

**Islamic University College  
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of Radiation Techniques**

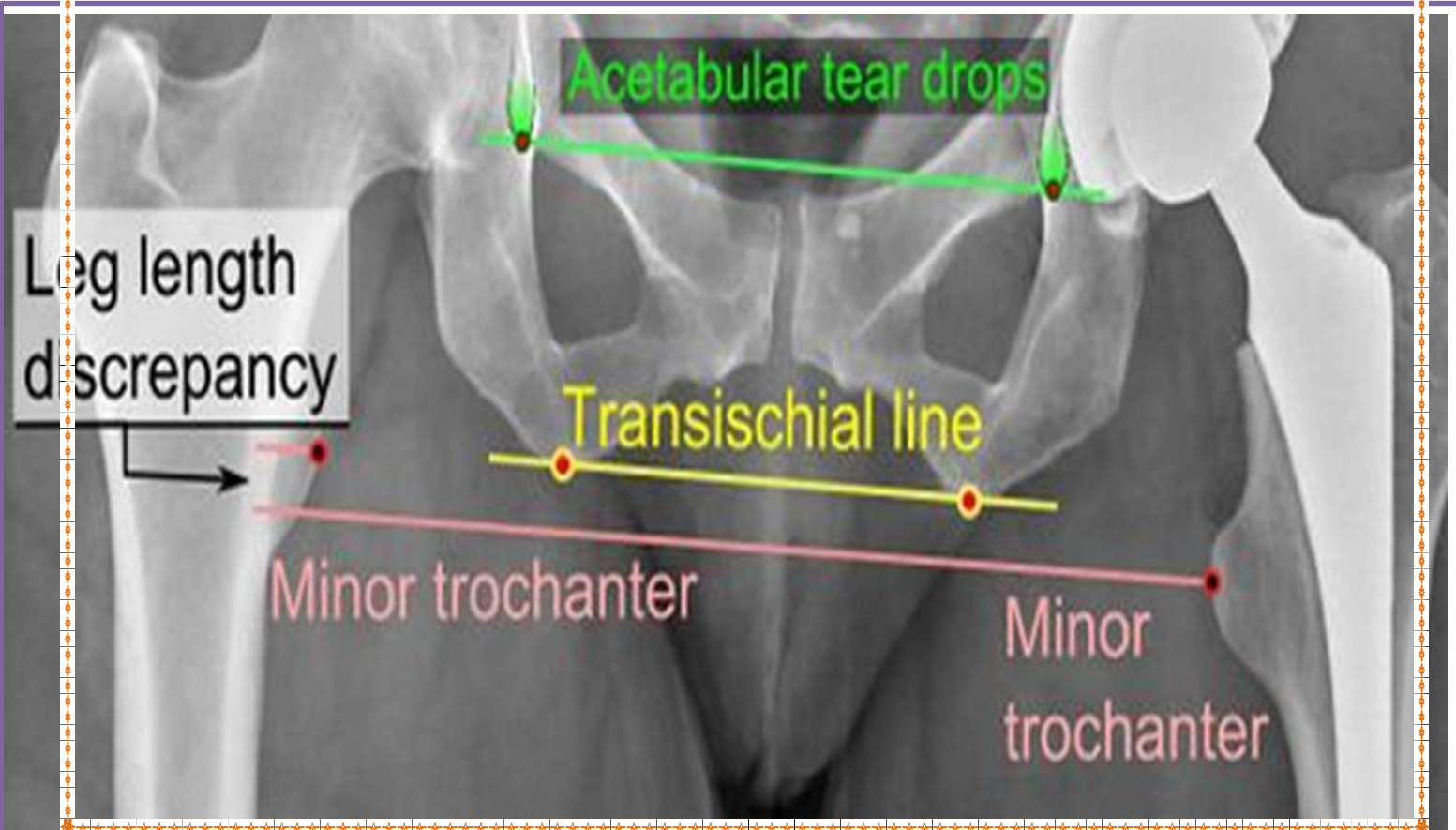


**RADIOLOGICAL FEATURE HIP , KNEE AND  
ANKLE JOINT OF LOWER LIMB**

**LECTURE-9-10-**

**Dr. Safaa AL-Mosawy**

**M S C . Tariq Mhummed**



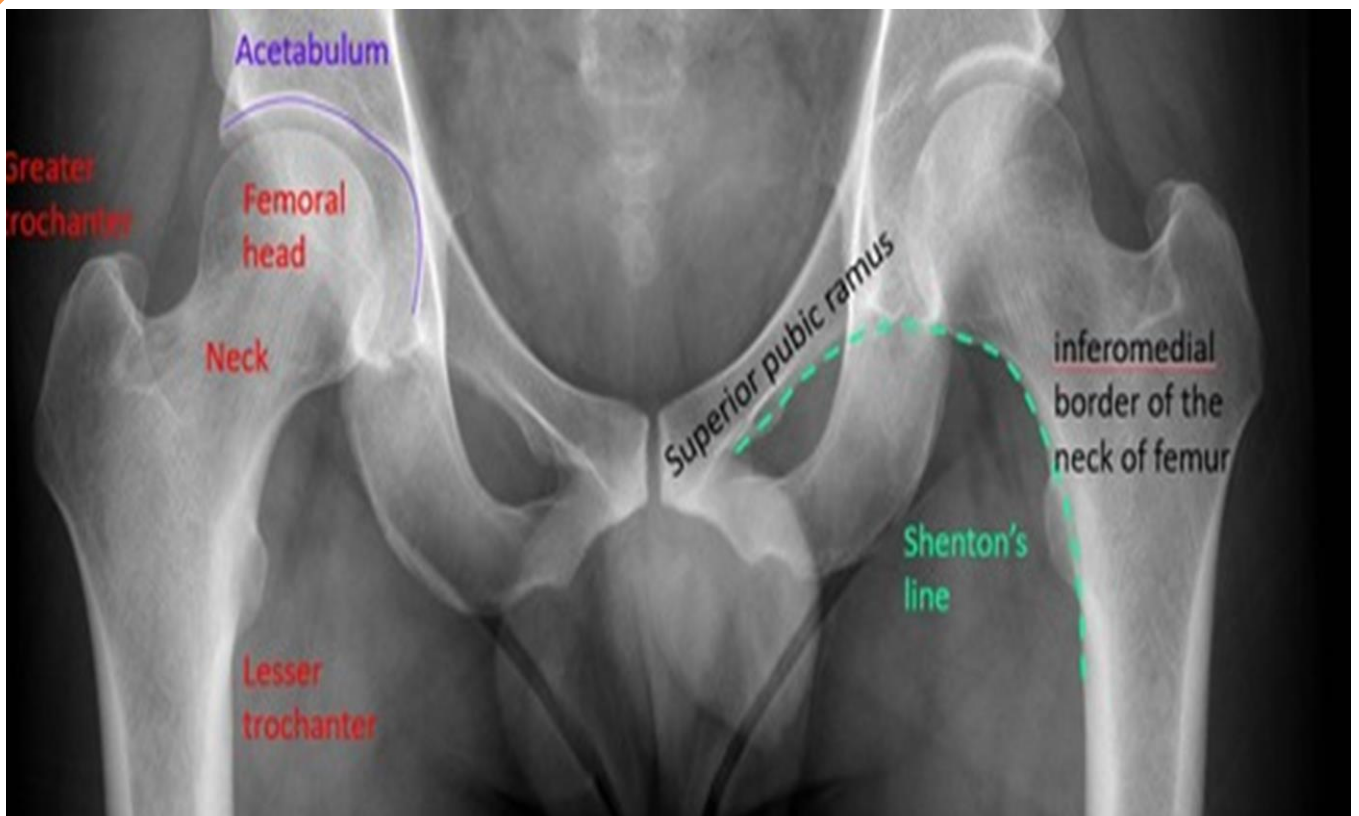
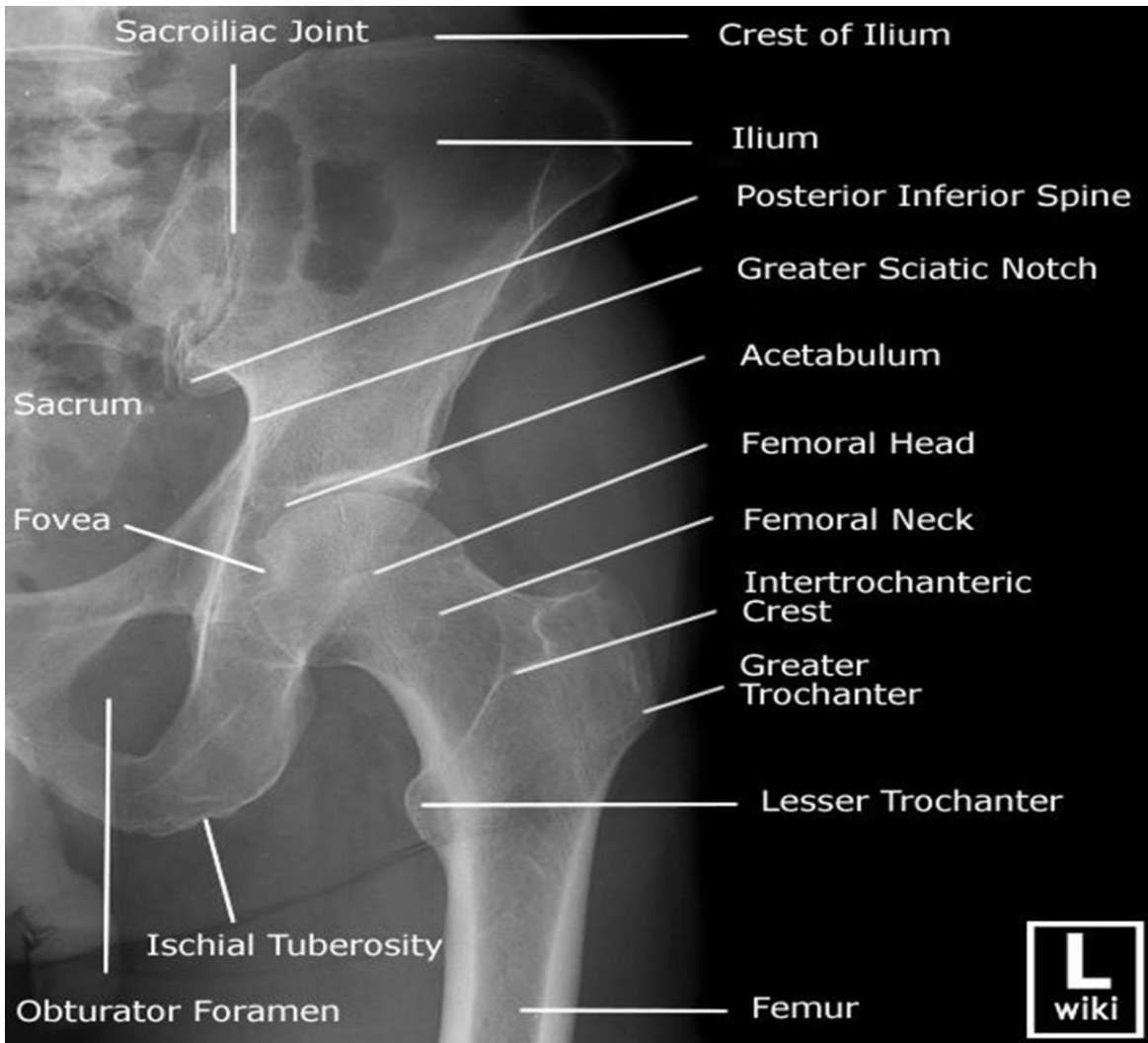
## The hip joint

The **hip joint** is a ball and socket synovial joint, formed by an articulation between the pelvic acetabulum and the head of the femur.

It forms a connection from the lower limb to the pelvic girdle, and thus is designed for stability and **weight-bearing** – rather than a large range of movement.

In this article, we shall look at the anatomy of the hip joint – its articulating surfaces, ligaments and neurovascular supply. The hip joint is **the junction where the hip joins the leg to the trunk of the body**. It is comprised of two bones: the thighbone or femur, and the pelvis, which is made up of three bones called ilium, ischium and pubis. The ball of the hip joint is made by the femoral head while the socket is formed by the acetabulum





# Structures of the Hip Joint

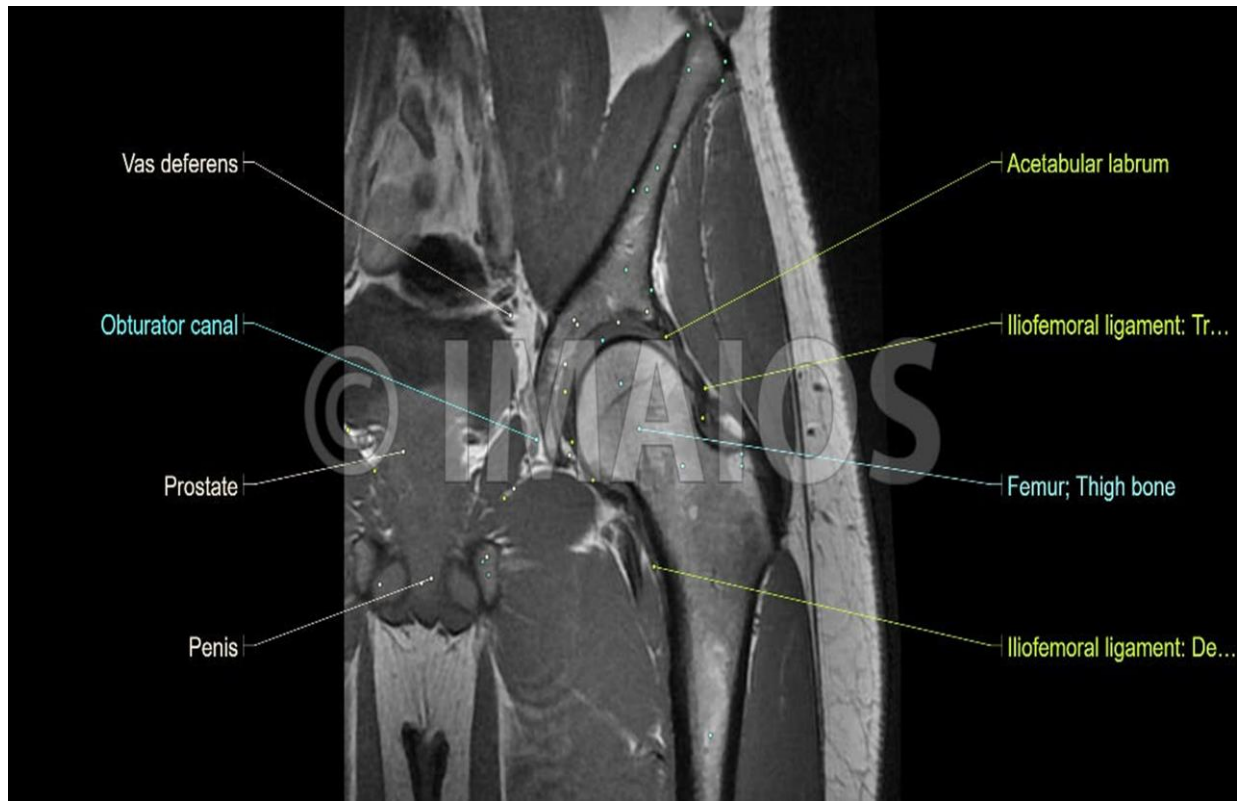
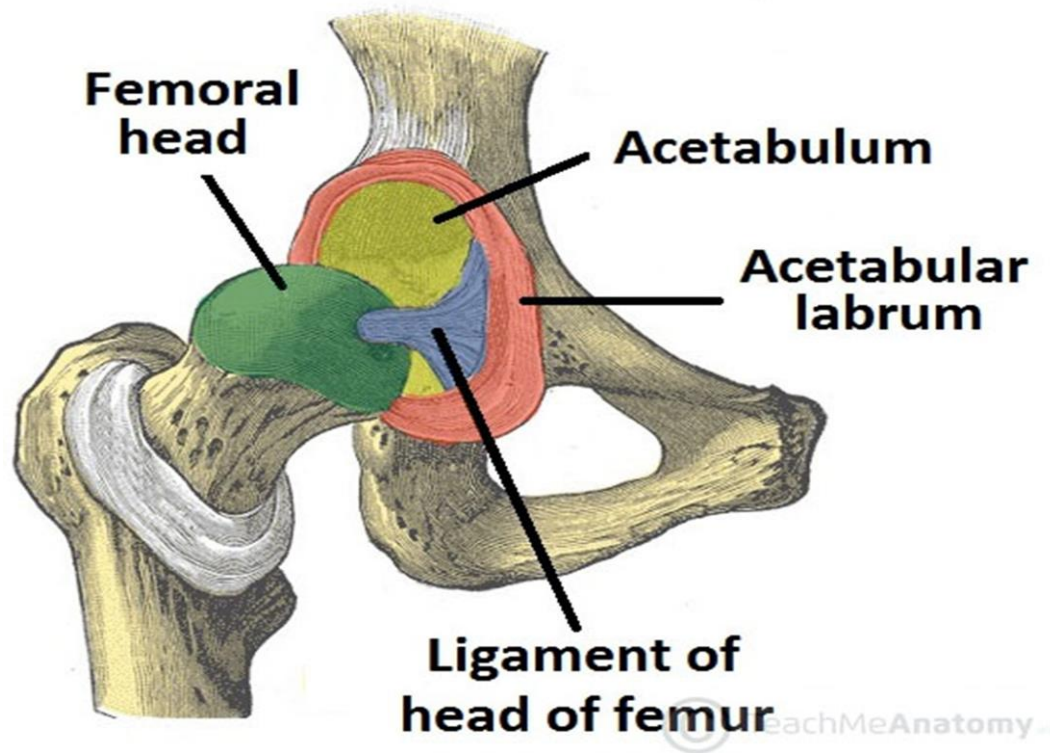
## Articulating Surfaces

The hip joint consists of an articulation between the head of femur and acetabulum of the pelvis.

The acetabulum is a cup-like depression located on the inferolateral aspect of the pelvis. Its cavity is deepened by the presence of a fibrocartilaginous collar – the acetabular labrum. The head of femur is hemispherical, and fits completely into the concavity of the acetabulum.

Both the acetabulum and head of femur are covered in articular cartilage, which is thicker at the places of weight bearing.

The capsule of the hip joint attaches to the edge of the acetabulum proximally. Distally, it attaches to the intertrochanteric line anteriorly and the femoral neck posteriorly.



**Anatomy of the hip (cross-sectional imaging on 3T MR and 3D medical pictures)**

## TYPE OF HIP JOINT

The hip is the area on each side of the pelvis. The pelvis bone is made up of 3 sections:

- **Ilium.** The broad, flaring portion of the pelvis.
- **Pubis.** The lower, rear part of the pelvis.
- **Ischium.** One of the bones that helps form the hip.

The hip joint is a ball-and-socket joint that allows motion and gives stability needed to bear body weight.

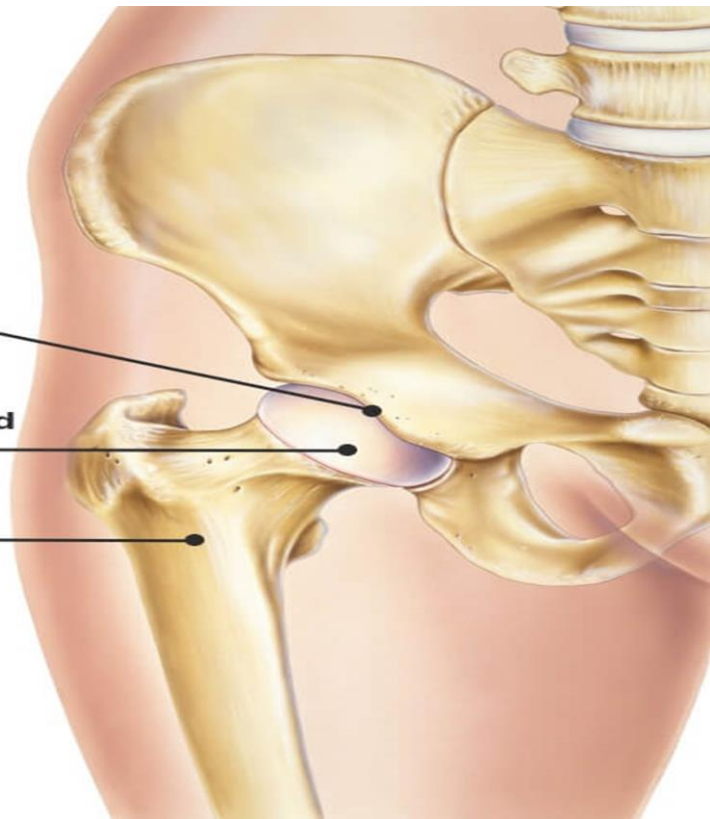
The socket area (acetabulum) is inside the pelvis. The ball part of this joint is the top of the thighbone (femur). It joins with the acetabulum to form the hip joint.

The hip is one of the most stable joints in the body. But because it bears your body weight, it is more likely to develop arthritis because of the extra pressure. Pain in the hip may be caused by injury to muscles, tendons, or the small fluid-filled sacs (bursae) that cushion and lubricate joints.

**Acetabulum  
(Socket)**

**Femoral Head  
(Ball)**

**Femur  
(Thighbone)**



## Hip series (Trauma)



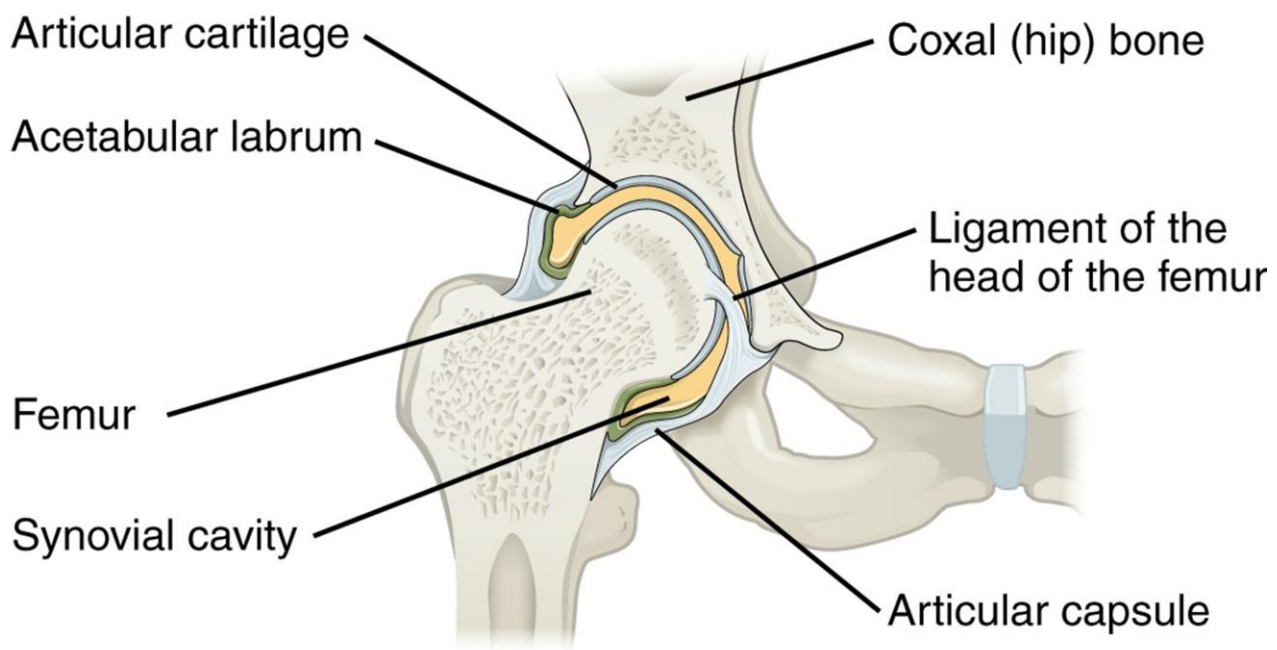
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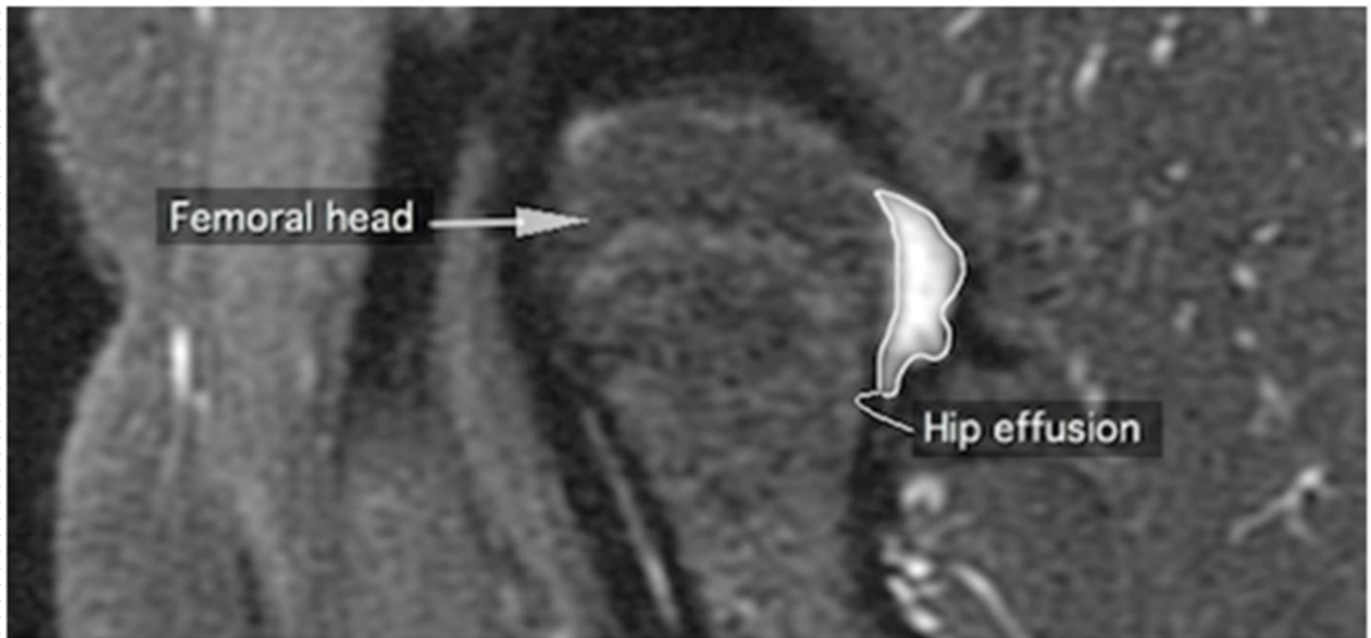


Horizontal beam Lateral

## CAPSULE OF HIP JOINT

The **hip joint capsule** is strong and dense, and is attached above to the acetabular margin 5-6 mm beyond its labrum, in front to the outer labral aspect and, near the acetabular notch, to the transverse acetabular ligament and the adjacent rim of the obturator foramen. It surrounds the femoral neck and is attached anteriorly to the intertrochanteric line, superiorly to the base of the femoral neck, posteriorly 1 cm above the intertrochanteric crest, and inferiorly to the femoral neck near the lesser trochanter.



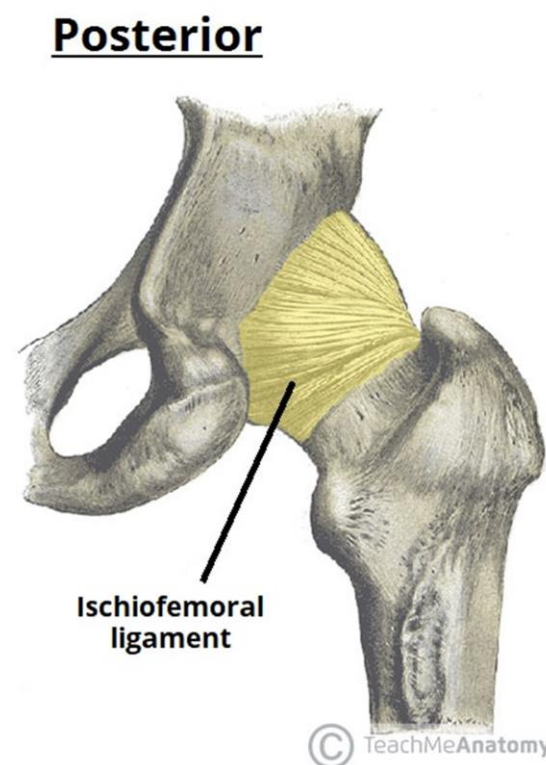
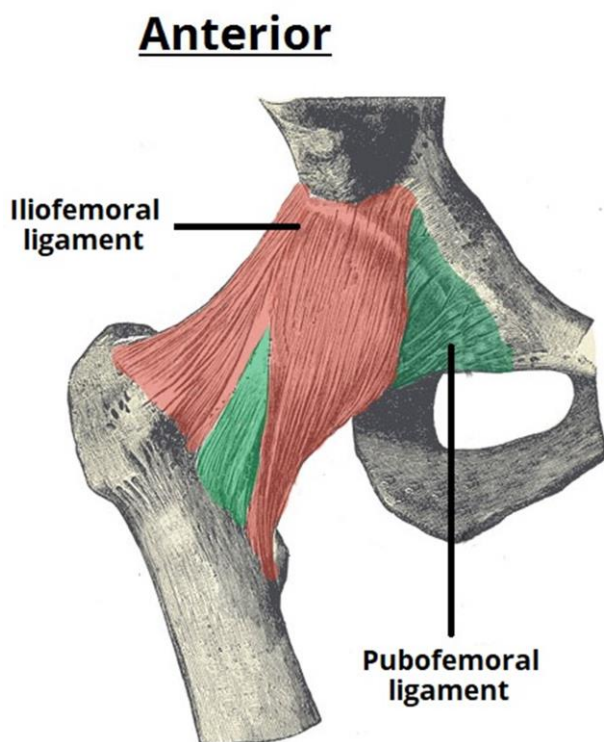


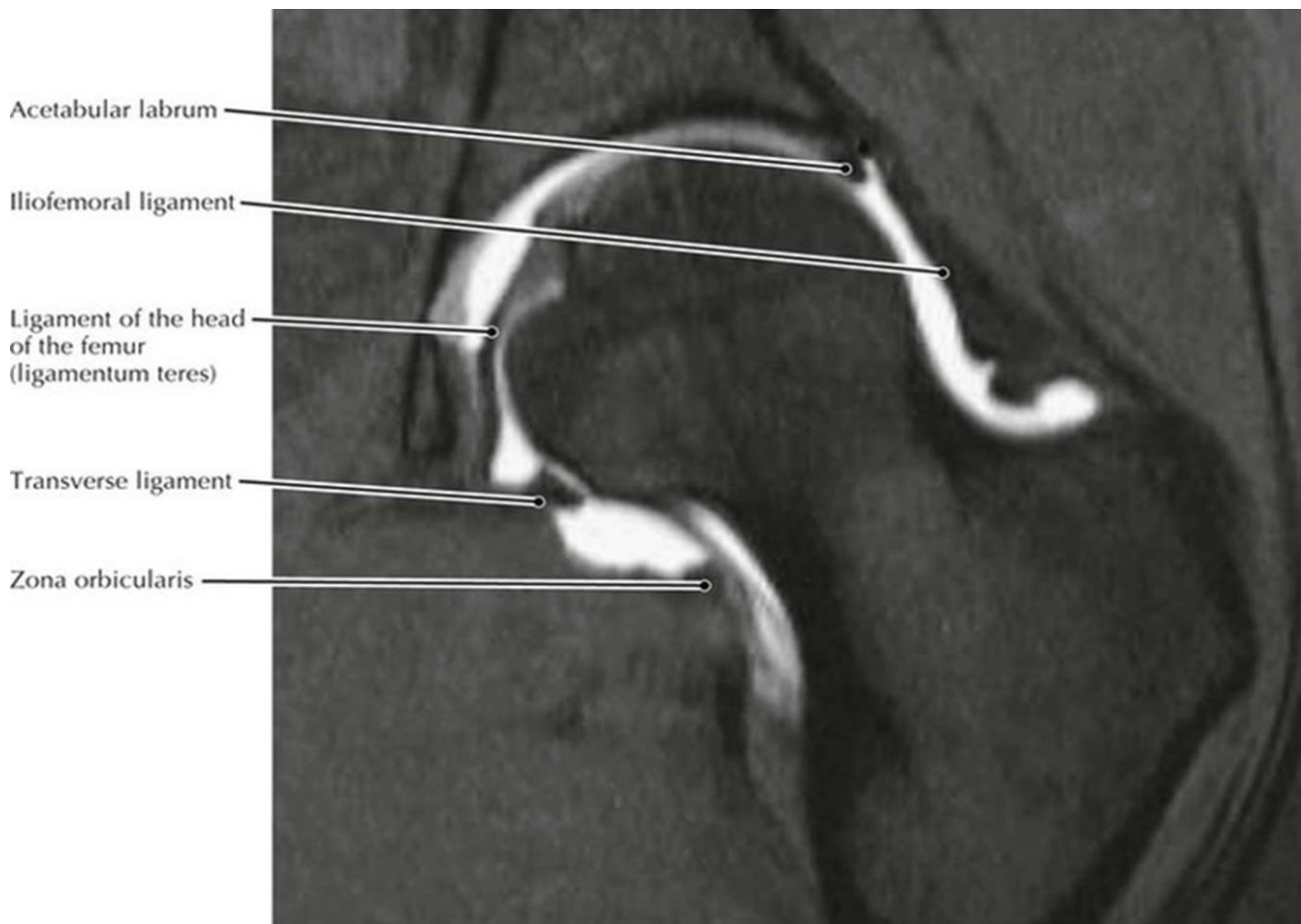
## Ligaments of hip joints

Ligaments are fibrous structures that connect bones to other bones. The hip joint is encircled with ligaments to provide stability to the hip by forming a dense and fibrous structure around the joint capsule. The ligaments adjoining the hip joint include:

- Iliofemoral ligament - This is a Y-shaped ligament that connects the pelvis to the femoral head at the front of the joint. It helps in limiting over-extension of the hip.
- Pubofemoral ligament - This is a triangular shaped ligament that extends between the upper portion of the pubis and the iliofemoral ligament. It attaches the pubis to the femoral head.

- Ischiofemoral ligament - This is a group of strong fibres that arise from the ischium behind the acetabulum and merge with the fibres of the joint capsule.
- Ligamentum teres - This is a small ligament that extends from the tip of the femoral head to the acetabulum. Although it has no role in hip movement, it does have a small artery within that supplies blood to a part of the femoral head.
- Acetabular labrum - The labrum is a fibrous cartilage ring which lines the acetabular socket. It deepens the cavity increasing the stability and strength of the hip joint.





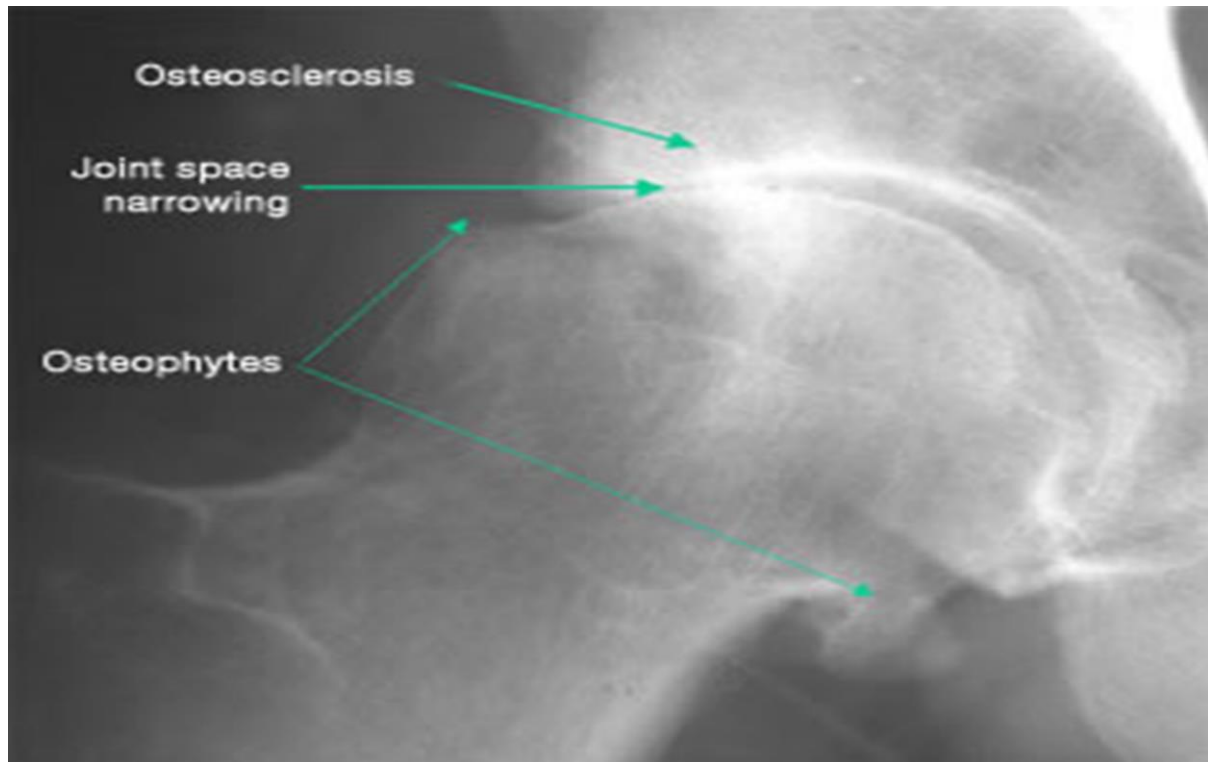
## RADIOLOGICAL FEATURE OF HIP JOINT

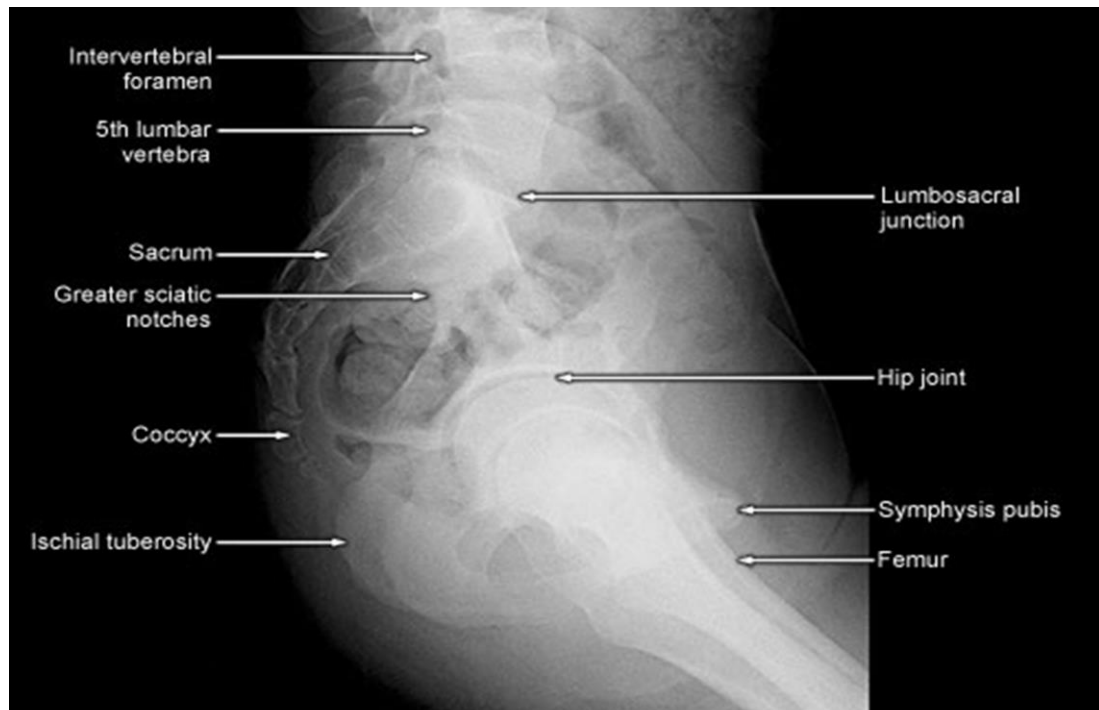
The hip joint is a ball and socket joint that represents the articulation of the bones of the lower limb and the axial skeleton (spine and pelvis). The rounded femoral head sits within the cup-shaped acetabulum.

The acetabulum is formed by the three bones of the pelvis (the ischium, ilium and pubis). Between them is a Y-shaped cartilaginous growth plate (the triradiate cartilage) which is usually

fused by age 14-16. The ball and socket articulation allows for a high degree of mobility. The **acetabular labrum** increases the depth of the joint <sup>1</sup>, thereby increasing the stability of the joint but causes a reduction in the movement at the joint. In comparison to the shoulder joint, it permits less range of movement due to the increased depth and contact area but displays far more stability.

The acetabulum covers nearly half of the femoral head. The actual hyaline articular cartilage-covered area (lunate surface) is C-shaped and forms an incomplete ring due to the **acetabular notch**. This notch is traversed by the **transverse ligament**.





## ARTHROGRAPHY

Arthrography is a type of imaging test used to look at a joint, such as the shoulder, knee, or hip. It may be done if standard X-rays do not show the needed details of the joint structure and function.

In arthrography, a long, thin needle is used to put contrast dye right into the joint and a series of X-rays is taken with the joint in various positions. X-rays use small amounts of radiation to get pictures of the inside of the body. Sometimes air is used as the contrast substance when regular contrast can not be used.

An arthrogram may also use fluoroscopy, CT (computerized tomography), or MRI (magnetic resonance imaging) instead of X-rays to get better pictures of the joint.

While arthrography is most commonly used to examine the knee and shoulder joints, it may also be used to look at other joints, such as the wrist, ankle, hip, or elbow.

## Hip Arthrography

Acetabular region of pelvis

What kind of joint is hip?

Diarthrotic- ball and socket joint

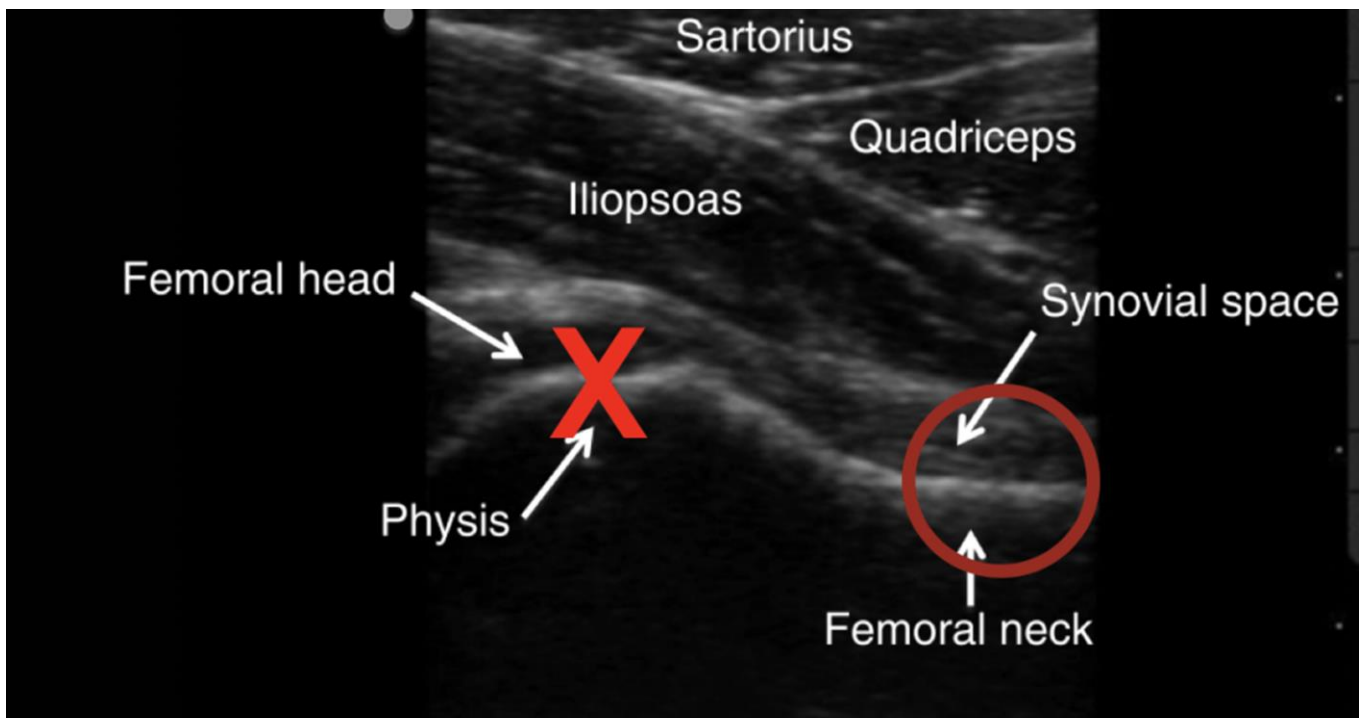
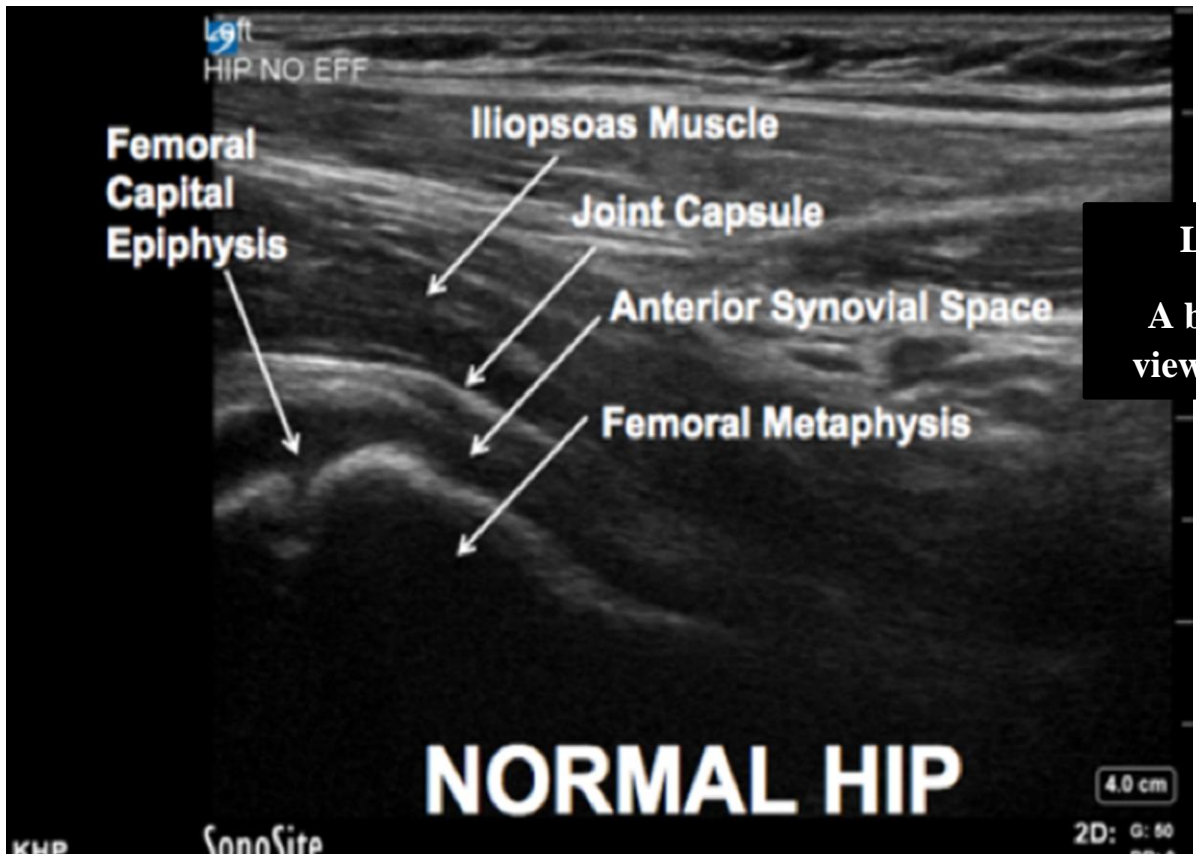
Allows flexion, extension, abduction, adduction, rotation



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# ULTRASONOGRAPHY

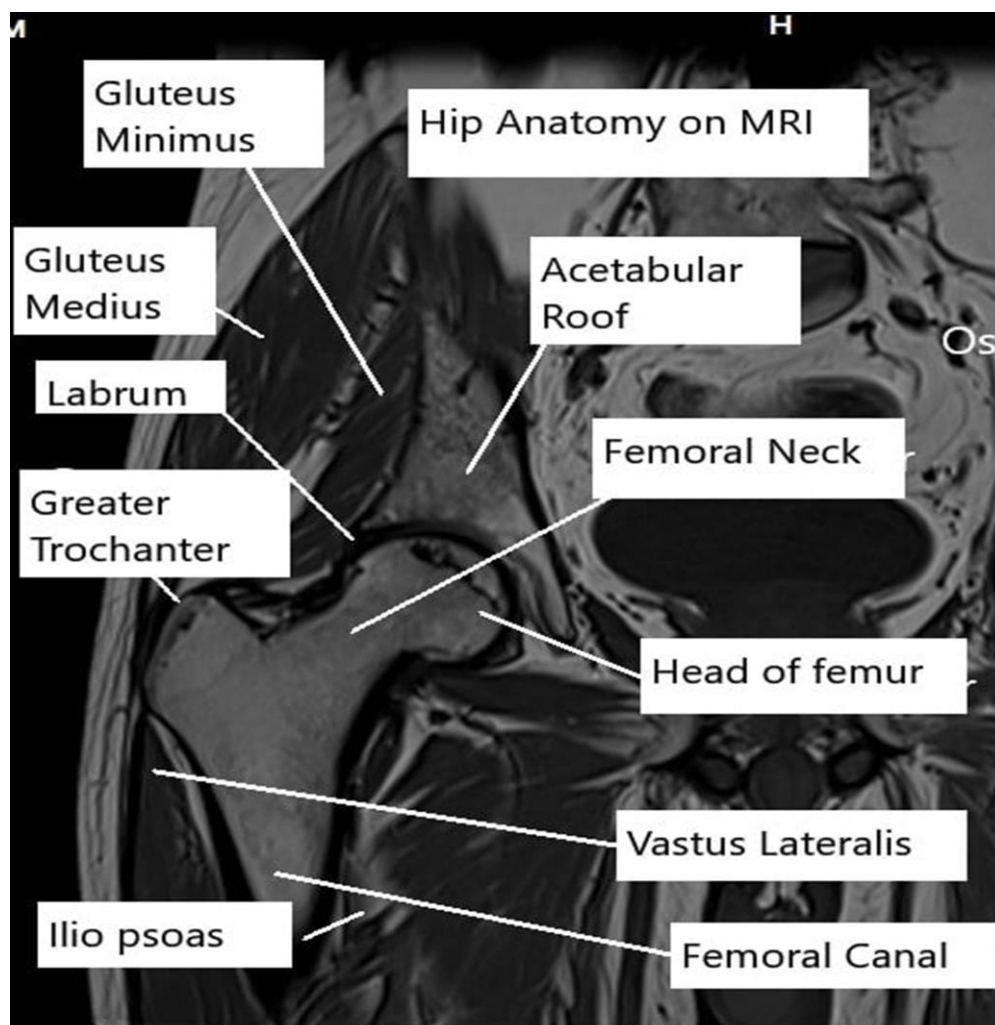
Ultrasonography (US) is a useful screening method for the diagnosis of developmental dysplasia of the hip (DDH) and congenital spinal anomalies in infants. In addition, US is a useful, noninvasive imaging modality for the diagnosis of transient synovitis in children. The early detection of DDH leads to a better prognosis without surgical intervention. Moreover, spinal US allows the detection of congenital malformations and can also demonstrate normal anatomy and normal variants that may resemble disorders. Therefore, radiologists should be familiar with the sonographic anatomy of the normal infant hip, scanning and measurement techniques for DDH, the US features of transient synovitis in children, spinal US techniques, and the US features of normal anatomical structures, normal variants, and congenital spinal anomalies.



# COMPUTED TOMOGRAPHY OF HIP JOINT

CT is indicated for diagnosing hip complications when the conventional initial assessment is inconclusive. It is also indicated prior to revision surgery when in doubt regarding the bone stock or a strong biological response to wear debris is suspected

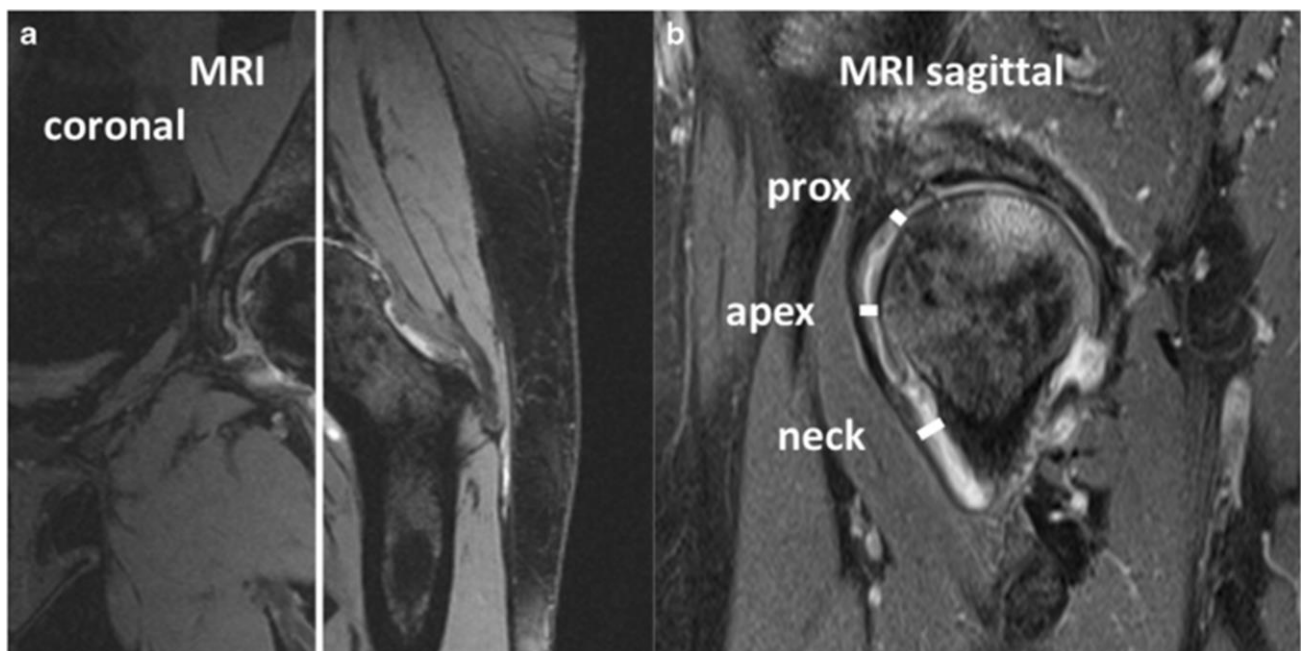
Three-dimensional assessment based on computed tomography (CT) allows optimizing the choice and positions of implants and anticipating difficulties to be encountered during surgery. Postoperative CT is used to monitor operative translation and plays a role in arthroplastic quality management

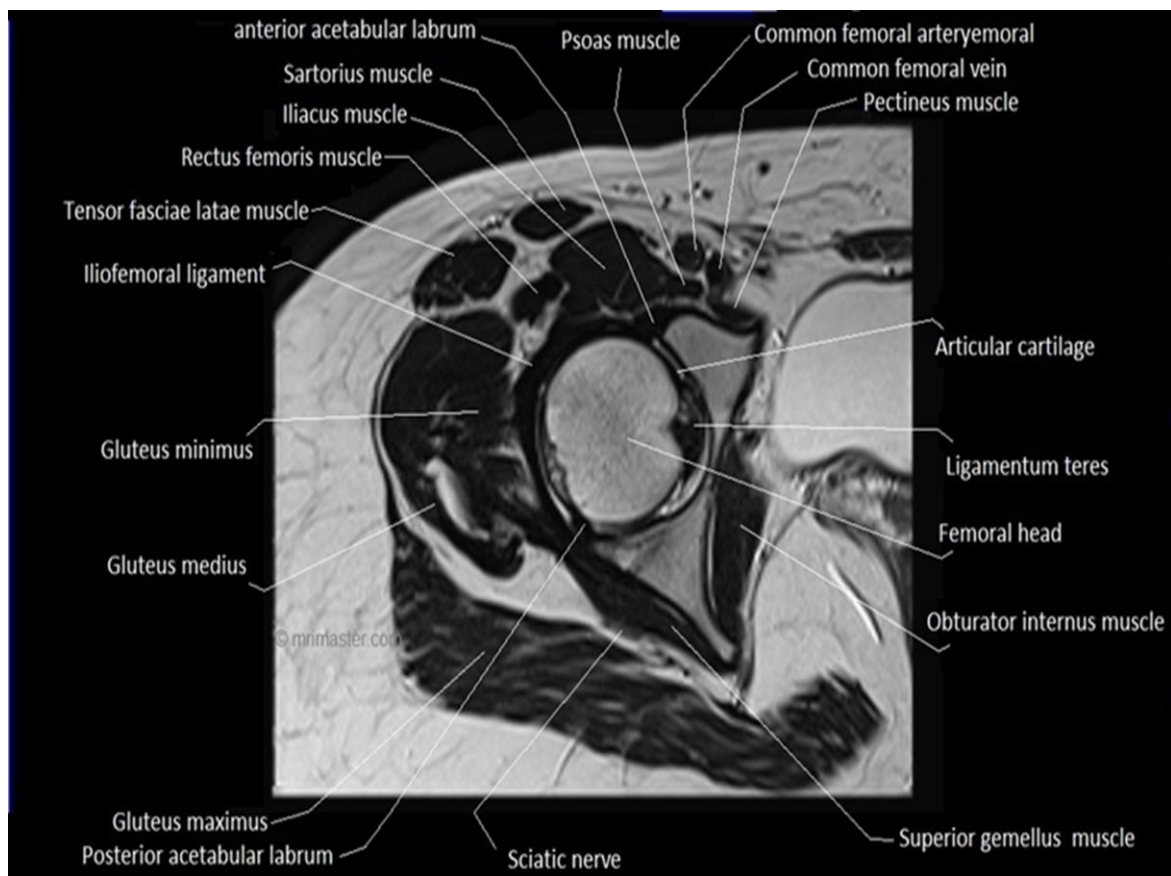


# Magnetic resonance imaging of hip joint

Magnetic resonance imaging (MRI) is the modality of choice for investigating painful hip conditions due to its multiplanar capability and high contrast resolution. This review focuses on the characteristic MRI features of common traumatic and pathologic conditions of the hip.

A MRI can pick up stress fractures or even bone bruises that a plain x-ray will usually miss. It can also detect the early findings of arthritis, even when the x-rays are normal, because it can show changes in your cartilage and the underlying bone

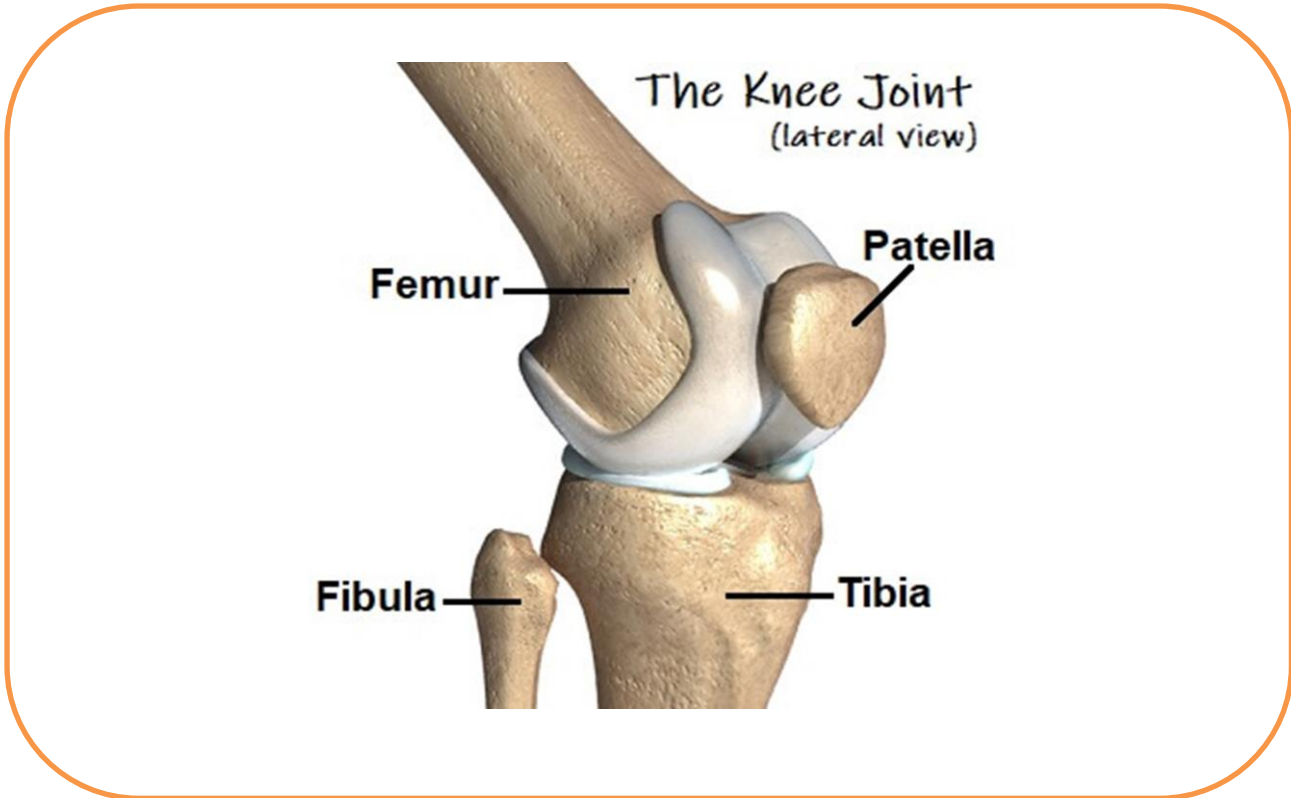




## Knee joint

The knee is a **synovial joint**, which means it is lined by synovium. The synovium produces fluid lubricating and nourishing the inside of the joint. Articular cartilage is the smooth surfaces at the end of the femur and tibia. It is the damage to this surface which causes arthritis.

The knee joint is a synovial joint that connects three bones; the femur, tibia and patella. It is a complex hinge joint composed of two articulations; the tibiofemoral joint and patellofemoral joint



## RADIOLOGICAL FEATURE OF KNEE JOINT

The knee joint is a modified hinge joint between the **femur**, **tibia**, and **patella**. It is the largest synovial joint in the body and allows flexion and extension of the **leg** as well as some rotation in the flexed position.

- location: two condylar joints between femur and tibia; saddle joint between patella and femur
- blood supply: main supply are the genicular branches of the **popliteal artery**
- nerve supply: branches from the femoral, tibial, common peroneal, and obturator nerves
- movement: flexion to  $150^{\circ}$ , extension to  $5-10^{\circ}$  hyperextension; rotation whilst in the flexed position to  $10^{\circ}$  actively and  $60^{\circ}$  passively

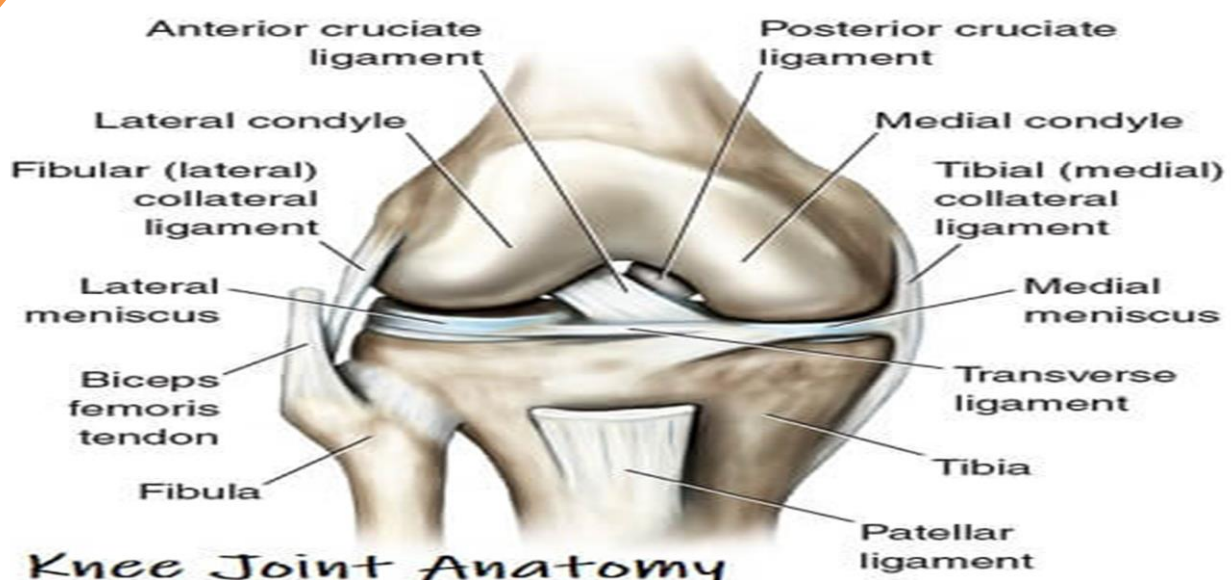


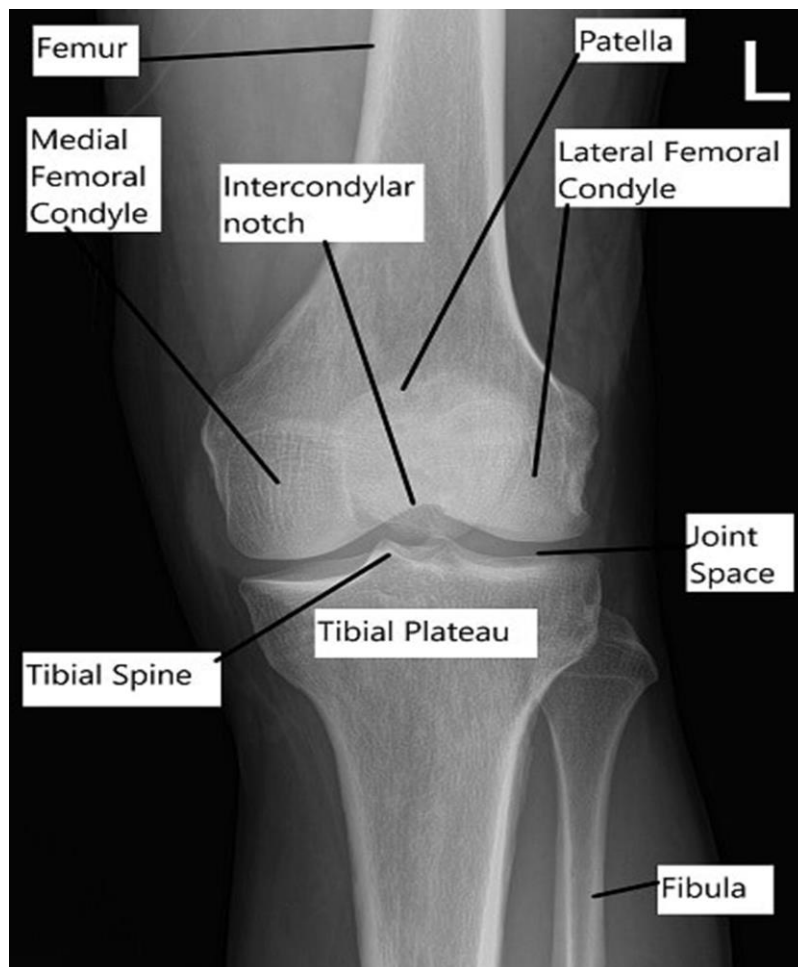
# INTERNAL STRUCTURE OF KNEE JOINT

The knee joint is essentially made up of three bones: The thigh bone (femur), the shinbone (tibia), and the kneecap (patella). The joint head on the femur has two strong bony projections, the condyles, which are covered with articular cartilage. The articular surface of the tibia is called the tibial plateau

Between the tibia and femur bone are two crescent-shaped pads of cartilage that reduce friction and disperse the weight of the body across the joint. They are: The lateral meniscus, situated at the outside of the knee. The medial meniscus, situated on the inside of the knee

The medial collateral ligament (MCL) is on the inner side of your knee. It attaches the thigh bone (femur) to the shin bone (tibia). The lateral collateral ligament (LCL) is on the outer side of your knee. It connects your femur to your calf bone (fibula





## Arthrography of knee joint

Indications for MR arthrography of the knee include assessment of the postoperative meniscus, the presence of chondral and osteochondral lesions, and the presence of intra-articular bodies. The major indication for CT arthrography is evaluating suspected internal derangement in patients who are unable to undergo MRI

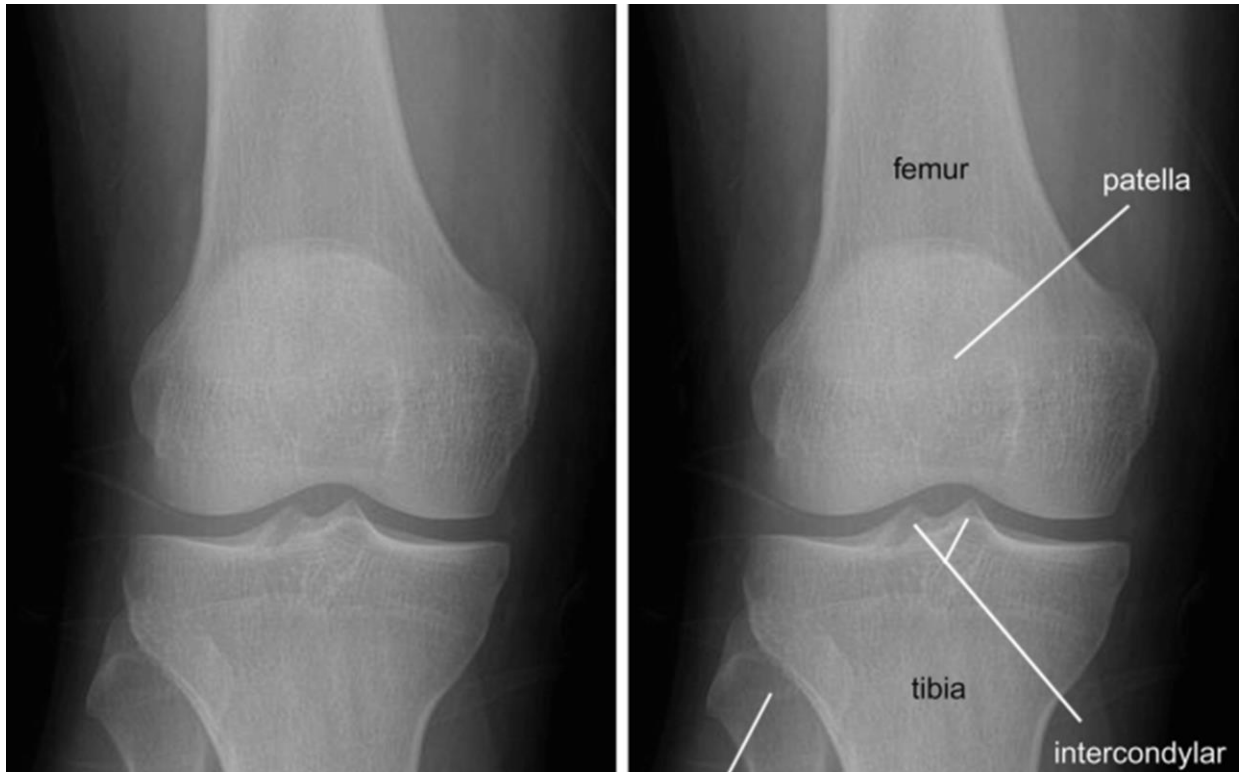
How long does an arthrogram take? The arthrogram itself usually takes about 15 minutes. You may then have to wait a short time before having the scan performed. A subsequent MRI scan may take 30-45 minutes, depending on the joint and the number of scans that have to be done.



## Plain film of knee joint

Plain radiography remains an important aspect in the diagnosis and treatment of knee conditions. A thorough understanding of which views to order and how to interpret them will remain an invaluable and accurate diagnostic tool. This chapter describes each

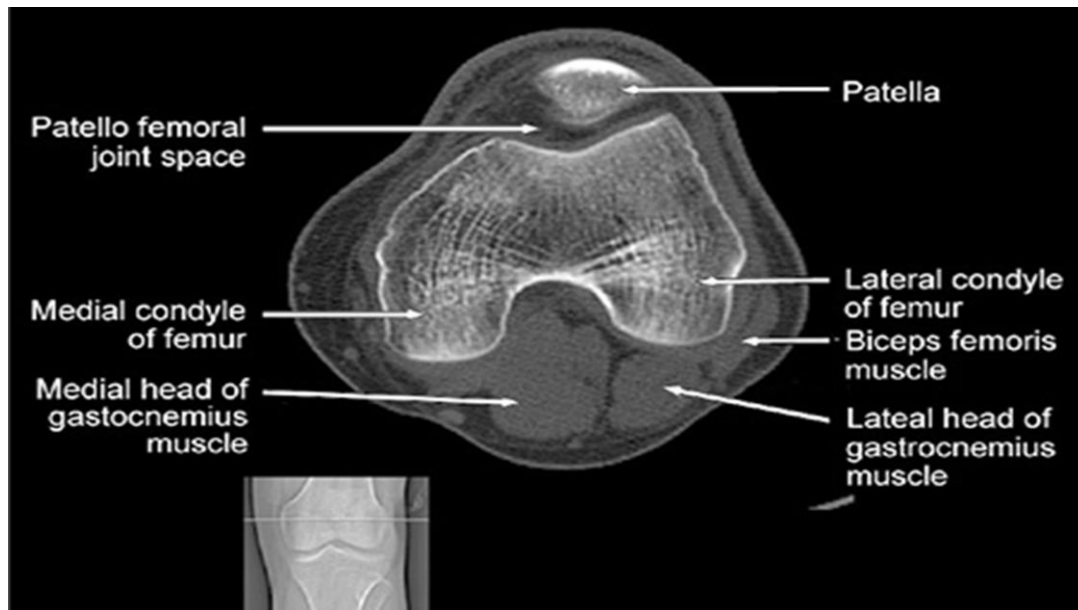
radiographic view, alongside its uses, before progressing into trauma, pathological conditions and finally surgical considerations



## COMPUTED TOMOGRAPHY OF KNEE JOINT

A CT scan can quickly create more detailed pictures of the knee than standard x-rays. The test may be used to detect: Abscess or infection. Broken bone

A CAT scan can be a helpful test for different types of arthritis. It can examine the joints deep within the body that traditional x-rays may not be able to examine adequately, including the pelvic region or the spine



## Magnetic resonance imaging of knee joint

Magnetic resonance imaging (MRI) of the knee is a common diagnostic examination performed for detecting and characterising acute and chronic internal derangement injuries of the knee and helps guide patient management. The examination is typically performed to diagnose or evaluate: knee pain, weakness, swelling

or bleeding in the tissues in and around the joint. damaged cartilage, meniscus, ligaments or tendons. sports-related knee injuries, such as sprains and torn ligaments, cartilage, or tendons.

Magnetic resonance imaging (MRI) has been established as an effective, noninvasive test for identifying meniscal tears and other knee pathology. When used for the appropriate indications, MRI is a valuable tool in the evaluation and management of knee pain



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