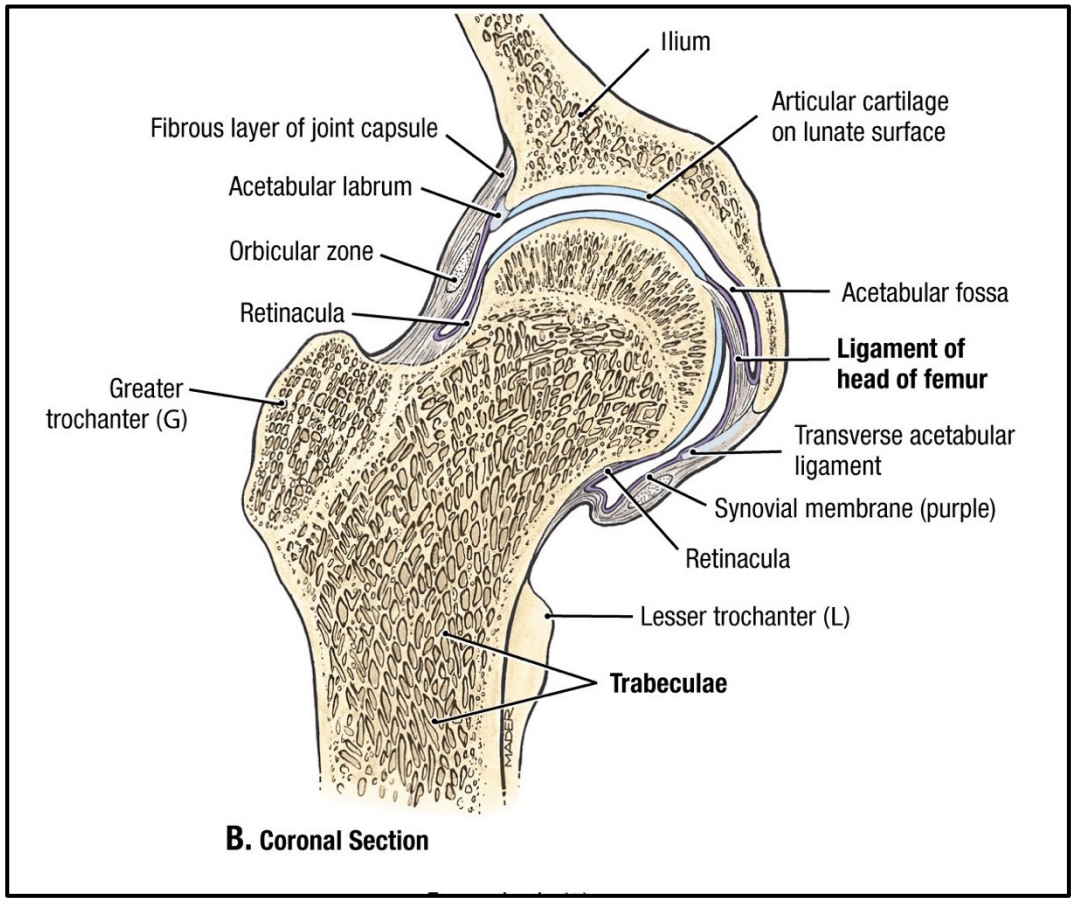
The hip joint is a ball and socket synovial joint between the head of the femur and the acetabulum of the hip bone.

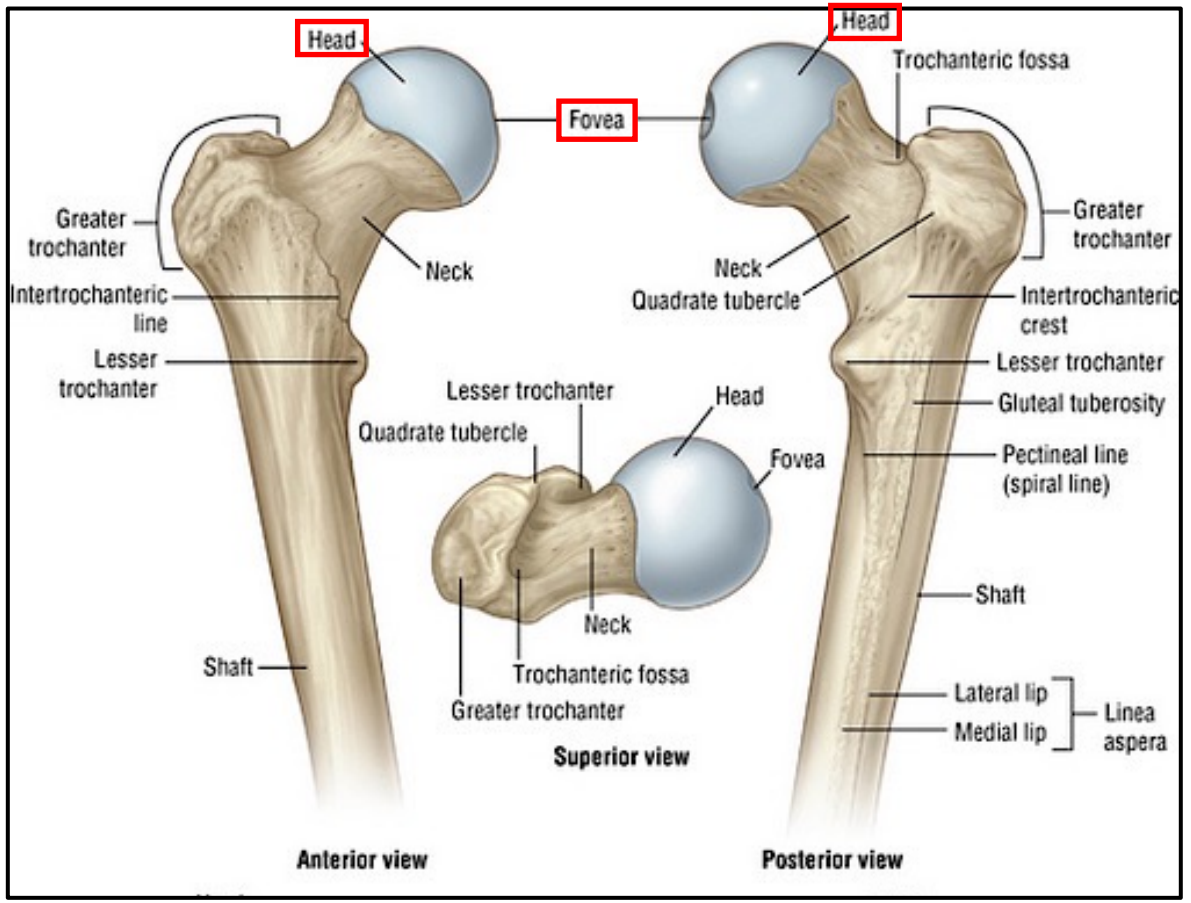
Femur

- **Head**
- The **fovea** is a depression at the end of the head where the **ligament of the femoral head (ligamentum teres)** attaches.
- Neck

Two elevated areas form the transition point between the neck and the shaft.

- The **intertrochanteric line** is the *anterior* attachment site of the fibrous capsule.
- The **intertrochanteric crest** is the *posterior* attachment site of the fibrous capsule.



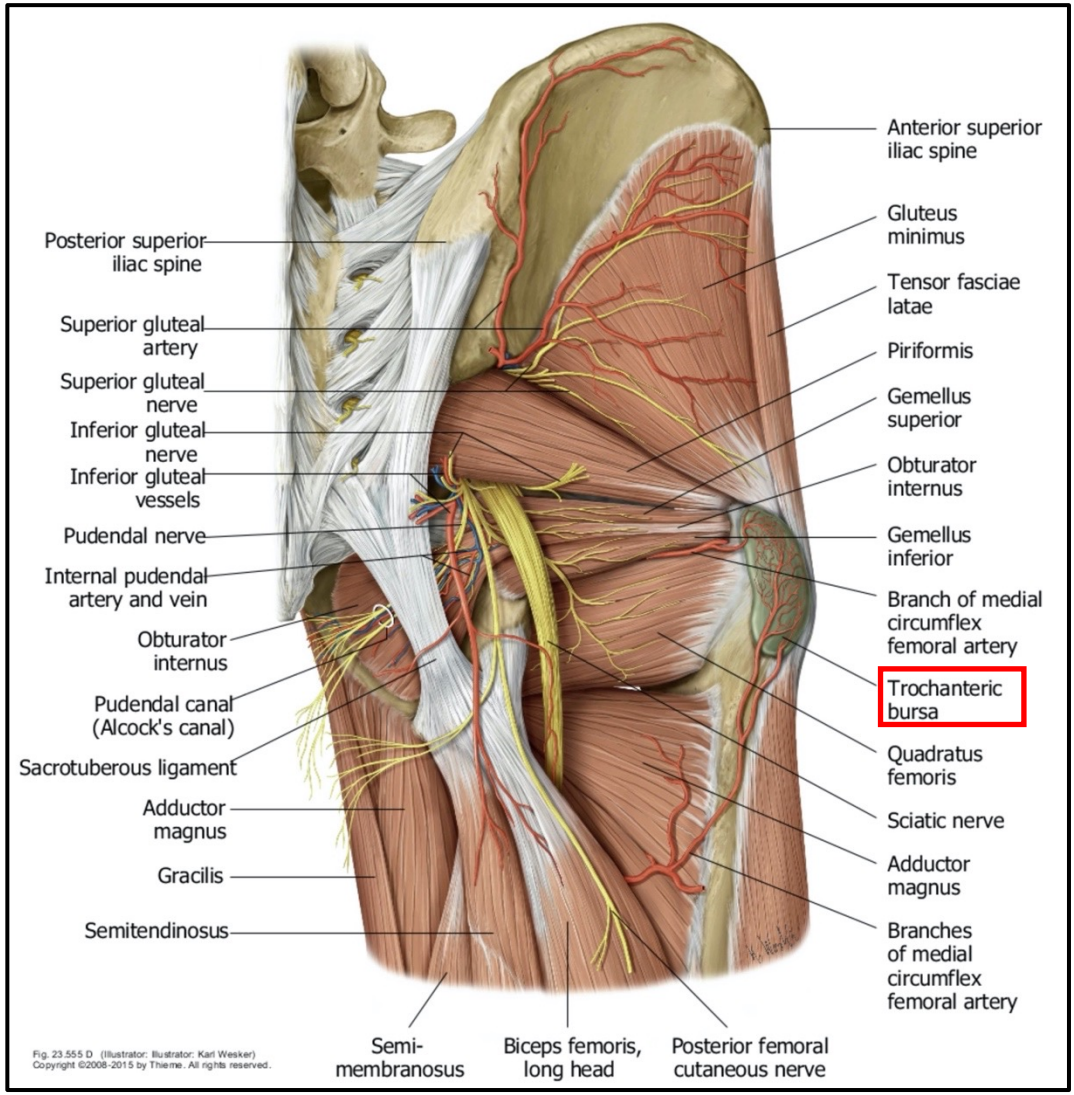


Trochanteric Bursa

CLINICAL ANATOMY: A **bursa (pl. bursae)** is a connective tissue sac lined by a synovial membrane.

- Bursae may be extensions of a joint cavity, or they may be completely independent structures; they are found wherever friction may impinge upon the free movement of structures.
- Bursae that completely surround tendons are termed tendon sheaths (Figure 2).
- Tendonitis and bursitis are inflammations of the tendon sheaths and bursae, respectively.
- Bursae are difficult to see in the cadaver, but their presence should always be appreciated.
- Both the **ischial** and **trochanteric bursae** may become inflamed as a result of excessive friction between the bursa and the underlying bone (Figure 1).
    - **Ischial bursitis** is usually the result of a prolonged injury, or sitting on a hard surface or in the same position for an extended period of time.
    - **Trochanteric bursitis** is more common in women and is the product of overuse. Runners and ballet dancers are particularly susceptible to trochanteric bursitis.

Figure 1



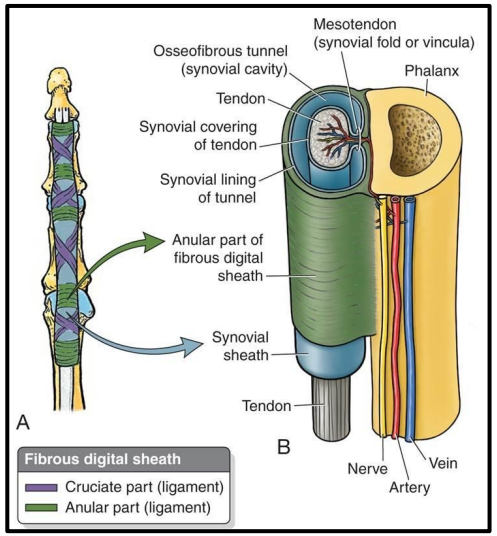
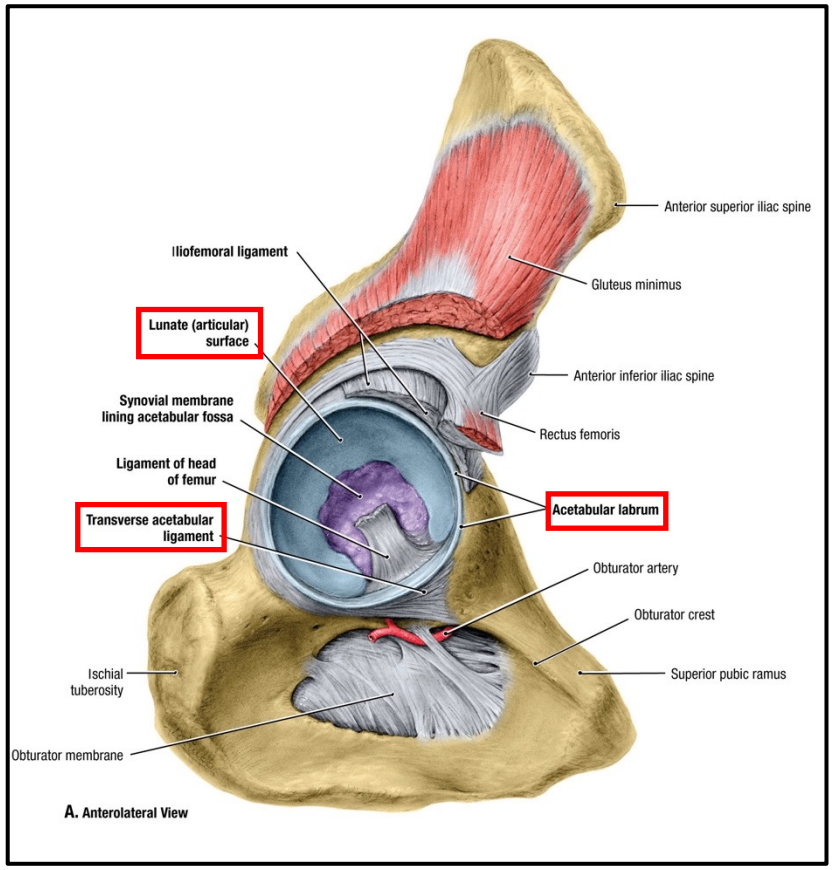


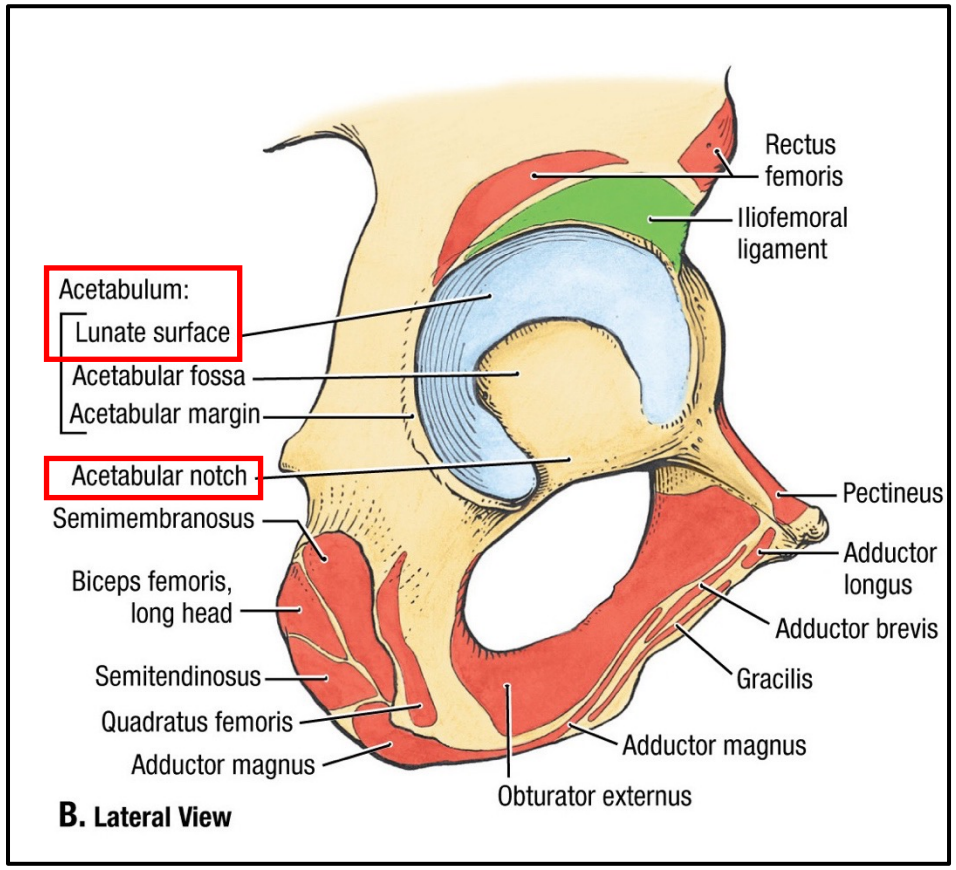
Figure 2

Hip Joint: Osteology (Continued)

Pelvic Bone (Os coxa, coxal bone, inominate bone)

- The **acetabulum** forms a fairly complete bony ring around the head of the femur. This osseous morphology contributes to the hip joint's stability (i.e., ability to resist dislocation).
- The **lunate surface** is an inner surface of the acetabulum, covered with articular cartilage that articulates with the head of the femur.
- The acetabular fossa is a round area contained by the lunate surface, which contains fat, and is the pelvic attachment site for the ligament of the femoral head.
- The **acetabular notch** is inferior to the acetabular fossa and is an open gap in the lunate surface that transmits neurovascular structures into the joint.
- The acetabular notch is spanned by the **transverse acetabular ligament.**



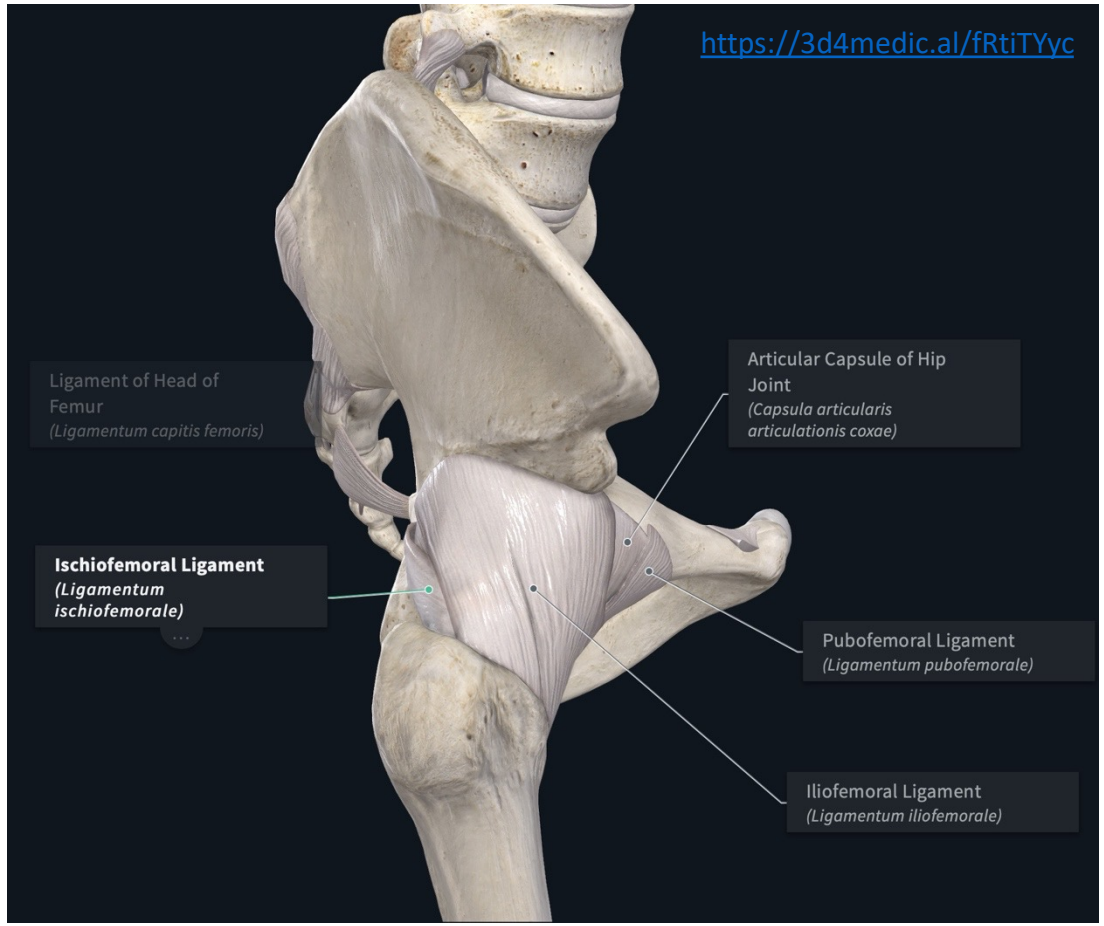


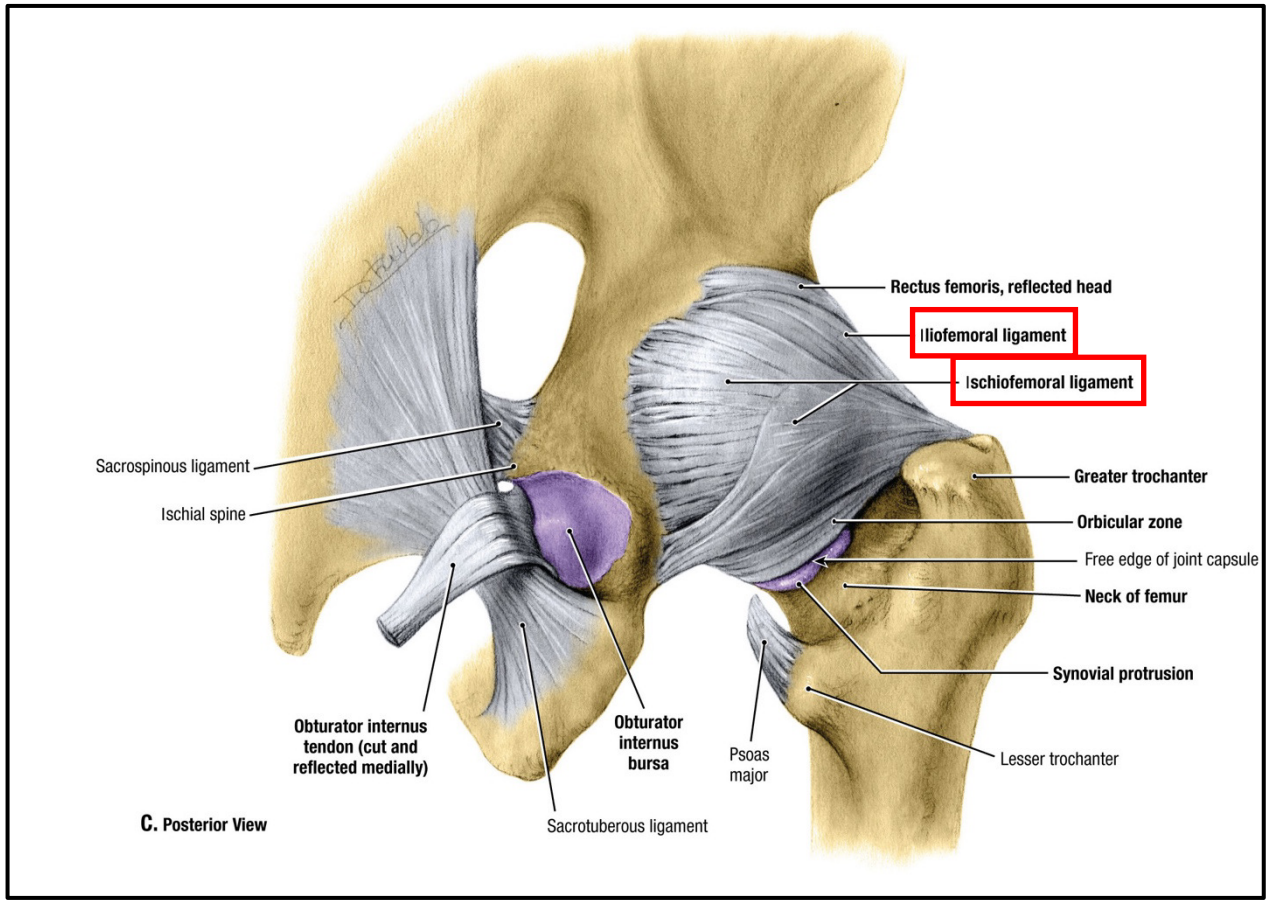
Hip Joint: Joint Capsule and Ligaments

The fibrous capsule of the hip joint attaches proximally to the acetabulum and transverse acetabular ligament, and distally to the intertrochanteric line and neck of the femur. It is strong enough to provide stability to the joint, but loose enough to allow free range of movement.

The ligaments that form parts of the capsule are:

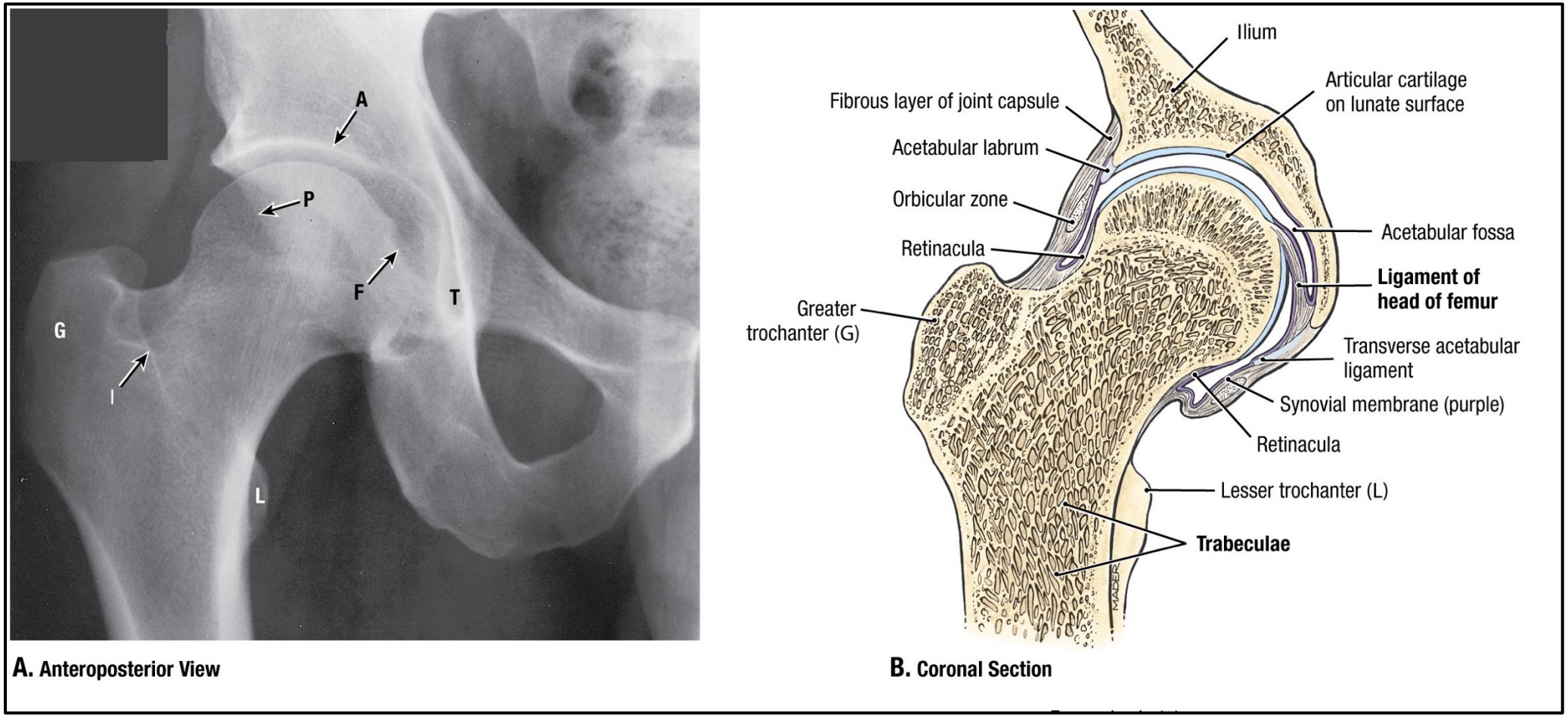
- **Iliofemoral ligament (Y ligament)**: a Y-shaped ligament that reinforces the capsule anteriorly. It prevents hyperextension of the femur while standing.
- **Pubofemoral ligament:** strengthens the capsule inferiorly and anteriorly; it prevents excessive abduction of the femur.
- **Ischiofemoral ligament**: reinforces the capsule posteriorly, and prevents excessive medial rotation and hyperextension.





Hip Joint: Conventional Radiography

A= Roof of acetabulum
P = Posterior margin acetabulum
F = Fovea
G = Greater trochanter
L = Lesser trochanter
I = Intertrochanteric line
T = “Teardrop” appearance from superimposition of structures at inferior margin of acetabulum



A. Anteroposterior View

B. Coronal Section

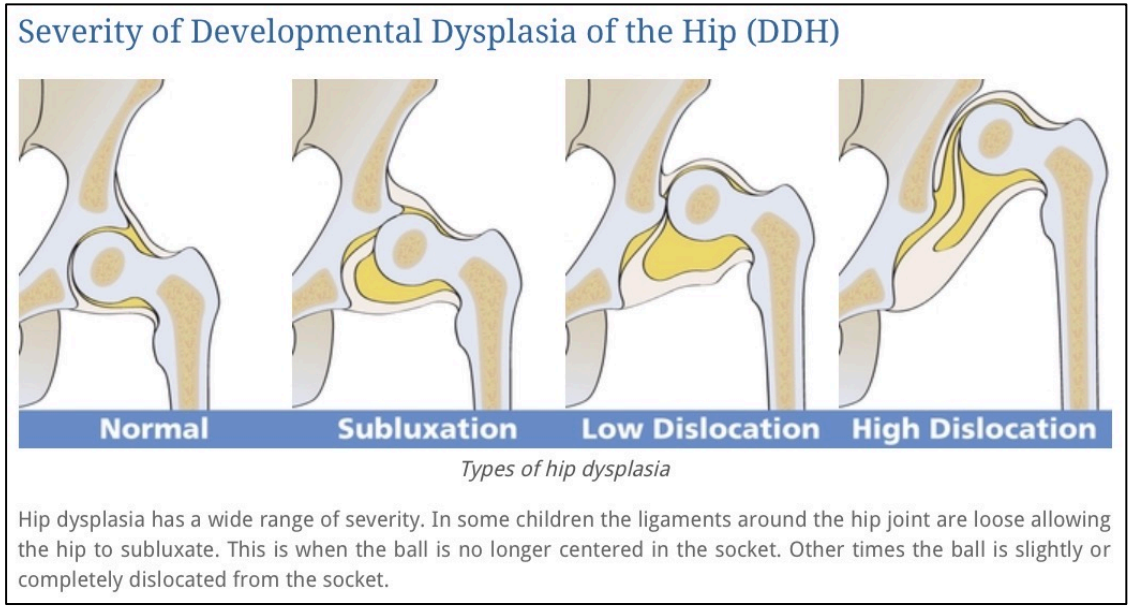
Hip Joint: Developmental Dysplasia

CLNICAL ANATOMY: Developmental dysplasia of the hip is the most common orthopedic disorder in newborns. The term developmental dysplasia of the hip (DDH) describes a spectrum of deformities involving the growing hip that results in varying displacement of the proximal femur from the acetabulum.

- •Dislocated: In the most severe cases of DDH, the head of the femur is completely out of the socket.
- •Dislocatable: In these cases, the head of the femur lies within the acetabulum, but can easily be pushed out of the socket during a physical examination.
- •Subluxable: In mild cases of DDH, the head of the femur is simply loose in the socket. During a physical examination, the bone can be moved within the socket, but it will not dislocate.

Developmental dysplasia of the hip is often the result of a a poorly developed acetabulum that is shallow in depth, which prevents the femoral head from firmly fitting into the acetabular "socket." In some situations, the ligaments stabilizing the joint are stretched.

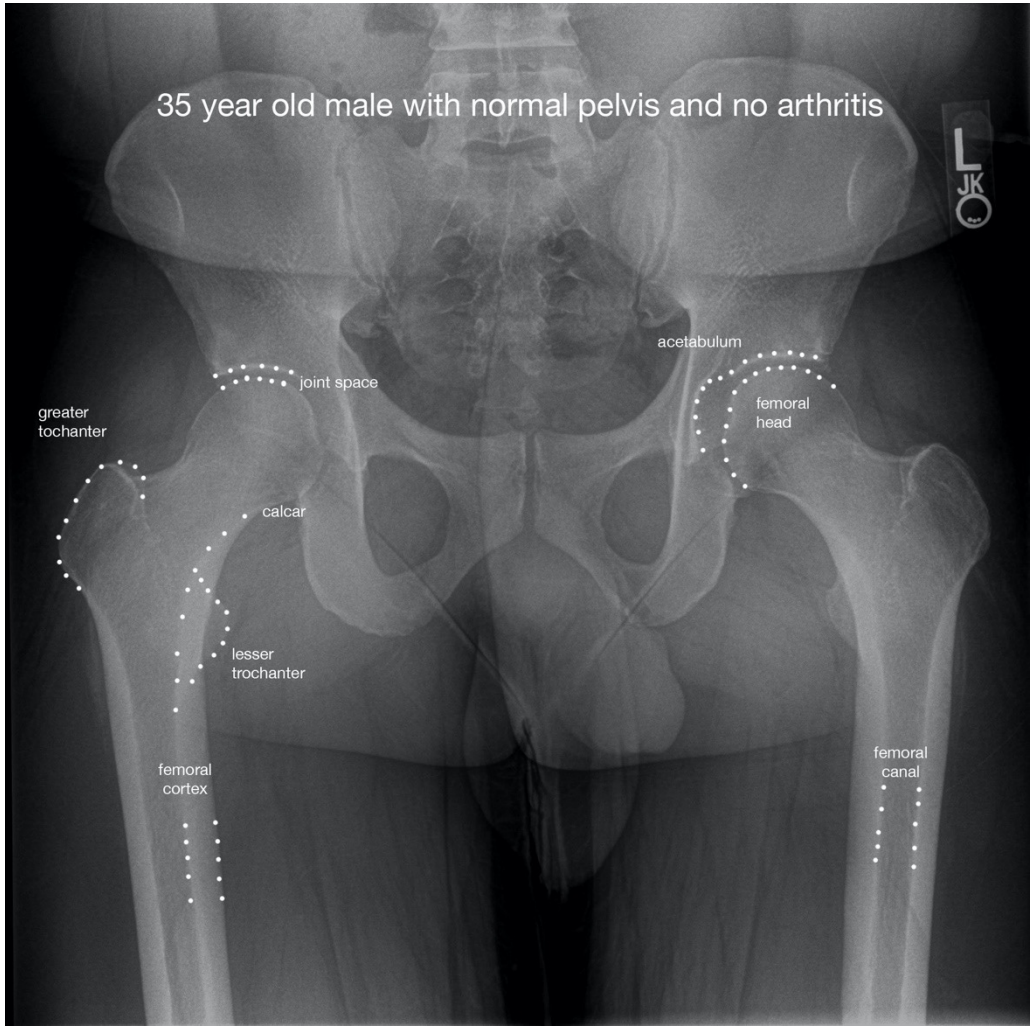
- The primary mechanism of screening and and diagnosis is palpable hip subluxation/dislocation on exam. When DDH is detected at birth, it can usually be corrected with the use of a harness or brace.
- If treatment is delayed beyond 2 years of age, hip deformity can lead to painful hips, waddling walking and a decrease in strength. If untreated altogether, osteoarthritis and other hip deformities can develop in young adulthood.

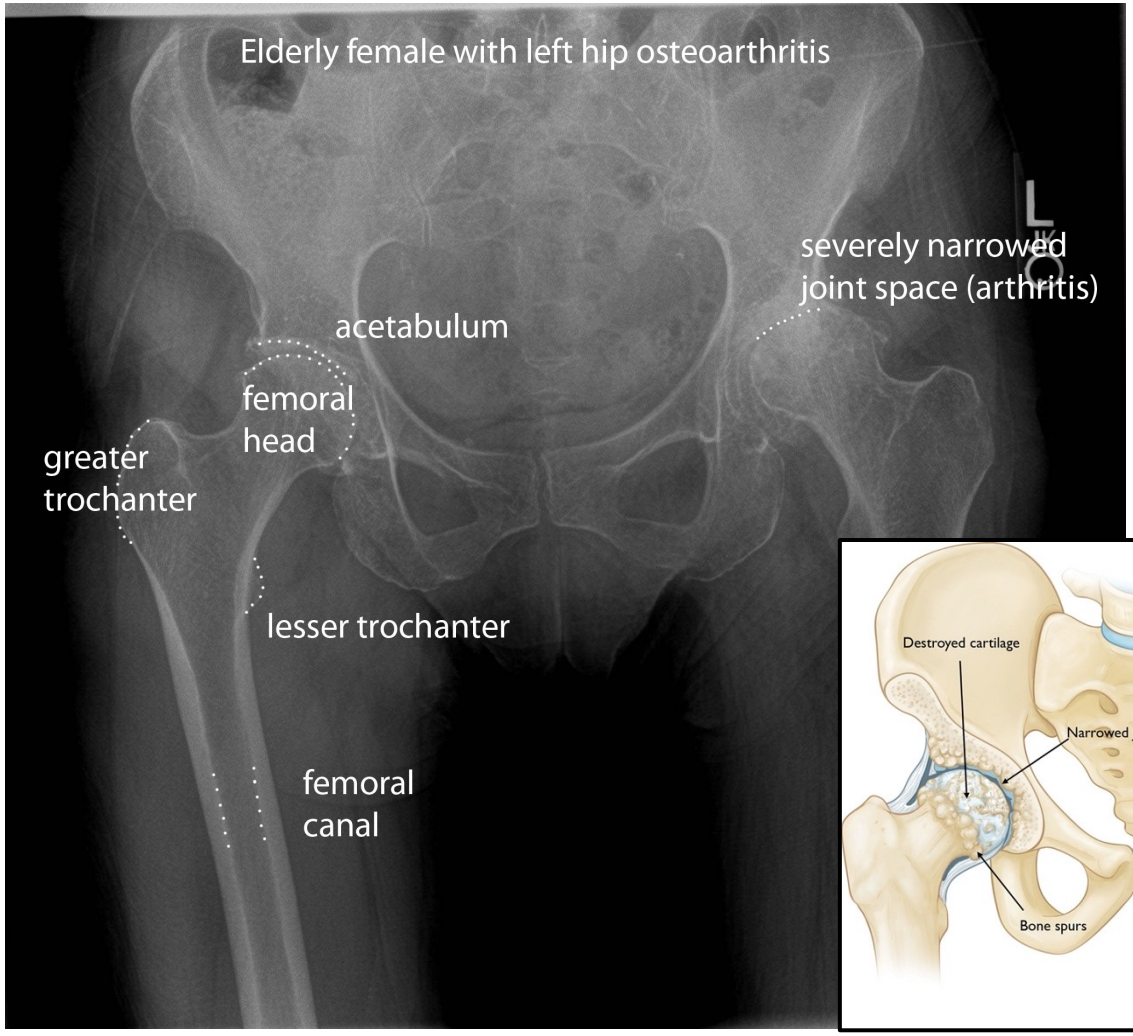


AP pelvic radiograph of a 2-year-old girl with developmental dysplasia of the left hip. The femoral heads are partially ossified. There is a dysplastic left acetabulum (shallow left acetabulum), and a small left femoral epiphysis when compared to the right. The left proximal femoral metaphysis is displaced superiorly and laterally. Note the fraying of the proximal femoral metaphyses (this patient was also diagnosed with rickets).

Hip Joint: Osteoarthritis

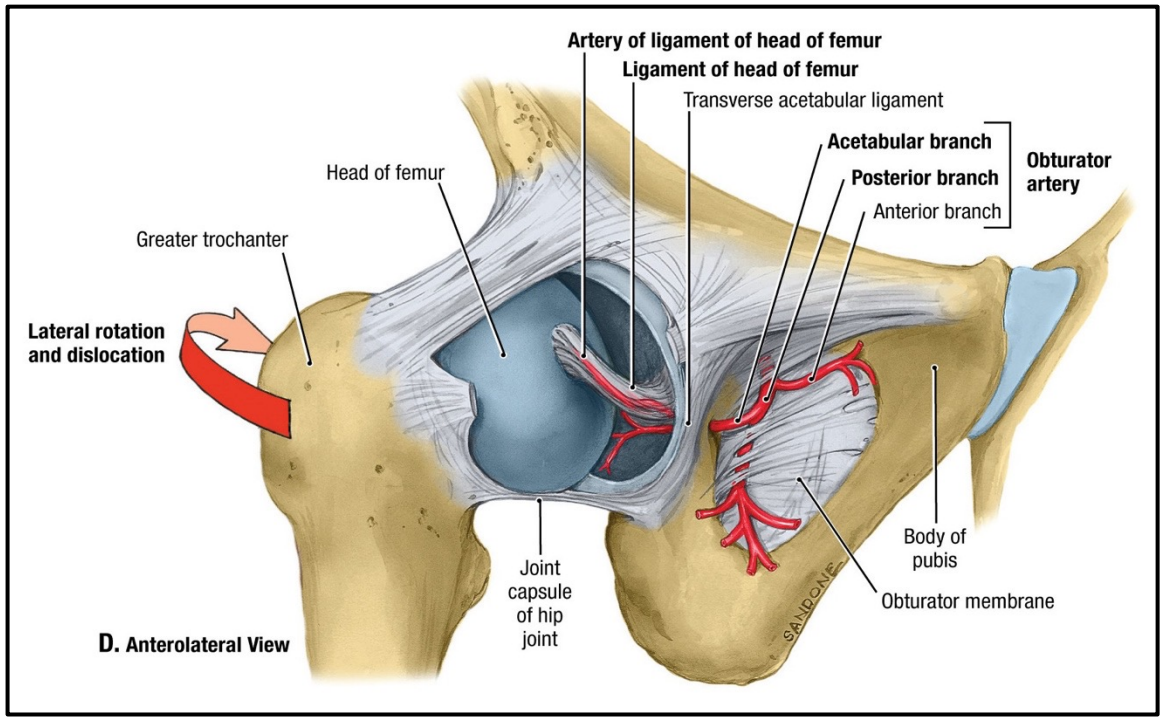
CLINICAL ANATOMY: In **osteoarthritis** of the hip, the cartilage gradually wears away over time. As the cartilage wears away, it becomes frayed and rough, and the protective joint space between the bones decreases, which can be seen on AP radiographs of the hip joint. This can result in bone rubbing on bone. To make up for the lost cartilage, the damaged bones may start to grow outward and form bone spurs (osteophytes). Osteoarthritis develops slowly and the pain it causes worsens over time. Recall the classic signs of osteoarthritis on radiographs: joint space narrowing, sclerosis, osteophytes, and subchondral cysts.



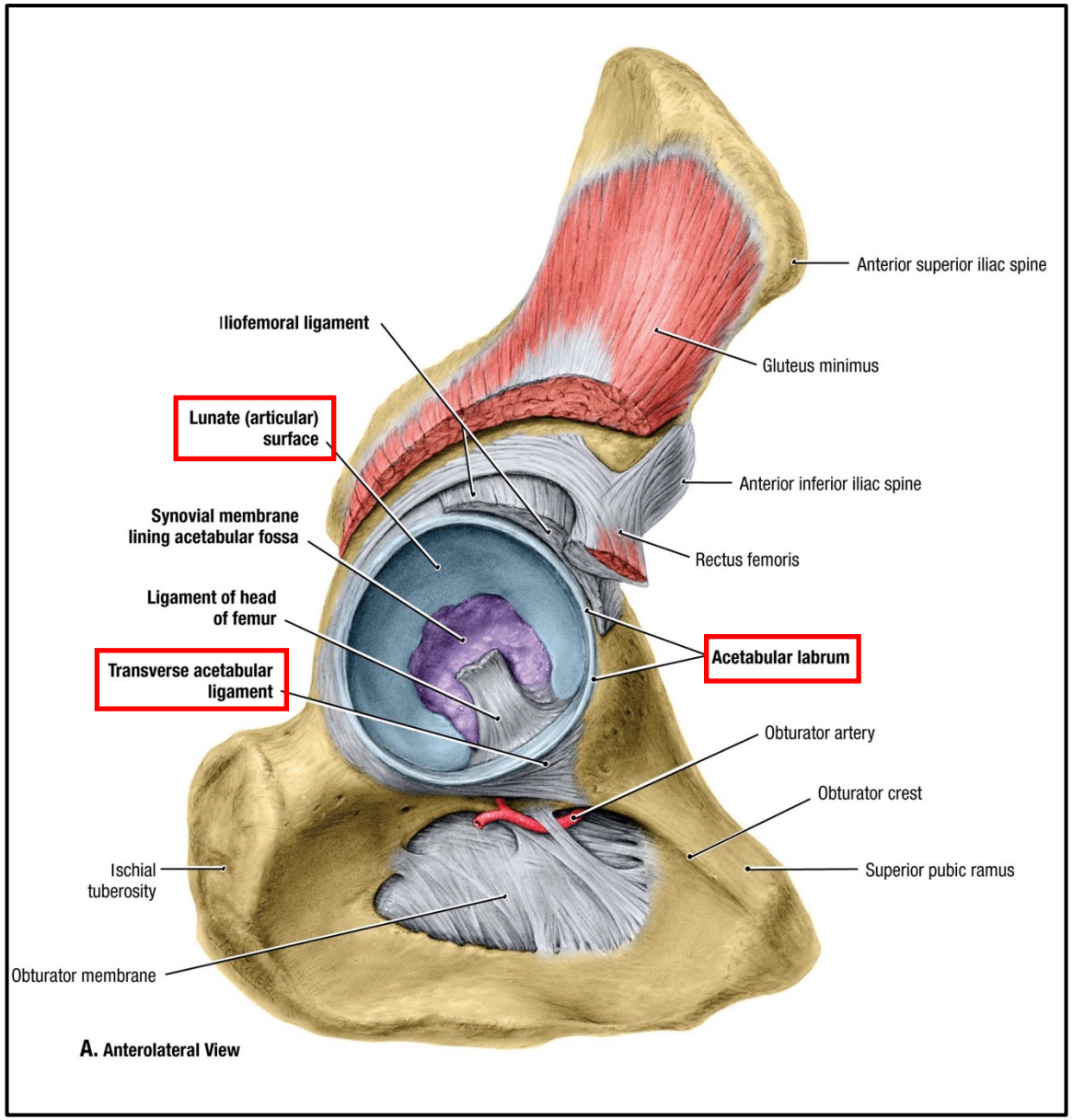


Hip Joint: Intracapsular Structures

- **Hyaline cartilage** covers the lunate surface and the femoral head
- **Transverse acetabular ligament** spans the acetabular notch converting it to a foramen
- **Ligament of the head of the femur** is a weak ligament that attaches to the fovea on the femoral head, and the acetabular notch/ transverse acetabular ligament.
- **Acetabular labrum** - similar to the glenoid labrum of the shoulder, the acetabular labrum functions to increase the depth of the acetabulum.

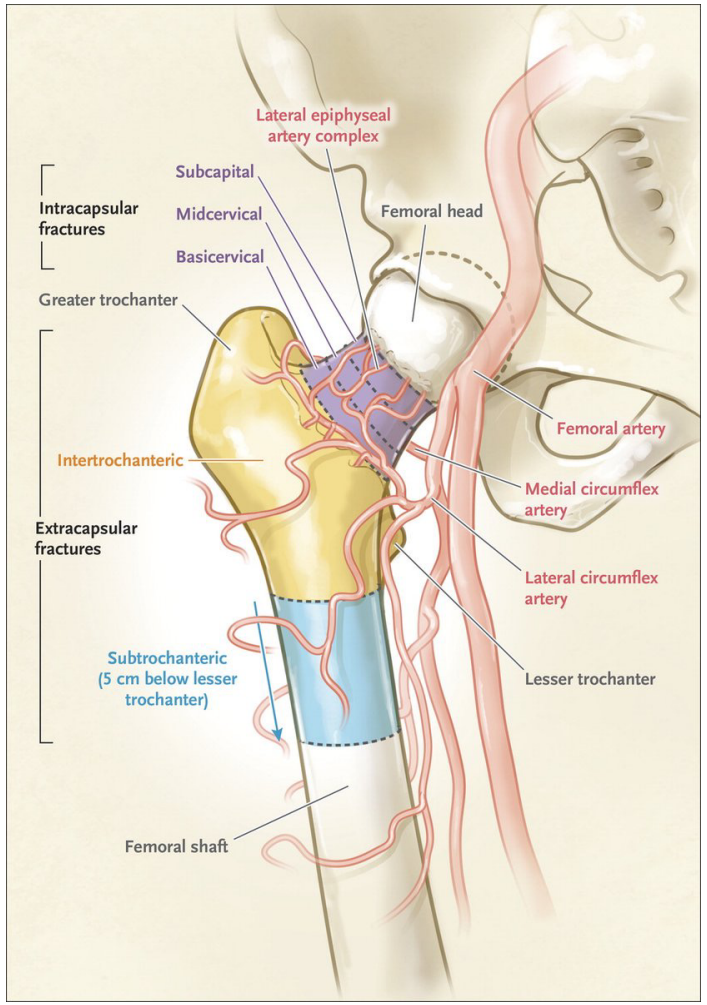


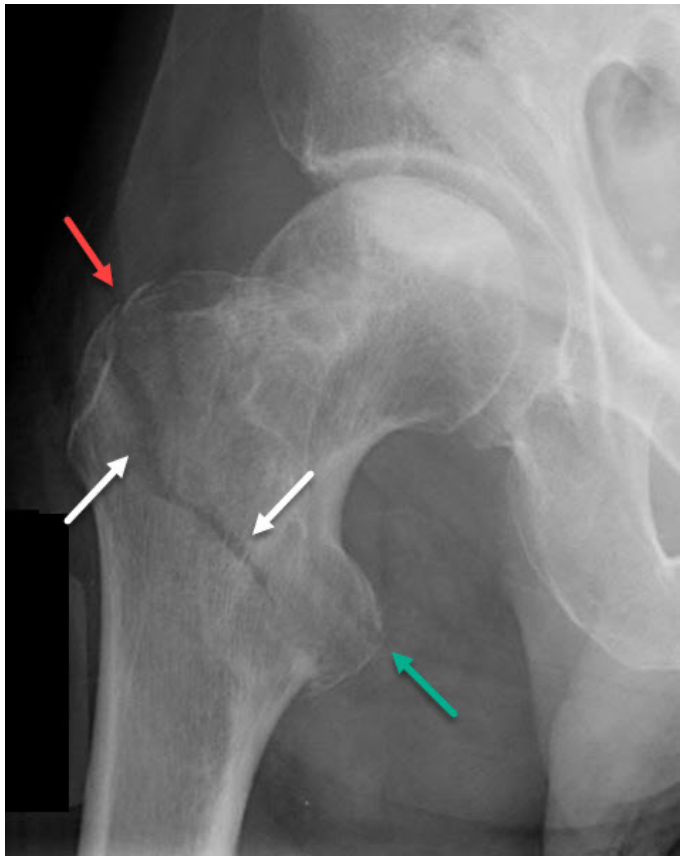
FUNCTIONAL ANATOMY: The ligament of the head of the femur usually transmits the artery of the femoral head, a branch of the obturator artery (Figure 2.2). This artery has a minor role in supplying blood to the femoral head prior to closure of the growth plate of the femoral head.



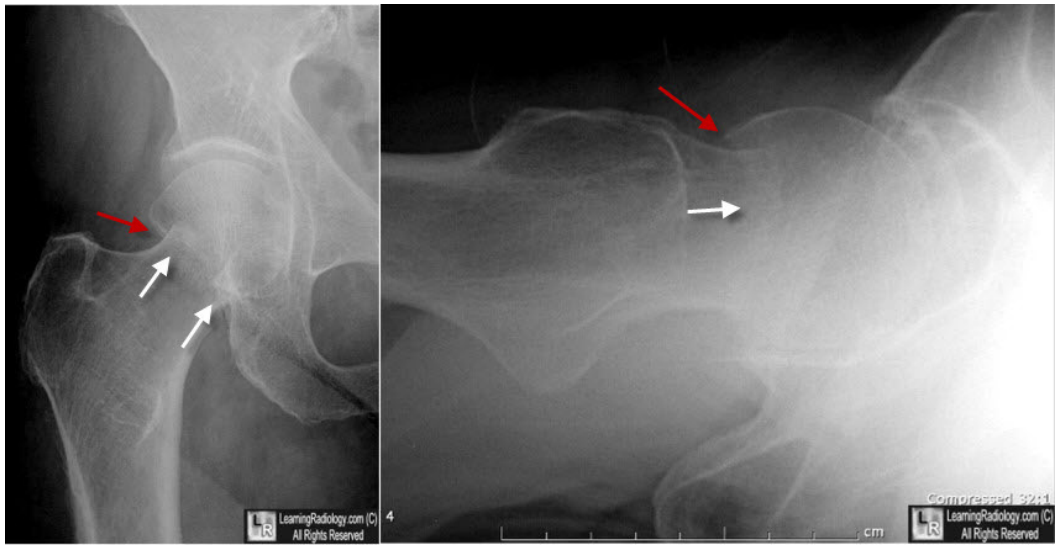
Hip Fractures

CLINICAL ANATOMY: Fractures of the proximal femur are generally characterized as “intracapsular” or “extracapsular” depending on whether they occur within or outside the fibrous capsule of the joint. Intracapsular fractures have a high incidence of subsequent avascular necrosis due to disruption of the medial circumflex artery. (See next slide.)





Intertrochanteric fracture (extracapsular fracture). There is a fracture from the greater (red arrow) to the lesser (green arrow) trochanter. A lucency, representing the fracture, runs between the two trochanters (white arrows).



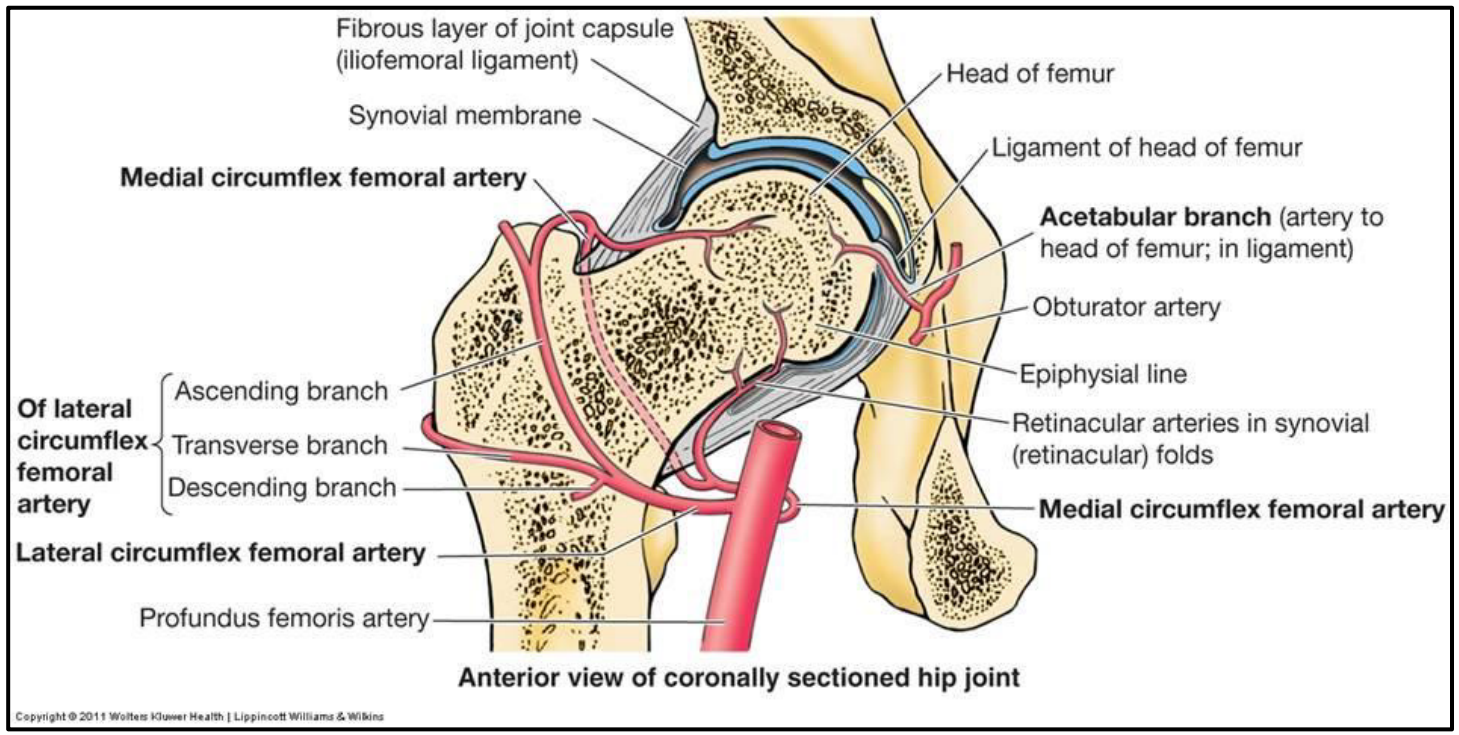
Sub-capital hip fracture (most common intracapsular fracture). On the frontal view, there is a step-off in the cortex superiorly (red arrow) while there is abnormal overlapping of the femoral head and neck (white arrows) due to impaction. On the lateral view, the same step-off can be seen (red arrow) as well as the impaction (white arrow).

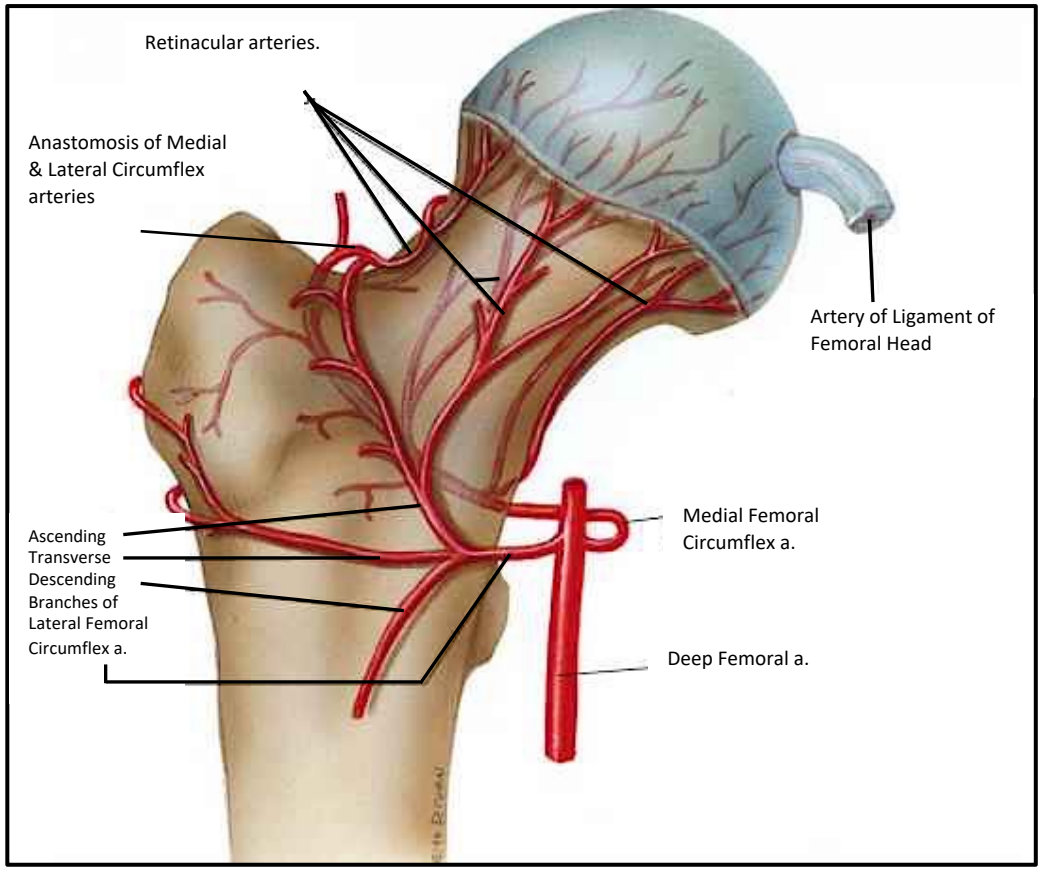
Hip Joint: Blood Supply

The major blood supply to the hip joint is provided by the **medial and lateral femoral circumflex arteries**. The medial branch is the most important source because it supplies most of the blood to the femoral head and neck. The femoral circumflex arteries form **retinacular branches** that enter the femoral head by coursing along the femoral neck deep to the synovial membrane.

The joint also receives a small contribution from the **obturator artery**, whose **acetabular branch** passes into the acetabular fossa through the acetabular foramen. The acetabular branch primarily supplies the acetabulum, although it sends a small branch to the head of the femur through the **ligament of the head**.

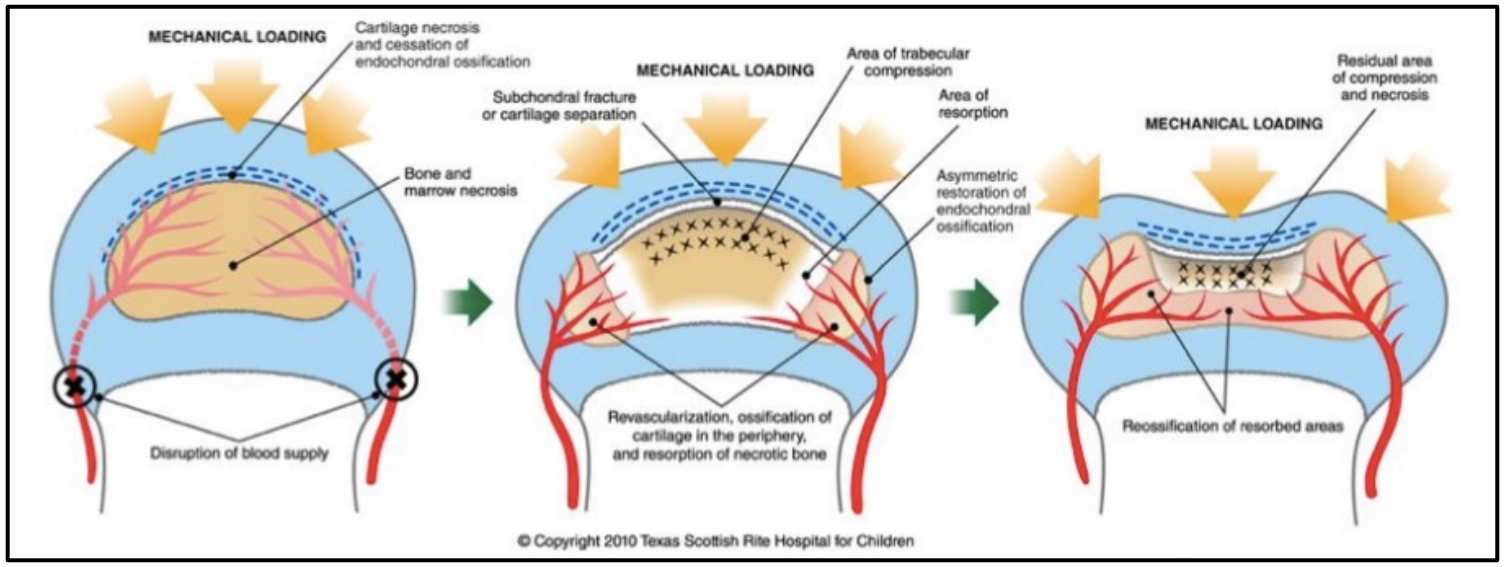
CLINICAL ANATOMY: Intracapsular fractures have a high incidence of subsequent avascular necrosis due to disruption of the medial circumflex artery. The artery to the head of the femur (branch of obturator) is inconsistent and does not supply enough blood to the femoral head to prevent avascular necrosis.

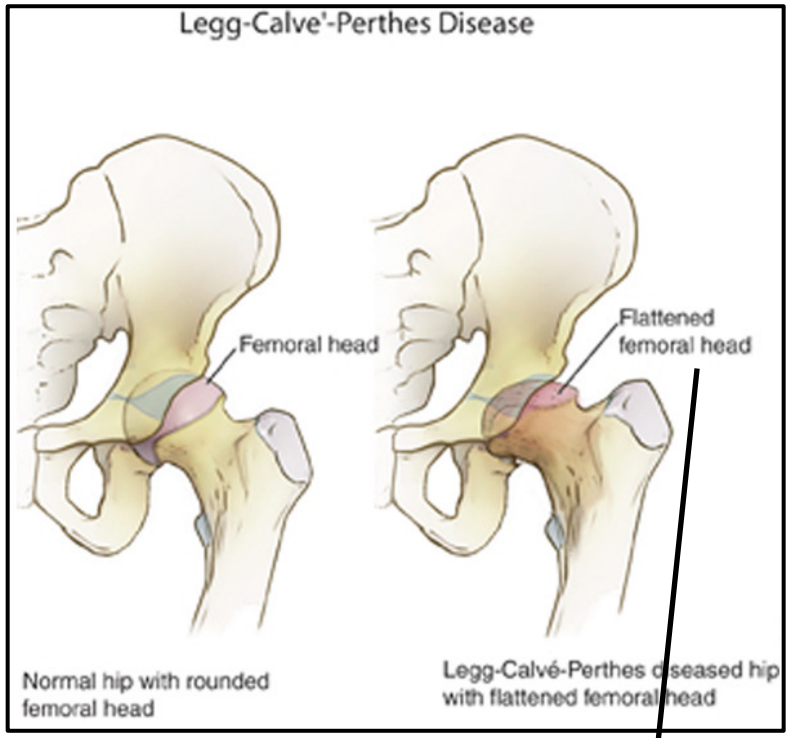


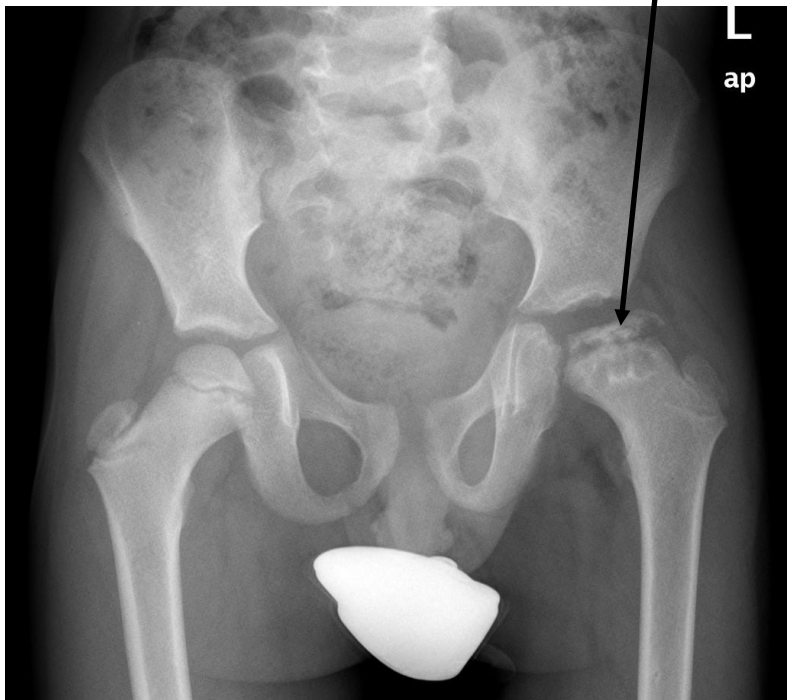


Hip Joint: Legg-Calvé-Perthes Disease

CLINICAL ANATOMY: Legg-Calvé-Perthes disease (LCPD; Legg-Perthes Disease) is defined as idiopathic avascular osteonecrosis of the capital femoral epiphysis of the femoral head. LCPD is a relatively unusual condition typically found in young children; it can lead to osteoarthritis in adults. It is caused by an interruption to the blood supply of the head of the femur close to the hip joint and is therefore equivalent to osteonecrosis. The pathogenesis of the femoral head deformity following ischemic necrosis is shown in the Figure below

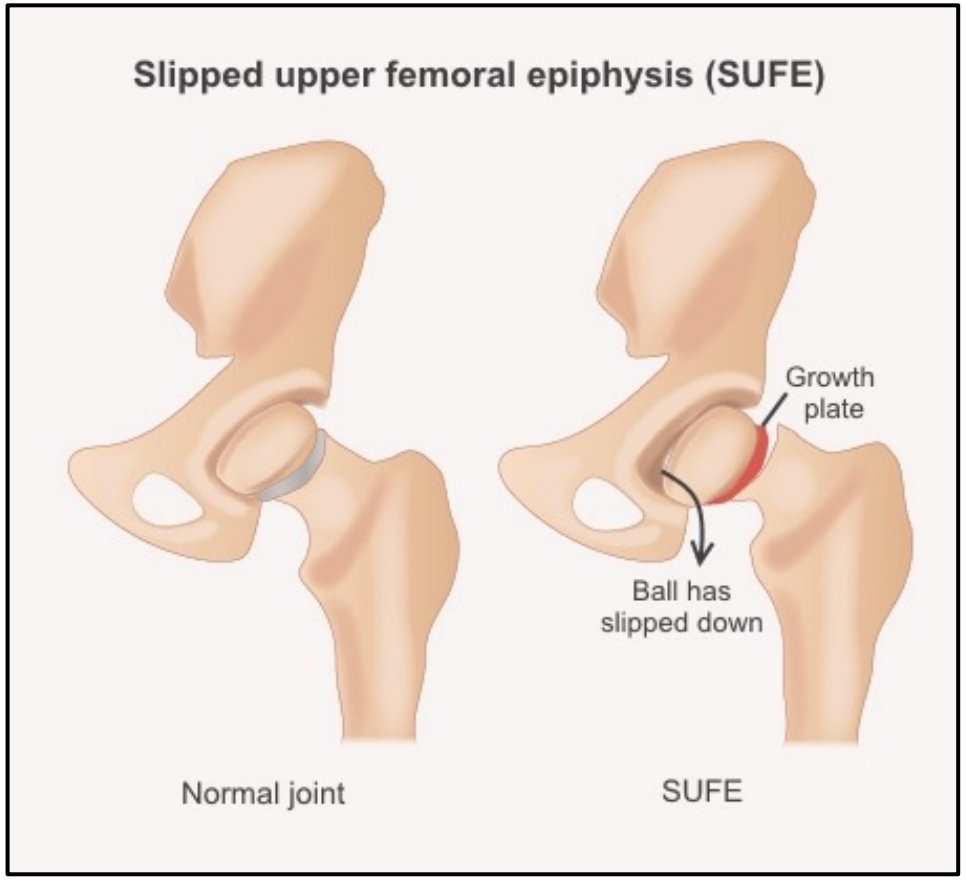


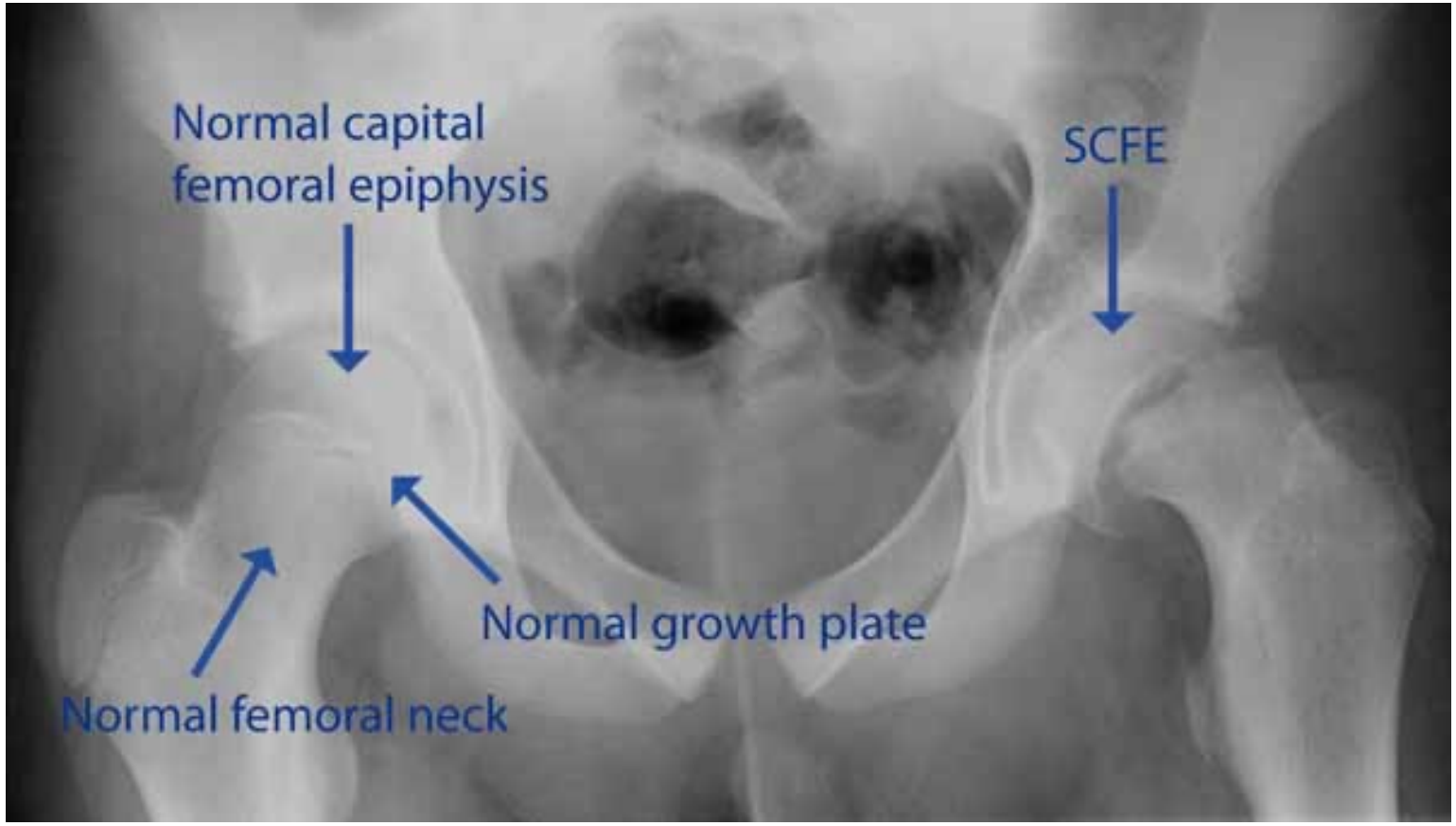




Hip Joint: Slipped Capital Femoral Epiphysis (SCFE)

CLINICAL ANATOMY: Slipped capital femoral epiphysis (SCFE), or fracture of the growth plate of the femoral head, is the most common hip abnormality presenting in adolescence. When the epiphysis is disrupted, blood supply to the head of the femur may be compromised and osteonecrosis of the head may result. In the US the incidence of SCFE is 1 case per 100,000 people. SCFE occurs most frequently in adolescents, with a slightly greater incidence in males than in females. SCFE typically occurs just after the onset of puberty, frequently in overweight and slightly skeletally immature boys.





Hip Joint: Summary of Motions

FLEXION	
Muscle	Innervation
iliopsoas: a) psoas major, b) iliacus	a) L1-L3 ventral rami b) femoral nerve
rectus femoris	femoral nerve
sartorius	femoral nerve
tensor fasciae latae	superior gluteal nerve
adductor longus & brevis	obturator nerve
adductor magnus (adductor portion)	obturator nerve
pectineus	femoral nerve
EXTENSION	
gluteus maximus	inferior gluteal nerve
semitendinosus	tibial nerve
semimembranosus	tibial nerve
biceps femoris (long head)	tibial nerve
adductor magnus (hamstring portion)	tibial nerve
ABDUCTION	
gluteus medius & minimus (lesser gluteals)	superior gluteal nerve
tensor fasciae latae	superior gluteal nerve

ADDUCTION	
Muscle	Innervation
adductors (longus, brevis, magnus)	obturator nerve
gracilis	obturator nerve
pectineus	femoral nerve
obturator externus	obturator nerve
LATERAL ROTATION	
sartorius	femoral nerve
gluteus maximus	inferior gluteal nerve
obturator externus	obturator nerve
piriformis	S1-S2
obturator internus	nerve to obturator internus
superior gemellus	nerve to obturator internus
inferior gemellus	nerve to quadratus femoris
quadratus femoris	nerve to quadratus femoris
MEDIAL ROTATION	
tensor fasciae latae	superior gluteal nerve
gluteus medius & minimus	superior gluteal nerve