

# Musculoskeletal Ultrasound

Echo anatomy & Scan technique



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# Sample

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# Chapter 1

# Finger (Hand)

## Introduction

Regarding USG of a finger all 4 sides (volar, dorsal, radial and ulnar) should be considered in order to complete the examination.

## Index

### Volar Structures

1. Flexor Tendons
  - a. FPL
  - b. FDS
  - c. FDP
2. Tendon Sheath
3. Volar Plate
4. Hand muscles
  - a. Thenar muscles
    - i. APB
    - ii. FPBS/FPBP
    - iii. OP
    - iv. ADP/TOH
  - b. Hypothenar muscles
    - i. PB
    - ii. ADM
    - iii. FDMB
    - iv. OPDM
  - c. Intrinsic muscles
    - i. Lumbracles
    - ii. Palmar Interosseous
    - iii. Dorsal Interosseous

### Radial and Ulnar Structures

Radial and Ulnar collateral ligaments

### Dorsal Structures

- Extensor Tendons
  - a. EPL
  - b. EPB
  - c. EIP
  - d. EDC
  - e. EDM

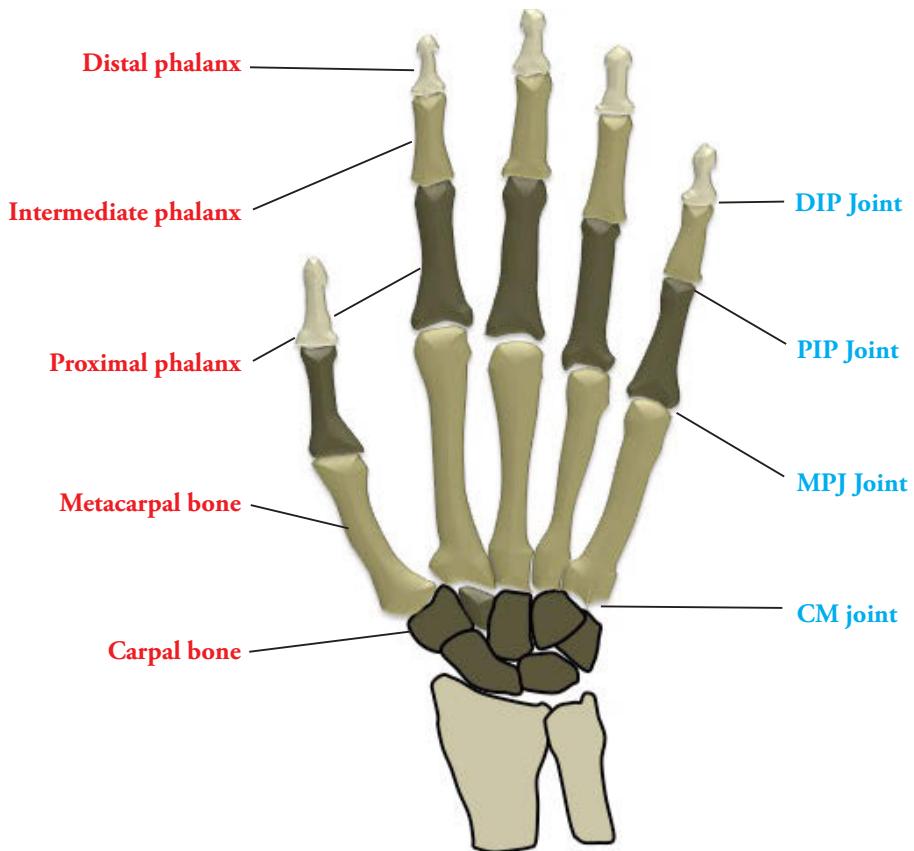
# Finger (Hand)

## Basic Information

The joints in the hand starting proximally are the carpal-metacarpel joints (CMCJ), metacarpal-phalangeal joints (MCPJ), proximal inter-phalangeal joints (PIPJ) and distal inter-phalangeal joints (DIPJ). The bony structures are metacarpal (MC) bones proximally, proximal phalanx (PP), middle phalanx (MP), and distal phalanx (DP) most distally.

A normal thumb does not possess a middle phalanx (Figure A and B). Each phalanx has a head, body and base. The base typically has a concave articular surface, and the head has a convex articular surface (except DP).

The volar surfaces of the phalanges provide insertion sites for flexor tendons and are comparatively rough. Each joint of the finger has flexion and extension movements via the function of the flexor, extensor and intrinsic muscles (plus some degree of abduction/adduction at the MCPJ level). The independent thumb has additional movement of abduction and adduction. Together, the hand and fingers combined with independent movement of the thumb provide important adduction motion to allow pinch and grip.



## Palmer aspect examination

**Master Point**

Palmer side examination can illustrate the abnormality in a few volar side pathology, such as the thickening of the A1 pulley and the involved flexor tendon in stenosing tenosynovitis (trigger finger), volar plate injury or associated bony avulsion in jammed fingers.

### Positioning

**Positioning** - resting the patient's supinated hand on a surface with all the fingers extended. Pictures a and b illustrate the use of a normal high frequency linear probe. Pictures c and d illustrate the use of the "hockey-stick" high frequency probe.

a. longitudinal inspection



b. transverse inspection



c. transverse inspection

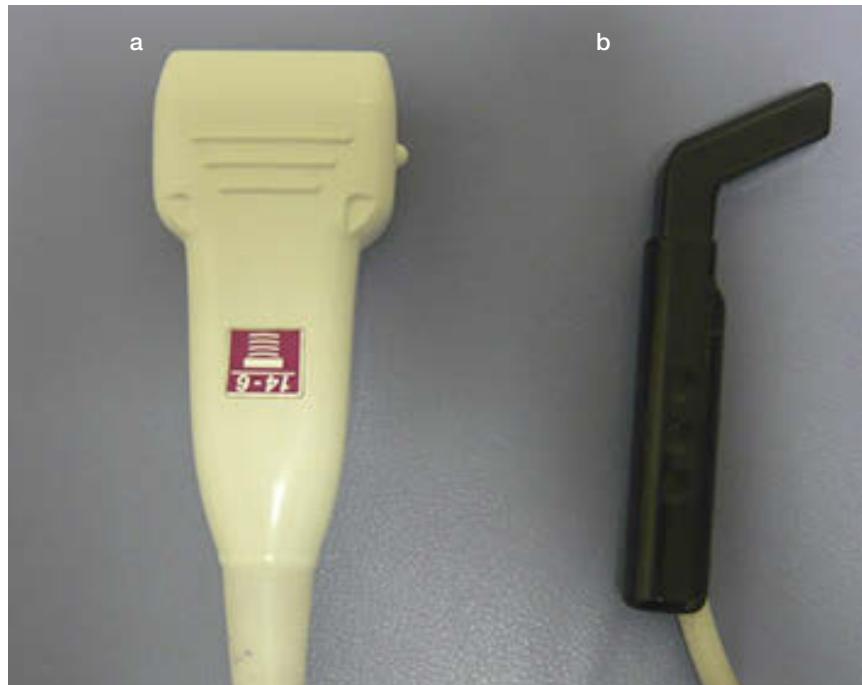


d. longitudinal inspection



## 2 types of probes

- a: normal high frequency linear probe
- b: "Hockey stick" high frequency linear probe



## Procedure

### Thumb Flexors

#### Step 1 Flexor Pollicis Longus viewed longitudinally

**Probe use** - centering on the metacarpal-phalangeal joint (MCPJ) with the probe placed parallel to the thumb.

##### Probe placement

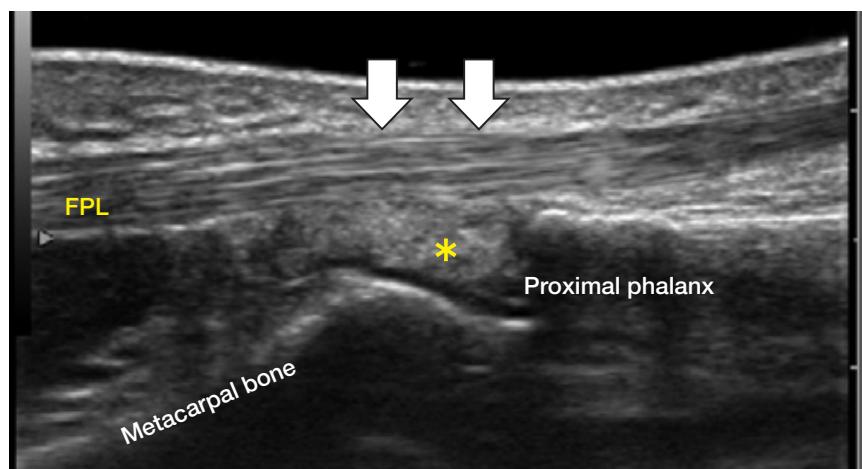
The probe should be tilted approximately 60 degrees in order to be perpendicular to the thumb's coronal plane.



**Probe use** - Inspect the FPL tendon and A1 pulley over the MCPJ.

#### longitudinal view of flexor pollicis longus

FPL has a fibrillar pattern. A1 pulley is directly above the MCPJ and has a slightly hypoechoic appearance. (white arrow) The volar plate is seen as a hyperechoic structure (\*).

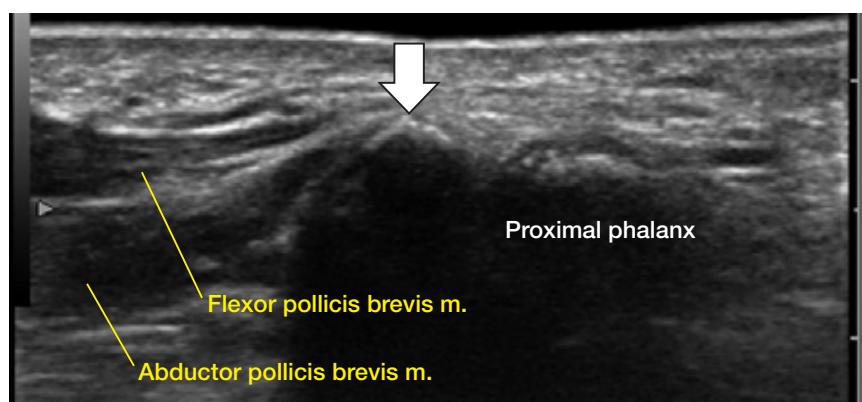


**Probe use** - a sesamoid bone can be seen on each side over the MCPJ.

#### FPL (longitudinal view)

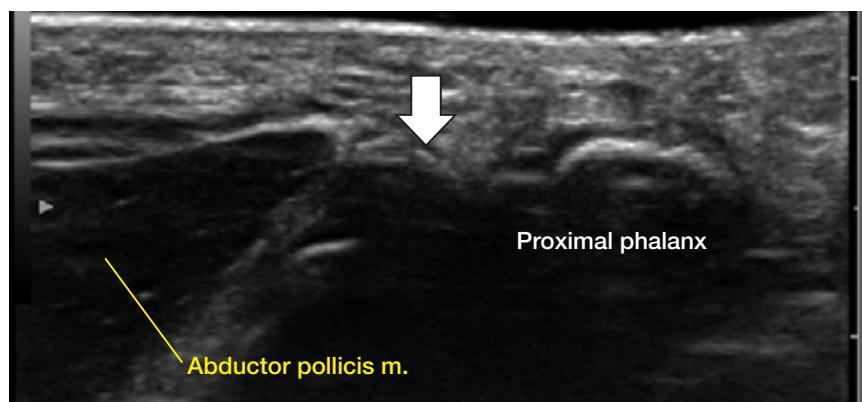
##### a: radial side sesamoid bone

Flexor pollicis brevis and abductor pollicis brevis insert into first proximal phalanx through the radial side sesamoid bone (white arrow).



##### b: ulnar side sesamoid bone

Adductor pollicis inserts into base of proximal phalanx through the ulnar sesamoid (white arrow).



# Chapter 2

# Wrist

## Introduction

When inspecting the wrist, there are 4 aspects to consider: palmer, dorsal, radial and ulnar sides.

## Index

### Volar side

1. Carpel Tunnel:
  - Median nerve
  - Flexor Pollicis Longus (FPL)
  - Flexor Digitorum Superficialis (FDS)
  - Flexor Digitorum alignment off
2. Guyon Canel:
  - Ulna nerve (UN)
  - Ulna artery (UA)
3. Palmaris Longus (PL)
4. Flexor Carpi Radialis (FCR)
5. Flexor Carpi Ulnaris (FCU)

### Radial side

1. First Extensor Compartment
  - Abductor Pollicis Longus (APL)
  - Extensor Pollicis Brevis (EPB)

### Dorsal side

1. Second Extensor Compartment
  - Extensor Carpi Radialis Longus (ECRL)
  - Extensor Carpi Radialis Brevis (ECRB)
2. Third Extensor Compartment
  - Extensor Pollicis Longus (EPL)
3. Forth Extensor Compartment
  - Extensor Digitorum Communis (EDC)
  - Extensor Indicis Proper (EIP)
4. Fifth Extensor Compartment!
  - Extensor Digiti minimi (EDM)

### Ulnar side

1. Sixth Extensor Compartment
  - Extensor Carpi Ulnaris (ECU)
2. Triangular Fibrocartilage Complex (TFCC)

## Basic Information

- The wrist is made up of distal radius, distal ulna and eight carpal bones.
- Distal Radial Ulnar Joint (DRUJ) allows supination and pronation, Radial-carpal joint (RCJ) and Midcarpal joint (MCJ) are responsible for extension and flexion of the wrist.
- The ratio of RCJ and MCJ movements in wrist extension is 50/50, whereas flexion the ratio becomes 40/60.

### Components of the wrist joint:

**Proximal carpal row:** Scaphoid (S), Lunate (L), Triquetrum (T), Pisiform (P)

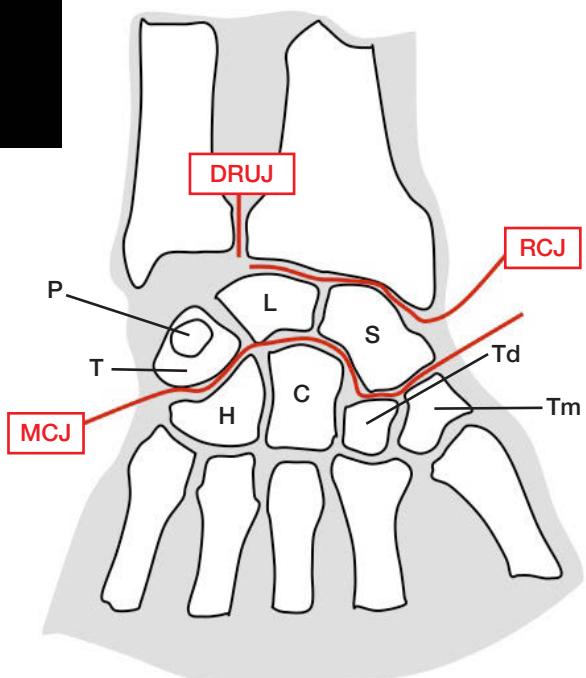
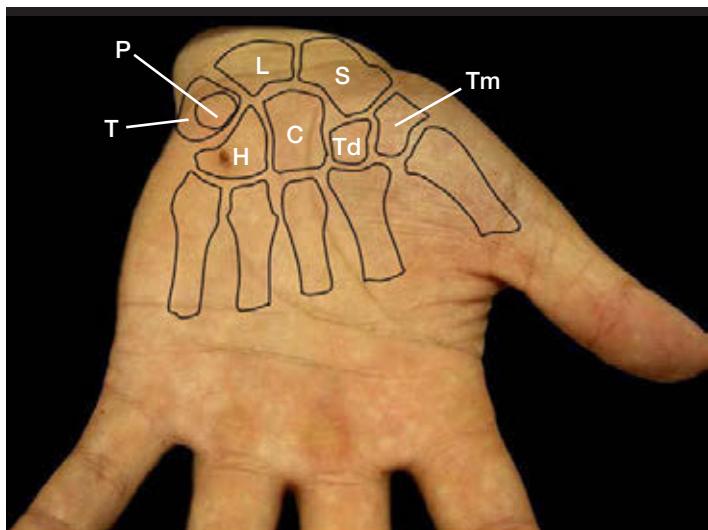
**Distal carpal row:** Trapezium (Tm), Trapezoid (Td), Capitate (C) and Hamate (H)

### Articulations:

**Radius - Ulna:** DRUJ

**Radius - Carpus:** RCJ

**Proximal carpal row - distal carpal row:** MCJ



## Volar side Examination

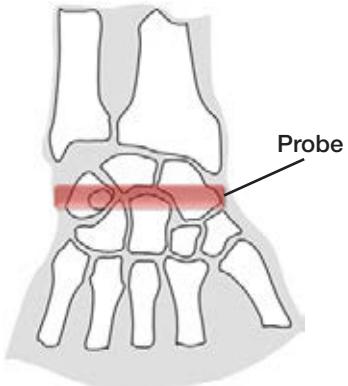
**Master Point**

When inspecting the volar side, beside flexor tendons, be sure to examine the two nerves prone to entrapment - the median and ulnar nerves.

### Positioning

**Positioning** - with patient seated and forearm supinated and supported

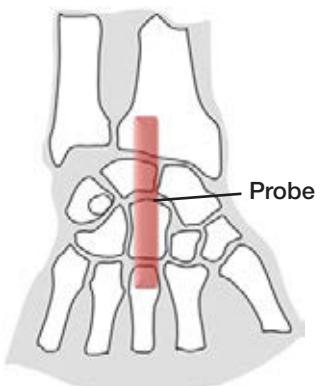
**Probe use** - Begin with the probe placed on short axis, and slide from proximal to distal to inspect the carpal tunnel and Guyon's canal.



Short axis probe placement



Long axis viewing begin from radial side and slide probeularly to inspect the flexor tendons, median and ulnar nerves.



Long axis probe placement



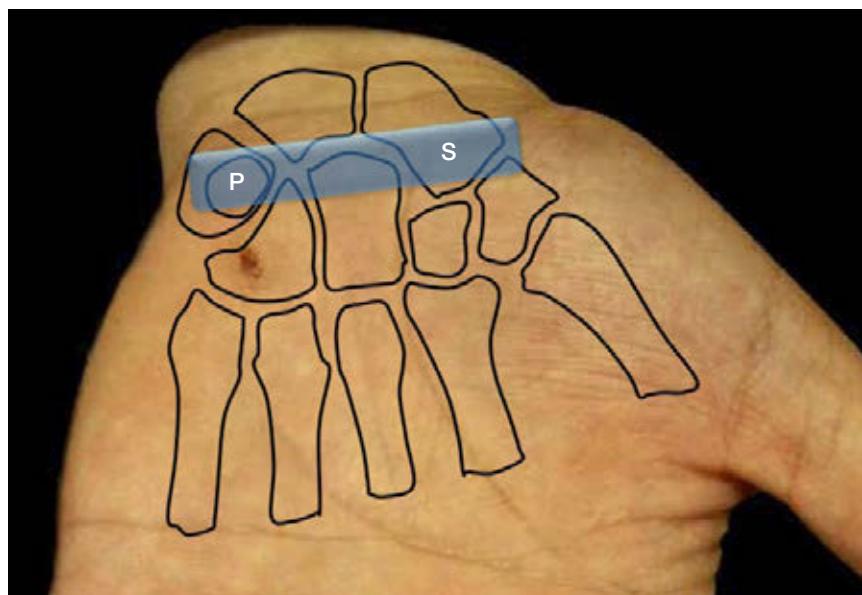
## ■ Procedure ■

### Approaching the carpal tunnel

#### Step 1 Pisiform and scaphoid tubercle

**Probe use** - Place probe along the line between the palpable pisiform and scaphoid tubercle

**Palpate to identify the pisiform and scaphoid tubercle**  
place the probe just distal to the distal volar skin crease of the wrist



#### Step 2 Flexor tendon, transverse carpal ligament and median nerve

**Probe use** - Within the carpal tunnel, the tendons will appear as elliptical structures, adjust probe angle accordingly for best viewing

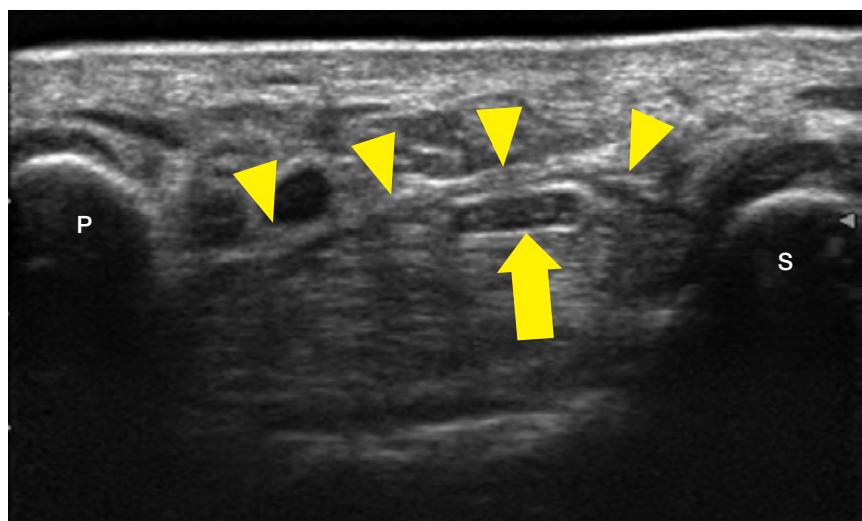
**transverse carpal ligament, median nerve**

hyperechoic semi-circular line (P) is the pisiform

hyperechoic semi-circular line (S) is the scaphoid tubercle

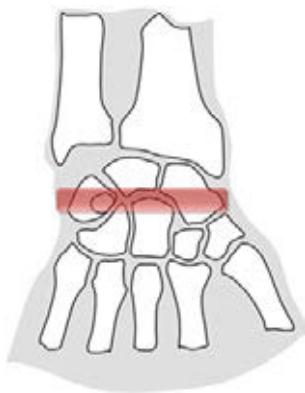
the hyperechoic linear structure that passes from P to top of S is the transverse carpal ligament (yellow arrow heads)

the hypoechoic elliptical structure underneath the transverse carpal ligament is the median nerve (yellow arrow)



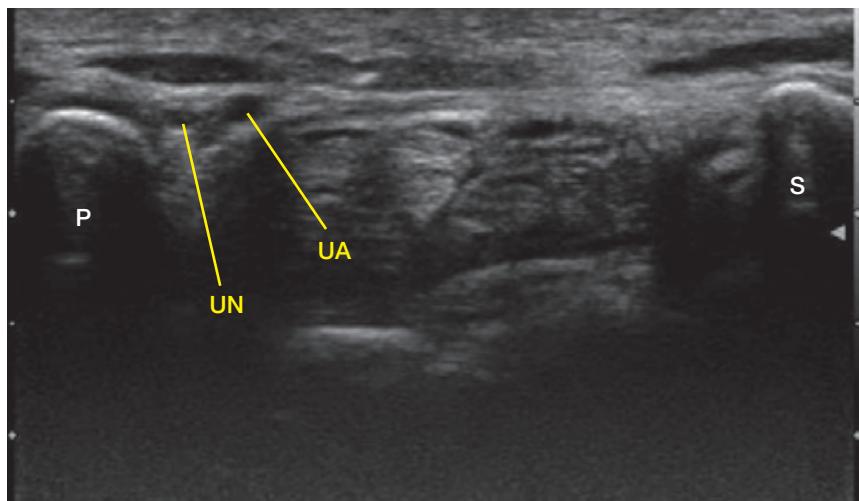
## Step 3 Guyon's canal [ulnar nerve (UN) and ulnar artery (UA)]

**Probe use** - While in transverse view over the carpal tunnel, locate a pulsatile round structure superficial to the transverse carpal ligament.



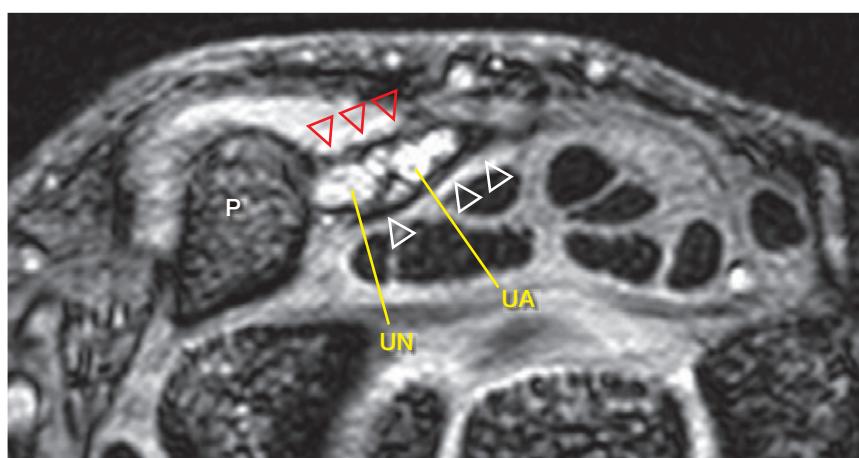
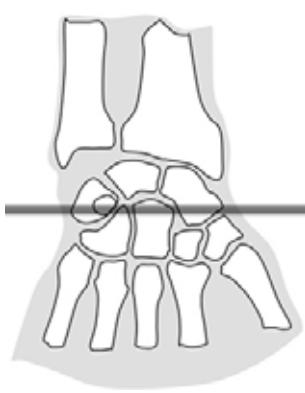
### ulnar nerve and artery

Ulnar artery and ulnar nerve are superficial to transverse carpal ligament (red arrow heads) and radial to pisiform (P). Ulnar nerve is ulnar to the artery.



### Guyon's canal on MRI

Guyon's canal is bound by the palmar aponeurosis (red arrow heads), transverse carpal ligament (white arrow heads) and pisiform (P). Ulnar artery and ulnar nerve are within the canal.

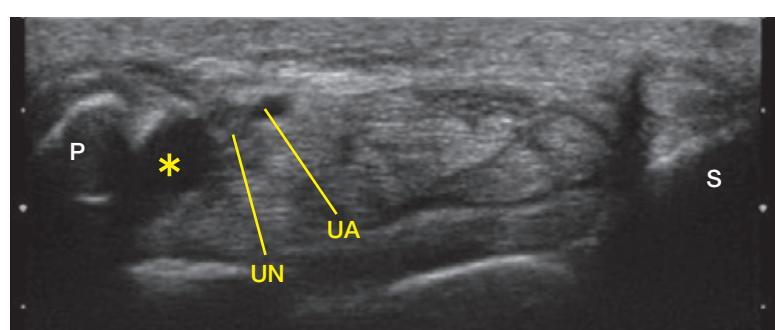


## QUESTION Box

**Q.** What features can be seen in Guyon's canal syndrome?

**A.** Guyon's canal syndrome is due to ulnar nerve entrapment. The most common reason being the presence of a ganglion which compresses on the nerve. They appear as hypoechoic lesions (\*)

Radial to pisiform bone lies an hypoechoic ganglion (\*), which has displaced the ulnar nerve and artery radially.



# Chapter 3

# Elbow

## Introduction

Elbow ultrasound examination can be divided into anterior, medial, lateral and posterio-raspects.

## Index

### Anterior aspect

1. Ulnohumeral joint
2. Radiohumeral joint
3. Bicep tendon
4. Radial artery
5. Median nerve
6. Radial nerve

### Medial aspect

1. Medial collateral ligament,  
Anterior oblique ligament
2. Ulnar nerve

### Lateral aspect

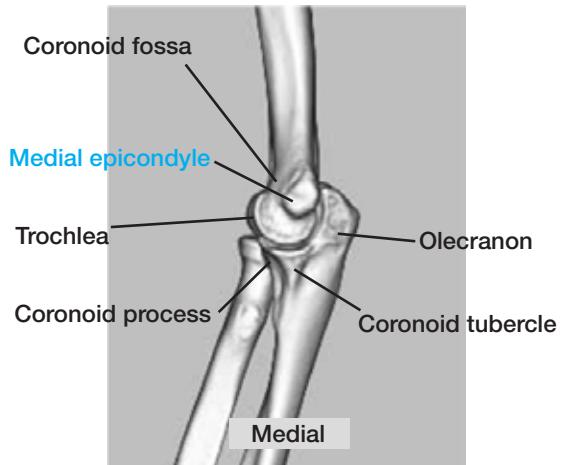
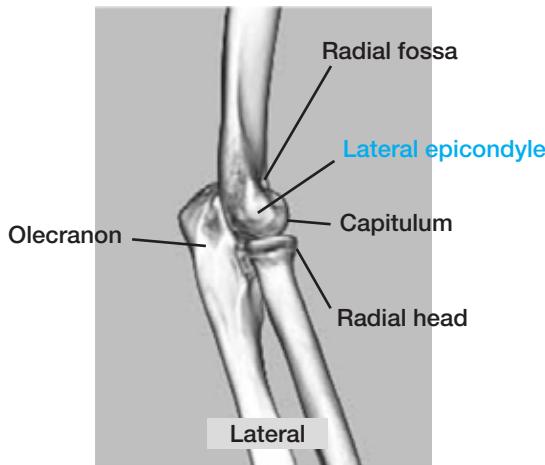
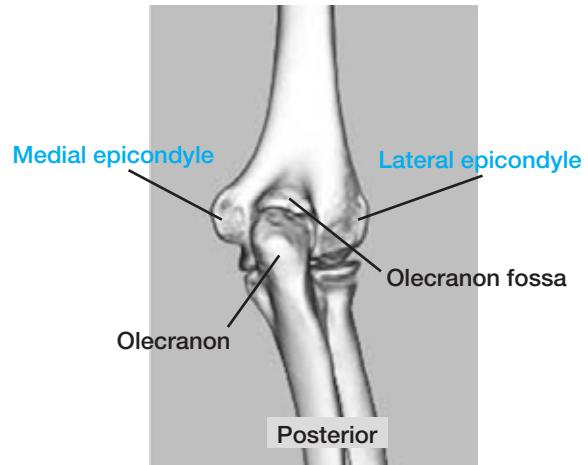
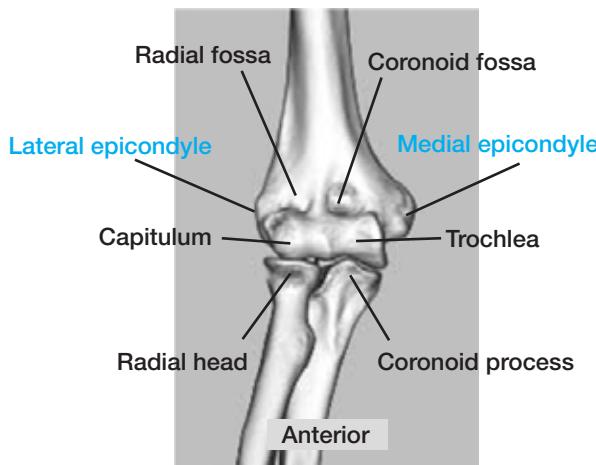
1. Lateral synovial fold
2. Lateral epicondylec. EIP
3. EDC

### Posterior aspect

1. Olecranon fossa
2. Olecranon
3. Capitulum

## Basic Information

- The elbow is made up of three articulations: radiohumeral, ulnohumeral and radioulnar joints.
- Radiohumeral joint is a ball and socket articulation between the capitulum and radial head involved in elbow flexion-extension as well as forearm supination-pronation.
- Ulnohumeral joint is a hinge type articulation between the trochlea and trochlea notch of ulna responsible of elbow flexion-extension.
- Proximal radioulnar joint is an axle joint between the radial head and radial notch of ulna mainly involved in forearm supination-pronation.
- Depending on the position of the elbow, all three joints as well as all surrounding soft tissue structures can be well visualized in ultrasound.
- Most elbow pain arise from soft tissue pathology, thorough understanding of these pathologic condition will help guide ultrasound examination.



## Anterior Examination

**Master Point**

Inpection of the radiohumeral and ulnohumeral joints as well as the bicep tendon, radial artery and median nerve can be done anteriorly.

### Positioning

**Positioning** - Patient in seated position with elbow extended and supported.

Patient positioning for anterior aspect examination



### Procedure

#### Distal humerus inspection

##### Step 1 Distal humerus inspection

**Probe use** - Begin at the distal shaft in short axis view

Placement of probe on distal humerus

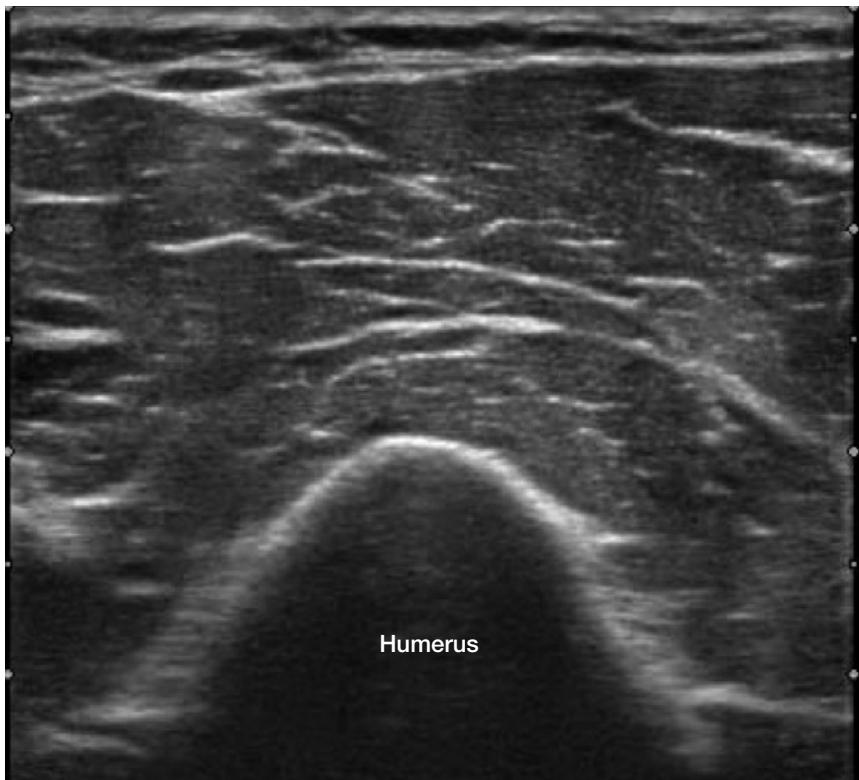


**Probe use** - Placement of probe for short axis view



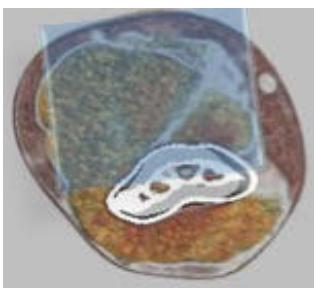
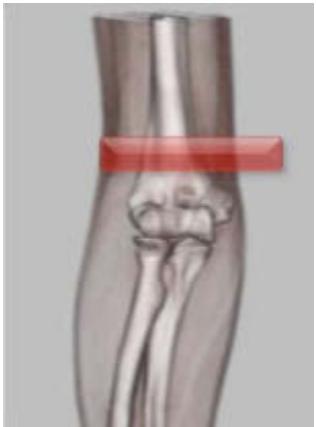
#### Distal humeral shaft

Semi-circular hyperechoic image is the cortex of the distal humeral shaft



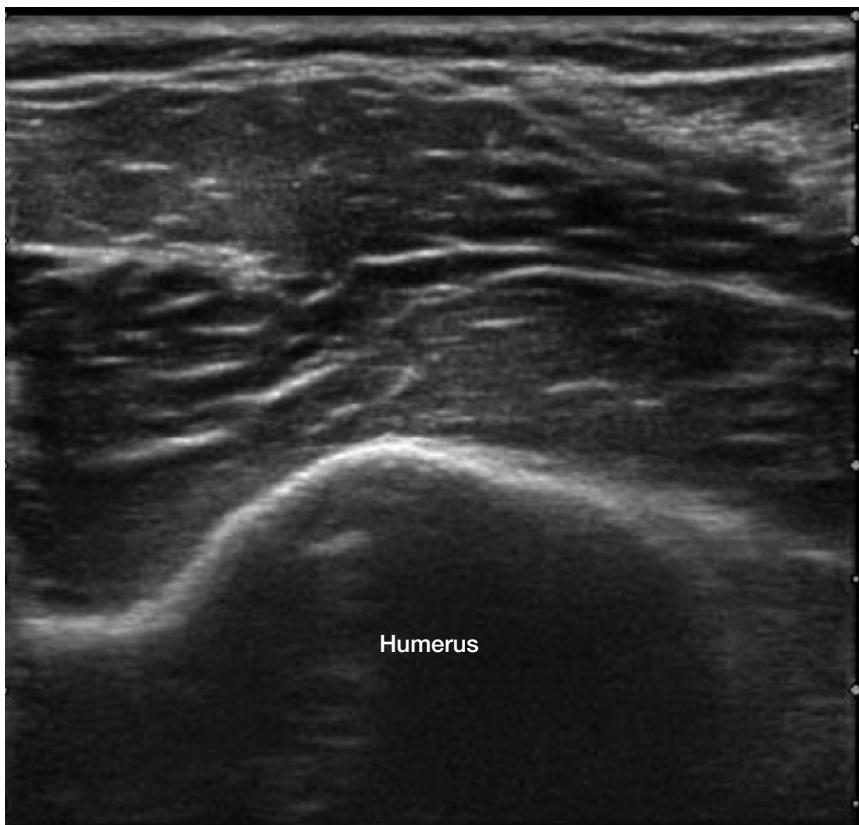
## Step 2 Radial fossa, coronoid fossa

**Probe use** - Slide probe distally and perpendicular along humeral shaft



#### Distal humerus

Distal humerus has a flatter and wider surface than the shaft.

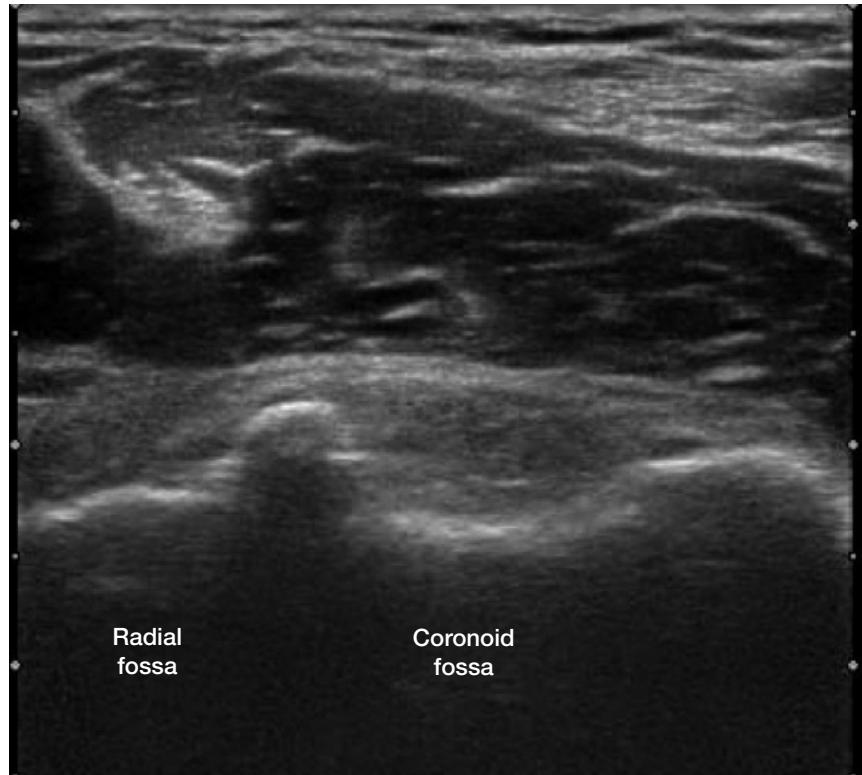


**Probe use** - Slide probe further to see the two bony fossae



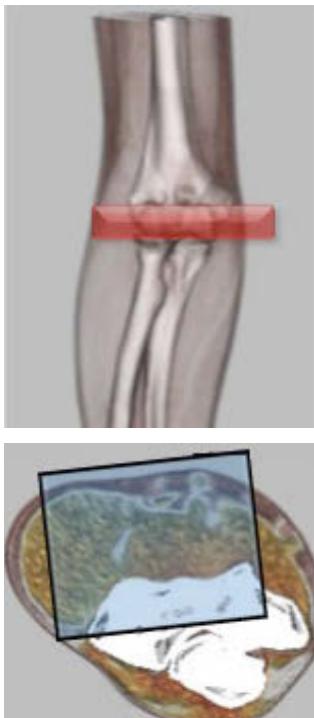
#### Radial fossa and coronoid fossa

Slightly off center, there is a bony ridge which divides the two fossae. Within the two fossae, the presence of fat pads can be seen.



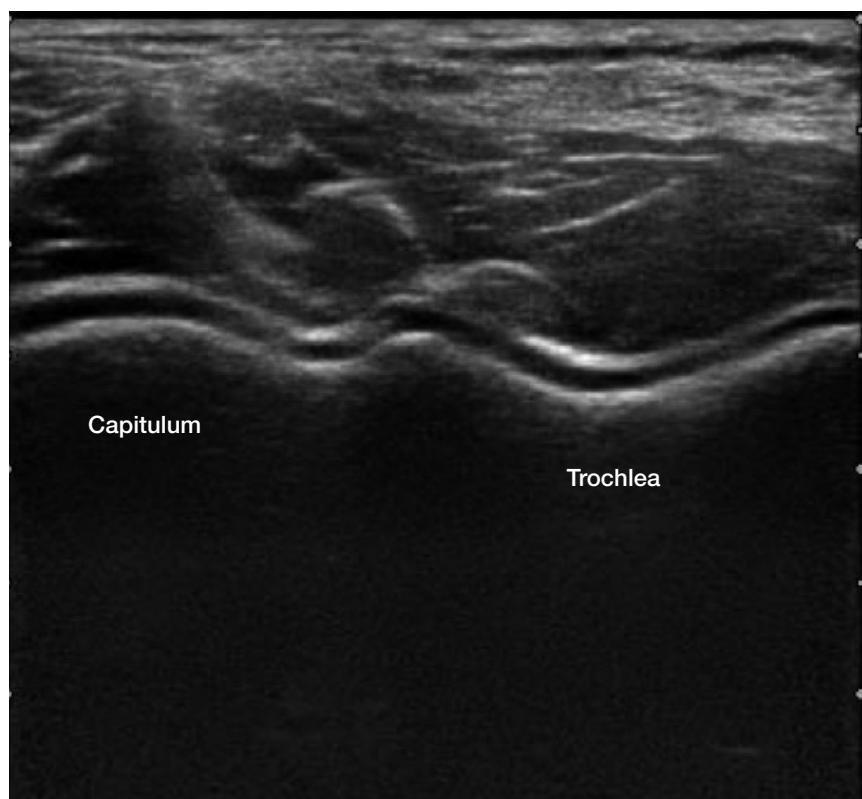
## Step 3 Capitulum and trochlea

**Probe use** - Slide probe further to visualize the capitulum and trochlea



#### Capitulum and trochlea in transverse view

Capitulum is on the lateral side and is more rounded, whereas the trochlea is concave. They are both lined with a hypoechoic layer of cartilage.



# Chapter 4

# Shoulder

## Introduction

Ultrasound examination of the shoulder can be divided into 5 regions: anterior, superolateral, posterior, axillary and superomedial.

## Index

### Anterior

1. Long head of bicep (LHBT)
2. Subscapularis
3. Subcorocoid bursa

### Superolateral

1. Supraspinatus
2. Infraspinatus
3. Subacromial bursa

### Posterior

1. Hill-Sachs lesion
2. Bennett Leision

### Axilla

1. Intra-capsular pathology - Bankart lesion

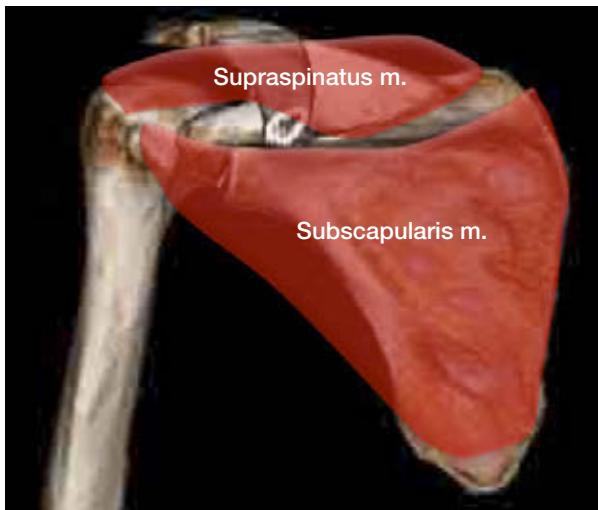
### Superomedial

1. Intra-capsular pathology - SLAP lesion

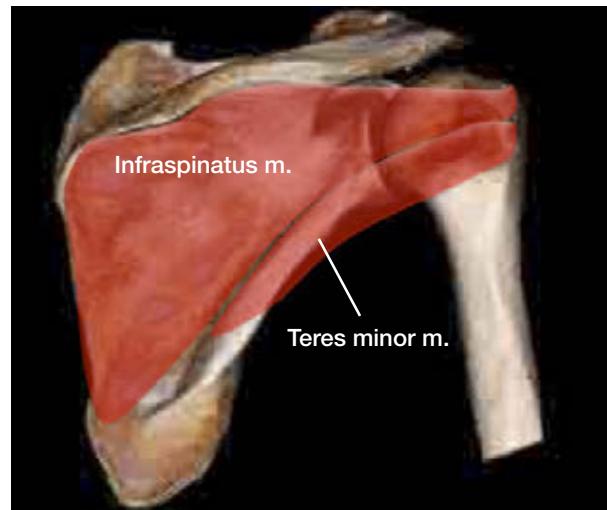
## Basic Information

- Shoulder joint is usually considered as the glenohumeral joint alone, however, there is also the acromioclavicular joint as well as the scapulo-thoracic joint.
- Supraspinatus, infraspinatus, subscapularis and teres minor, together form an indistinguishable structure with the joint capsule to become the rotator cuff.

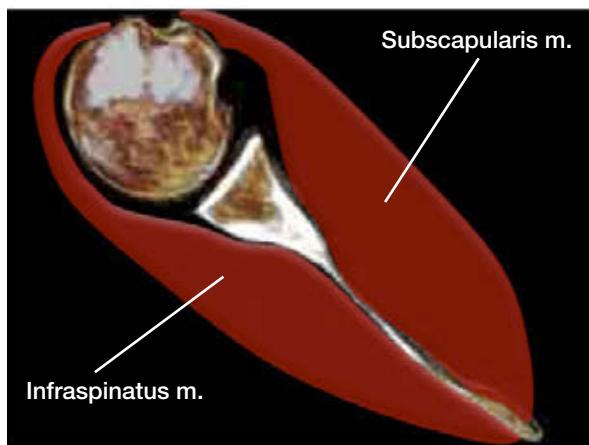
a. anterior view



b. posterior view



c. superior view



## Examination from anterior aspect

**Master Point**

Ultrasound examination of the anterior aspect can reveal long head of bicep tendon and subscapularis pathology.

### Positioning

**Positioning** - Patient should sit on a stool, with the hand resting on the thigh

**position of patient's limb for ultrasound examination of the anterior aspect**

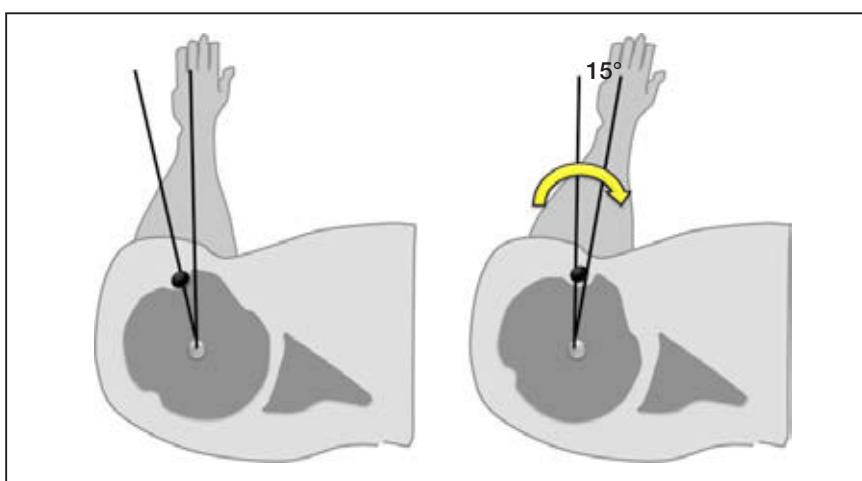


**Probe use** - with the limb placed in this way, the bicep tendon should easily be located when probe is placed directly anterior.

**Location of long head of bicep tendon**

a: with the humerus in neutral position, the bicep tendon is located approximately 15° laterally.

b: internally rotate the humerus (placing the hand on the thigh) by 15° should bring the bicep tendon anteriorly for better viewing.



## ■ Procedure ■

### Examination of the long head bicep tendon

#### Step 1 Examination of the long head bicep tendon

**Probe use** - place the probe anteriorly as pictured

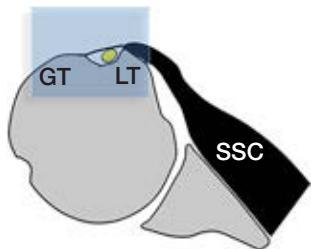


#### Examine the bicep tendon in short axis

the long head of bicep tendon will appear hyperechoic with a elliptical shape.

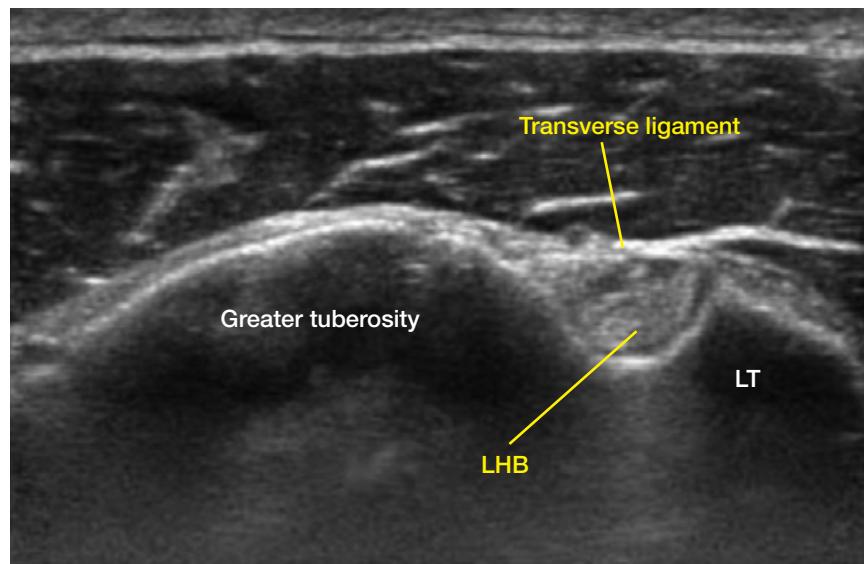
##### a: transverse section of the glenohumeral joint

the bicipital groove is formed between the greater tuberosity laterally and lesser tuberosity medially. There is a transverse ligament between the two tuberosities.



##### b: image of the LHB on short axis view

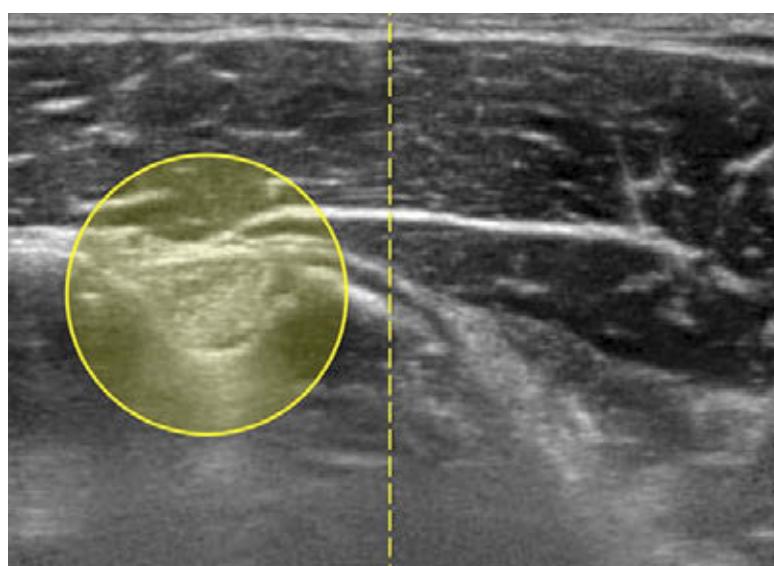
the bicep tendon passes through the bicipital groove has an hyperechoic elliptical shape.



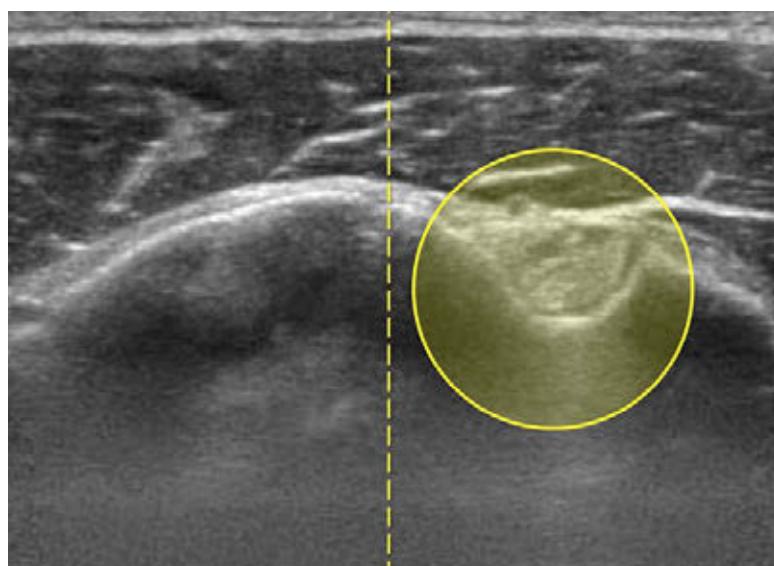
[TL: Transverse ligament; GT: greater tuberosity; LHB: long head of bicep; LT: lesser tuberosity]

**Probe use** - centering over the bicep tendon, move the probe along the length of the tendon to inspect the status of the tendon

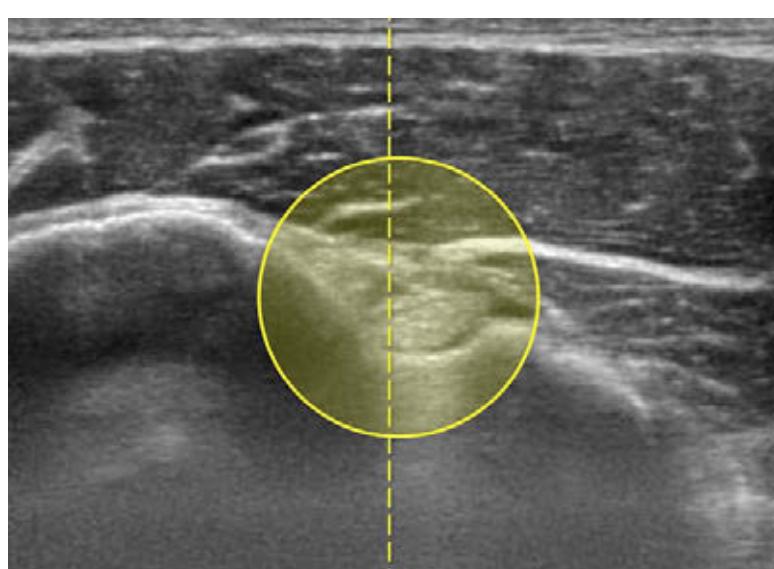
a: probe placed too medially



b: probe placed too laterally



c: proper placement of the probe with the LHB in the middle of the screen



## Chapter 5

# Lower Leg and Ankle

### Introduction

Ultrasound investigation of lower leg and ankle can be divided into anterior, lateral, medial and posterior aspects.

### Index

#### Anterior aspect

1. Tibia
  - Tibialis posterior
  - Flexor digitorum longus
2. Ankle joint
  - Trochlea of talus
  - Neck of talus

#### Lateral aspect

1. Lateral malleolus (distal fibula)
2. Anterior inferior tibiofibular ligament (AITFL)
3. Anterior talofibular ligament (ATFL)
4. Calcaneofibular ligament (CFL)
5. Peroneus tendons

#### Medial aspect

1. Medial malleolus
2. Deltoid ligament
3. Tarsal tunnel
  - Tibial nerve
  - Posterior tibial artery and vein
    - Tibialis posterior
  - Flexor digitorum longus
  - Flexor hallucis longus

#### Posterior aspect

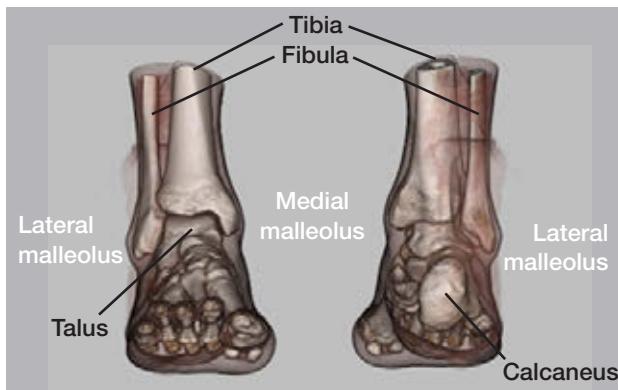
1. Gastrocnemius muscle
2. Soleus muscle
3. Achilles tendon
4. Calcaneal tuberosity

# Lower leg and ankle joint

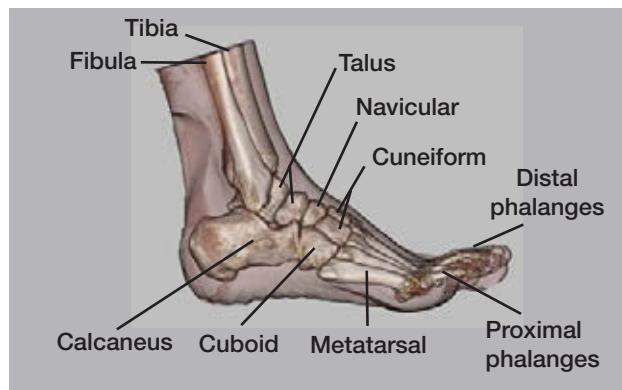
## Basic Information

- Ankle joint is a hinge joint consisting of tibia, fibula and talus.
- In terms of surface anatomy, the lateral prominence (distal fibula) is the lateral malleolus, medial prominence (distal tibia) is the medial malleolus (A).
- The talus articulates with the calcaneus to form the subtalar joint; articulation between talus and navicular is talonavicular joint; articulation between calcaneus and cuboid is calcaneocuboid joint. Talonavicular joint and calcaneocuboid joint are collectively known as transverse tarsal joint (Chopart joint).
- Navicular articulates with medial, intermediate and lateral cuneiforms to form the cuneonavicular joints; Cuboid and cuneiform bones articulate with metatarsal bones to form the tarsometatarsal joints, also known as Lisfranc joint (C)
- Proximal to Chopart joint is the hindfoot (talus and calcaneus); Mid-foot (navicular, cuneiform bones and cuboid) is between Chopart and Lisfranc joints; and forefoot (metatarsal bones and all phalanges) refers to portion distal to Lisfranc joint (C).
- Ultrasonographic examination of this region involves inspection of all these areas (A-D).
- Since the range of motion in these joints are not great, certain chondral pathology cannot be well visualized. However, the ligamentous structures and tendons are essentially all easily identifiable.
- Ankle joint is the most commonly sprained joint of the body, thus ligamentous examination is vital in making correct diagnosis.

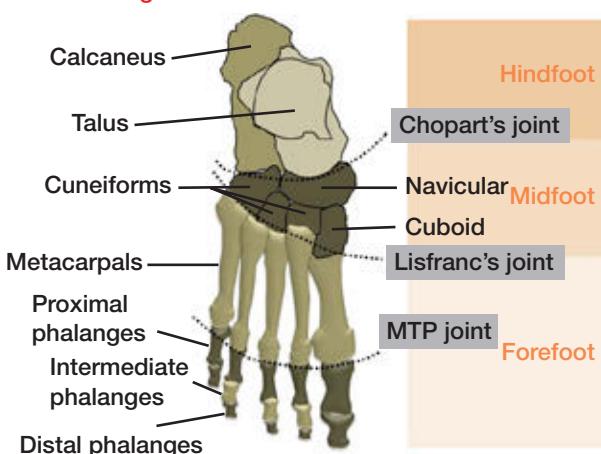
A: Anterior and Posterior aspects



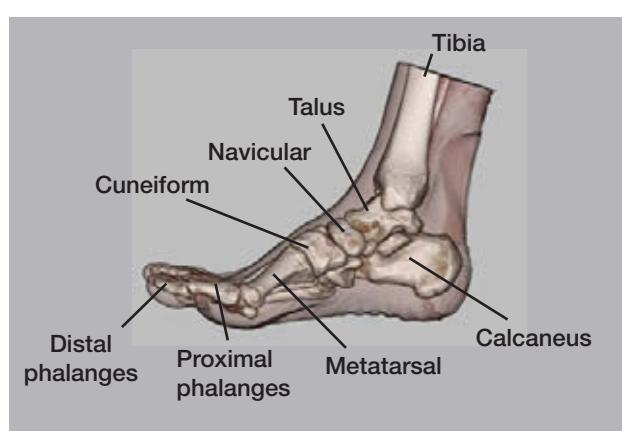
C: Lateral aspect



B: Three regions of the foot



D: Medial aspect



## Anterior Aspect

**Master Point**

Lower leg and ankle joint examination revolves around examination of the tibial periosteum and ankle joint itself.

### Positioning

**Positioning** - Patient should be seated with the knee extended and foot supported with the ankle joint in resting position.



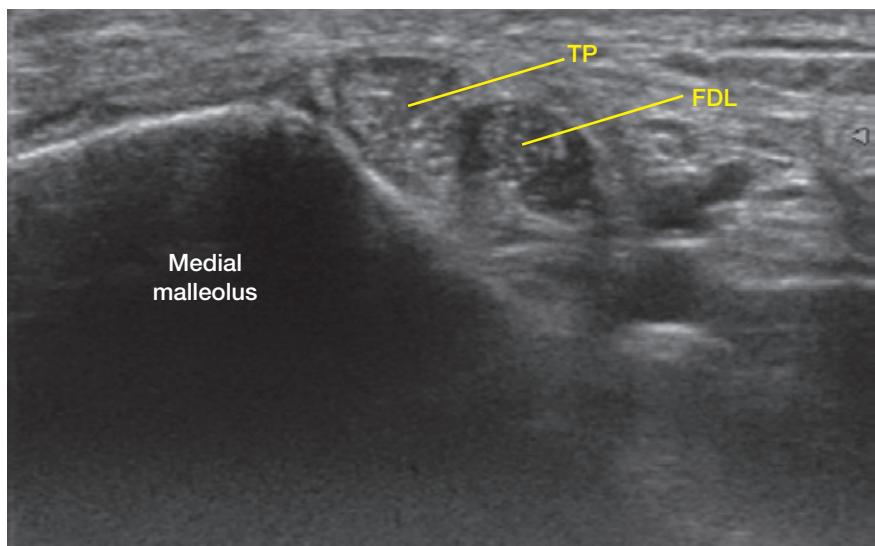
### Procedure

#### Step 1 Tibia

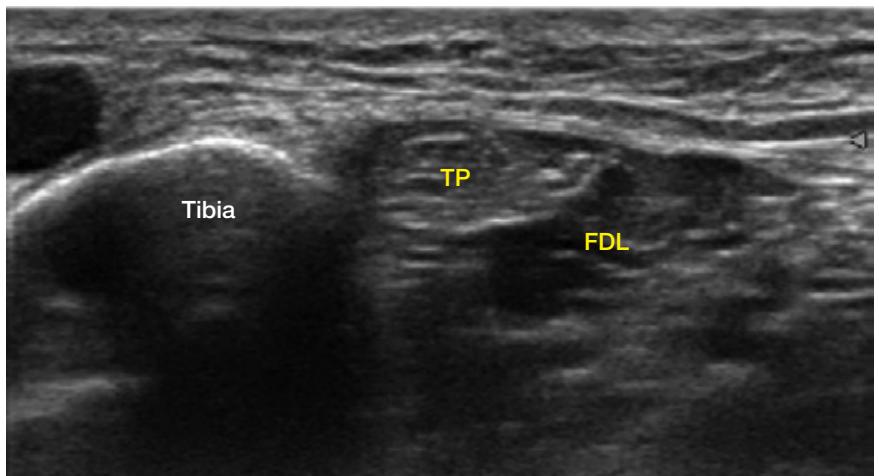
**Probe use** - Place probe on posterior aspect of the medial malleolus in transverse view. Identify tibialis posterior (TP) and flexor digitorum longus (FDL) tendons and slide probe anteriorly.



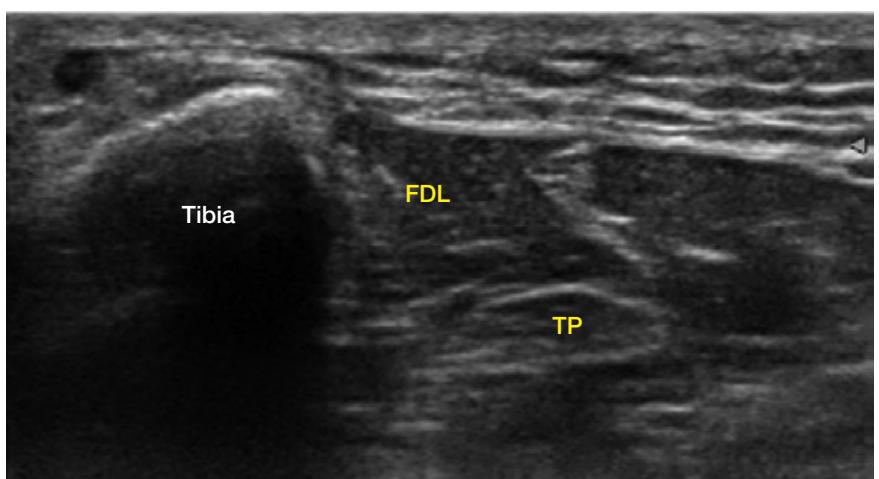
**Shaft of tibia in transverse view**  
**a: posterior aspect of medial malleolus**



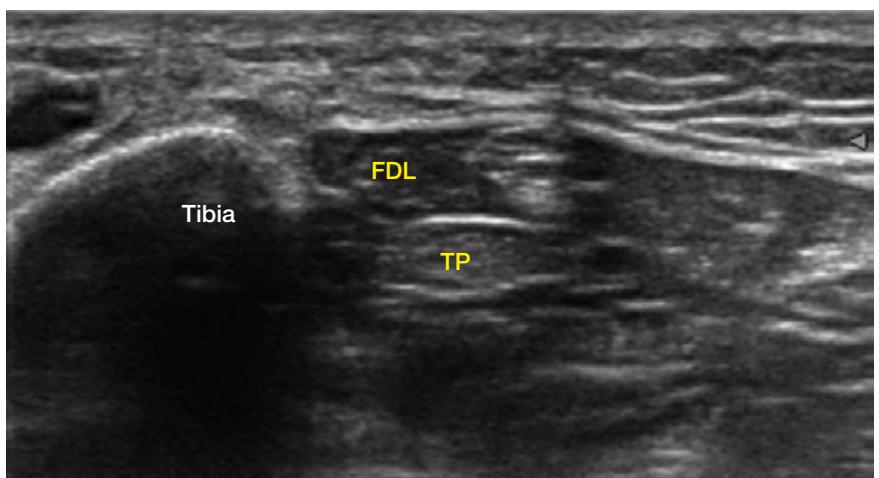
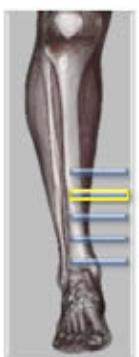
**b: Lower leg region**  
TP lies medial to the tibia  
with FDL deep to it.



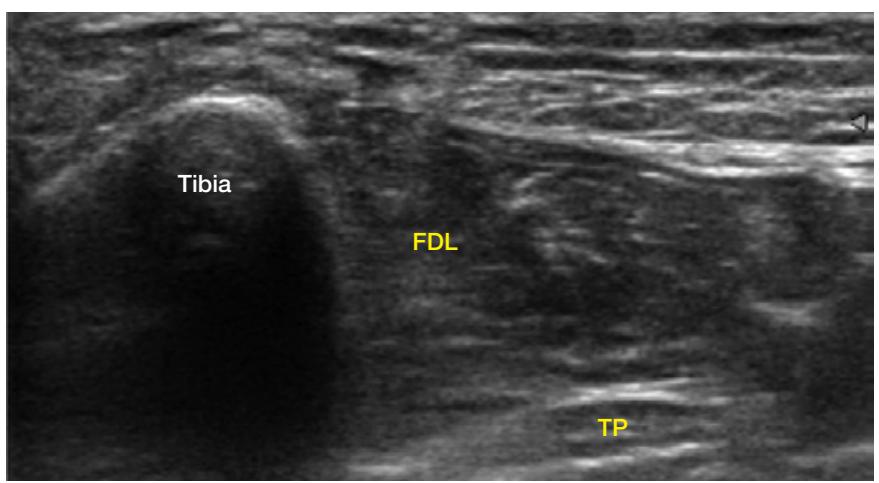
**c: Distal 1/3 of leg**  
TP is now deep to FDL  
which is now attached to  
tibial surface.



**d: Just distal mid shaft**  
If periosteum of tibia is  
seen thickened here,  
stress fracture is a  
possibility.

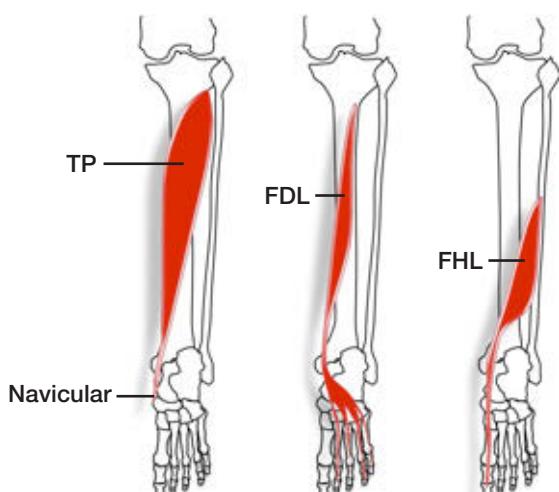


**e: Mid-shaft of tibia**  
If there is periosteal thickening,  
it will be obvious  
in longitudinal view  
also.



**Echo****anatomy** Muscles that originate from tibial shaft

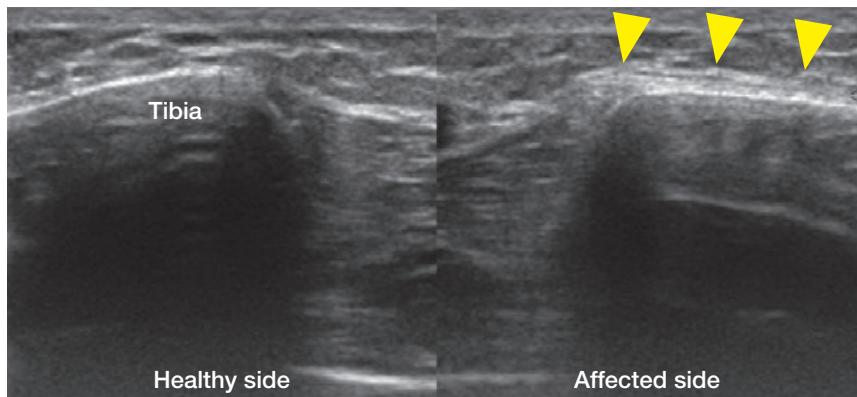
- On the posterior surface of the tibia (deep compartment of the leg) is the origin of tibialis posterior, flexor digitorum longus and flexor hallucis longus. Tibialis posterior arise from tibial shaft, interosseous membrane and fibula; FDL mainly arises from tibial shaft; FHL mainly comes from fibular shaft.
- FDL runs superficial to tibialis posterior proximally, but becomes deep to tibialis posterior tendon near the ankle joint region.

**QUESTION Box**

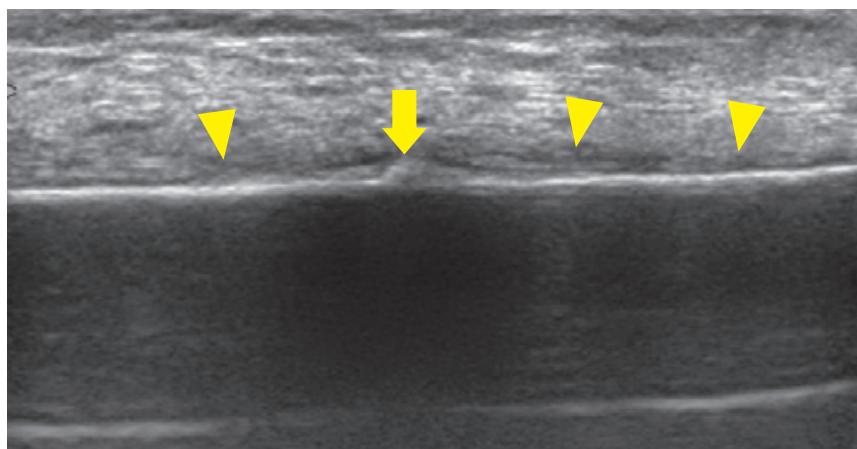
**Q.** What can be the pathology if one complains of lower leg pain?

**A.** Commonly occurring in athletes, "shin splints" is pain and tenderness at the distal 1/3 junction of the tibia.

The pain is most noticeable when running where pressure is transmitted along the medial border of the tibia. There is periosteal thickening if compared to normal side.

**Shin splints****Medial Tibial Stress Syndrome****a: Ultrasound image in long axis view**

There is periosteal thickening (yellow arrow heads) and hyperechoic cortical line of callus formation (yellow arrow) are signs of stress fracture.



**A.** Callus formation can be seen, which suggests stress fracture.

# Chapter 6

# Knee

## Introduction

Ultrasonographic examination of the knee can be divided into anterior, medial, lateral and posterior aspects.

## Index

### Anterior Aspect

1. Extensor mechanism
  - Quadriceps muscle
  - Suprapatellar bursa
  - Suprapatellar fat pad
  - Prefemoral fat pad
  - Patella
  - Patellar tendon
  - Infrapatellar fat pad (Hoffa fat pad)
2. Femorotibial joint
  - Medial femoral condyle (weight bearing area)
  - Anterior cruciate ligament (ACL)
3. Patellofemoral joint
  - Synovial folds
  - Medial patellofemoral ligament (MPFL)
4. Joint Capsule • Bursa
  - Prepatellar bursa
  - Superficial infrapatella bursa
  - Deep infrapatella bursa
5. Fat pads

### Medial Aspect

1. Medial collateral ligament (MCL)
  - Medial femoral epicondyle
2. Medial meniscus (MM)
3. Pes anserinus
  - Sartorius muscle

Gracilis muscle

Semitendinosus muscle

### Lateral Aspect

1. Lateral collateral ligament (LCL)
  - Lateral femoral epicondyle
  - Fibula head
2. Lateral meniscus (LM)
3. Biceps femoris muscle
4. Popliteus tendon
5. Iliotibial band
  - Gerdy's tubercle

### Posterior Aspect (Popliteal Fossa)

1. Semimembranosus
  - Gastrocnemius medial head and (Baker cyst)
  - Gastrocnemius medial head
  - Semimembranosus muscle
2. Posterior cruciate ligament (PCL)
3. Fabella
  - Fabello-fibular ligament (FFL)
  - Arcuate ligament
  - Gastrocnemius lateral head
4. Neurovascular structures
  - Sciatic nerve
  - Tibial nerve
  - Common peroneal nerve
  - Popliteal vessels

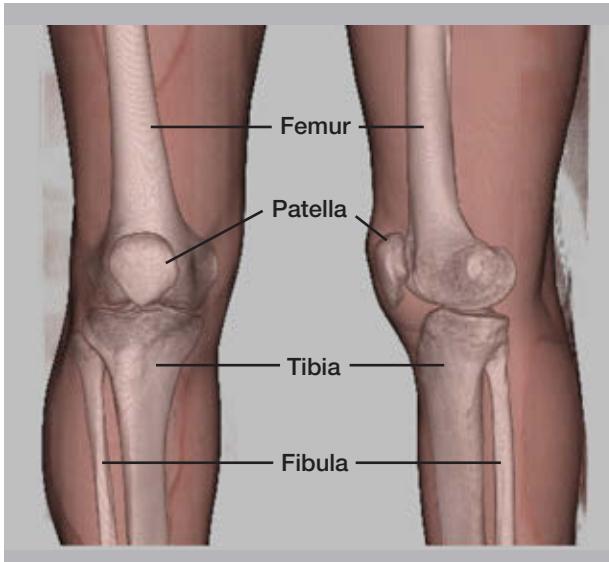
# Knee Joint

## Basic Information

- Knee joint consists of femur, tibia, fibula and patella and is the largest joint in the body.
- The main action of the joint is between femur and tibia (femorotibial joint), and the patellofemoral joint (PFJ). (A)
- Although there is no actual motion at the fibula, it is a site of ligament attachments, vital to the knee's stability.
- The extra-articular ligaments of the knee include MCL and LCL, intra-articular ligaments are the ACL and PCL. Together they confer stability to the knee's range of motion.
- Fabella is a sesamoid bone located within the lateral head of gastrocnemius (C). It is found just proximal and posterior to tibiofibular articulation.
- Certain parts of ACL and PCL are not visible in ultrasonographic examination, however both collateral ligaments, both menisci and all muscular and tendinous structures surrounding the knee can be examined.
- Knee injury is quite common, extensor mechanism injuries are more frequent in paediatric and adolescent population while ligamentous and meniscal structure injuries are more prevalent in adults.
- Ordinarily, high frequency linear probes are used, but posterior structures of the knee are better seen with low frequency probes.
- Ultrasonographic examination of anterior, medial and lateral aspects of the knee can be done in long axis view, but short axis view can also provide important information in certain conditions. Popliteal fossa is mostly examined in short axis view.

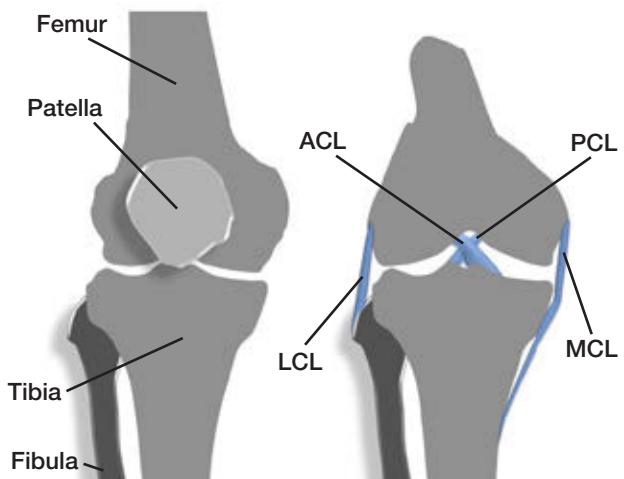
### A: Anatomy of the knee

Tibiofemoral joint and patellofemoral joints are the main components of the knee, while the proximal tibiofibular joint is not directly involved in knee movement.



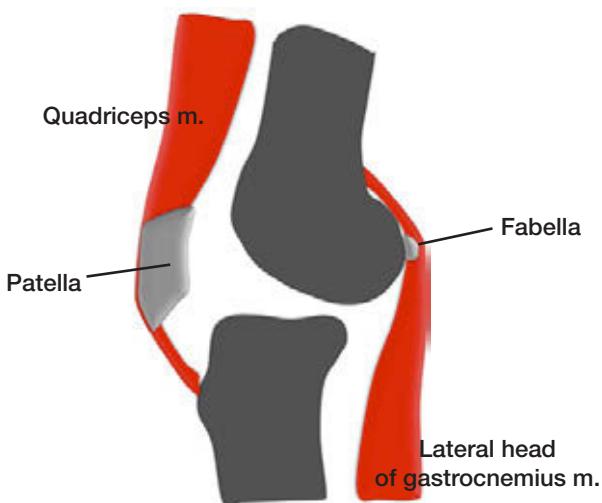
### B: Anatomy of the knee (slightly flexed)

ACL runs between the lateral femoral condyle and tibial plateau.

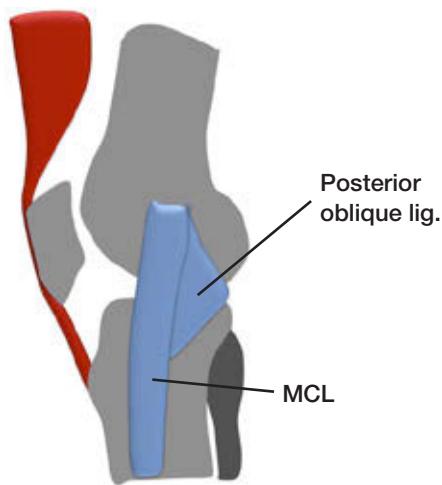
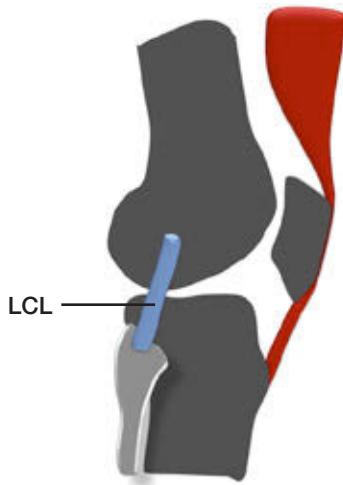


**C: Fabella**

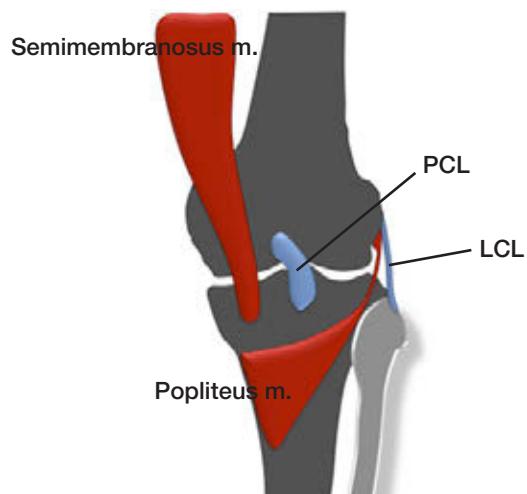
The fabella is a sesamoid bone within the lateral head of gastrocnemius. It is visible in plain X-ray in 30% of cases (bony fabella), and is cartilaginous in approximately 70% of cases.

**D: Ligaments of the knee (Medial Aspect)**

Medial collateral ligament originates in the medial epicondyle. The superficial portion runs linearly towards the tibia, there are also posterior oblique fibers which has an oblique course.

**E: Ligaments of the knee (LCL between Lateral Epicondyle and Fibula Head)****F: Ligaments of the knee (Posterior Aspect)**

Popliteus tendon (PT) is deep to LCL.



# Anterior Aspect

## Master Point

The main structures to be inspected in the anterior aspect of the knee are the extensor mechanism, tibiofemoral joint and patellofemoral joint.

## Extensor Mechanism of the Knee

The quadricep muscle exerts its extensor function via the quadricep tendon, patella, patellar tendon. In paediatric population, the force transmitted through tibial tuberosity results in increase growth compared to the longitudinal growth. This hypertrophy is the cause of Osgood-Schlatter disease which is mostly seen in late pre-teen to early teens. There is characteristic painful bony swelling at tibial tuberosity. The hypertrophy ends with skeletal maturity. There is an increase incidence of patellar tendonitis in young adulthood (Jumper's knee).

## Positioning

**Positioning** - Patient may be seated or lie supine.

### Probe use -

a: Place probe anteriorly just proximal to the patella in long axis. The knee can either be extended or slightly flexed. Move probe laterally and medially to examine this region.



b: Flex the knee when examining the patellar tendon. Start from the distal pole of patella and then distally to tibial tuberosity. Be sure to slide probe side-to-side to see the entire width of the patellar tendon.

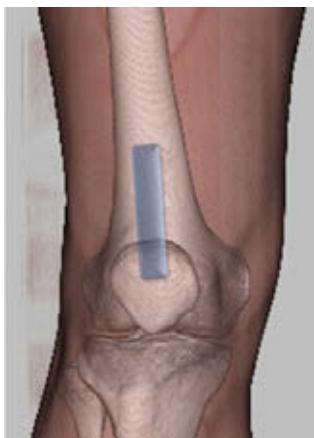


## ■ Procedure ■

### Proximal to Patella

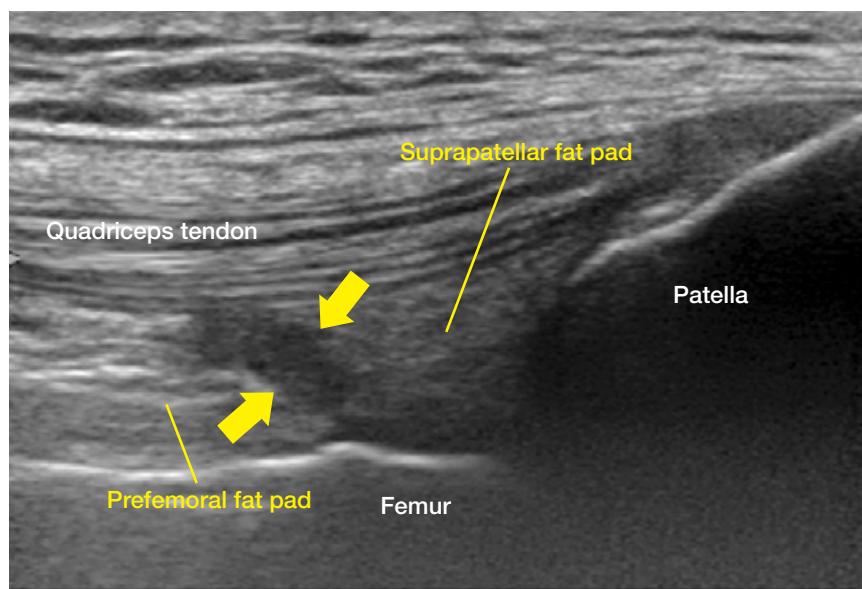
#### Step 1 Suprapatellar bursa

**Probe use** - Examine the extended knee in long axis view.



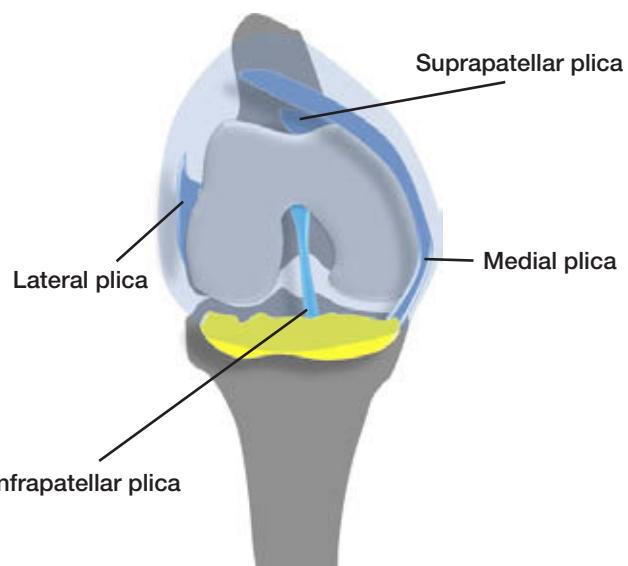
##### Suprapatellar bursa in long axis view

The suprapatellar bursa (yellow arrows) is a hypoechoic space between the supra-patellar fat pad and prefemoral fat pad.



#### Echo anatomy Suprapatellar bursa

- Up to 5 months of gestation, fatty tissue migrate anteriorly through the inter-condylar notch to become the infra-patellar fat pad. Essentially three compartments are formed between this fat pad, the suprapatellar bursa and the joint compartment. From 5 months on, the partition walls resolve resulting in a single joint compartment.
- The remnants of the partition walls become synovial bands or plicas.



# Chapter 7

# Hip Joint • Thigh

## Introduction

Ultrasonographic examination of the hip and thigh region can be divided into anterior, medial, lateral and posterior aspects.

## Index

### Anterior Aspect

1. Hip Joint
- Acetabulum
- Femoral Head and Neck
- Acetabular Labrum
- Iliofemoral Ligament
2. Iliopsoas, Neurovascular Structures
- Inguinal Ligament
- Femoral Vein, Artery and Nerve
3. Anterior Inferior Iliac Spine (AIIS)
- Rectus Femorus
4. Anterior Superior Iliac Spine (ASIS)
- Sartorius
- Tensor Fascia Lata
5. Quadriceps
- Rectus Femoris
- Vastus Medialis
- Vastus Lateralis
- Vastus intermedius

### Medial Aspect

1. Superficial Layer
- Adductor Longus
- Gracilis
2. Intermediate Layer
- Adductor Brevis
3. Deep Layer
- Adductor Magnus

### 4. Adductor Canal

Musculature (Sartorius, Adductor Longus, Vastus Medialis)  
Tendinous Structures  
Tendon Hiatus (Vastus Medialis)

### Lateral Aspect

1. Superficial Layer
- Gluteus Maximus
- Tensor Fascia Lata
- Iliotibial Band
2. Deep Layer
- Gluteus Medius
- Gluteus Minimus
- Greater Trochanter

### Posterior Aspect

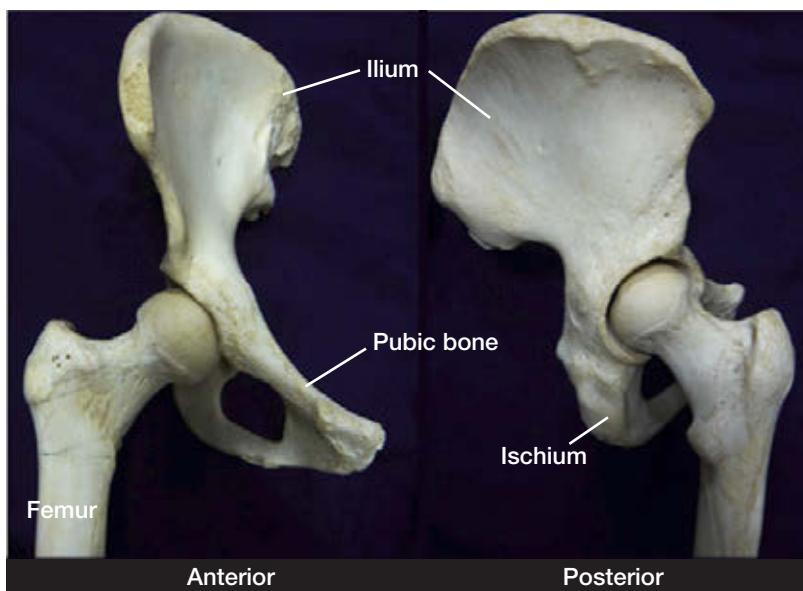
1. Superficial Layer
- Gluteus Maximus
2. Deep Layer
- Piriformis
- Superior Gemellus
- Obturator Internus
- Inferior Gemellus
- Quadratus Femoris
- Sciatic Nerve
3. Ischial Tuberosity
- Semimembranosus
- Semitendinosus
- Biceps Femoris Long Head

# Hip Joint • Thigh

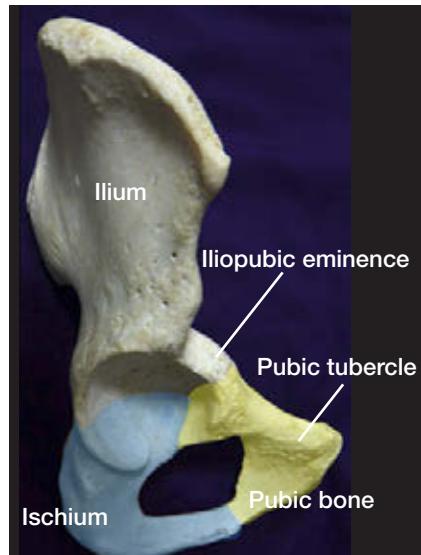
## Basic Information

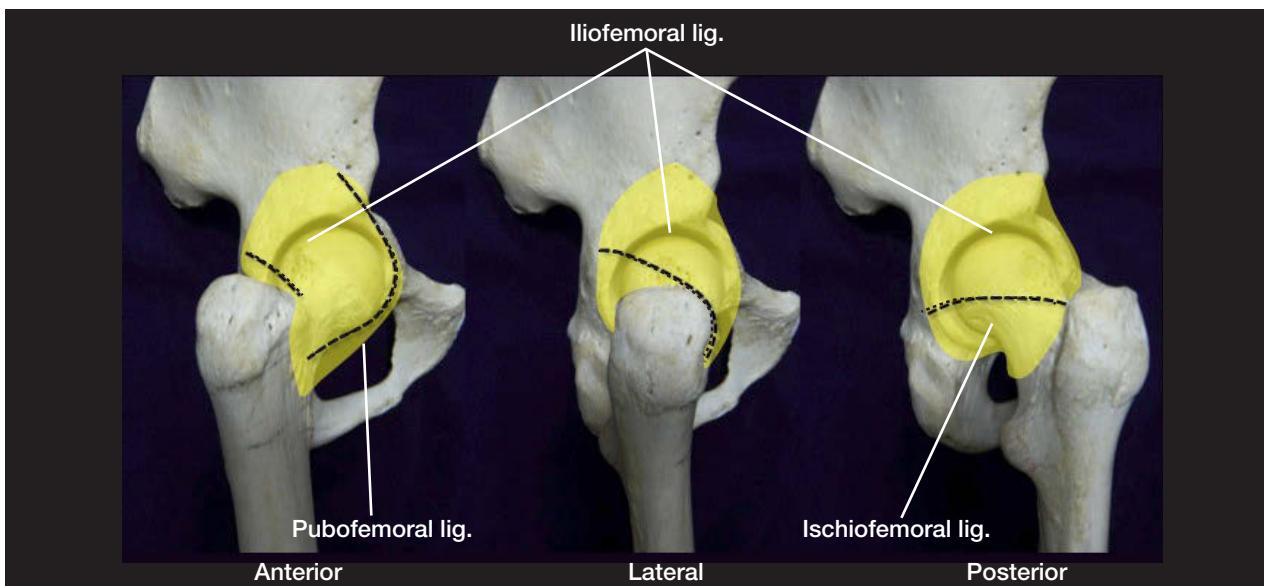
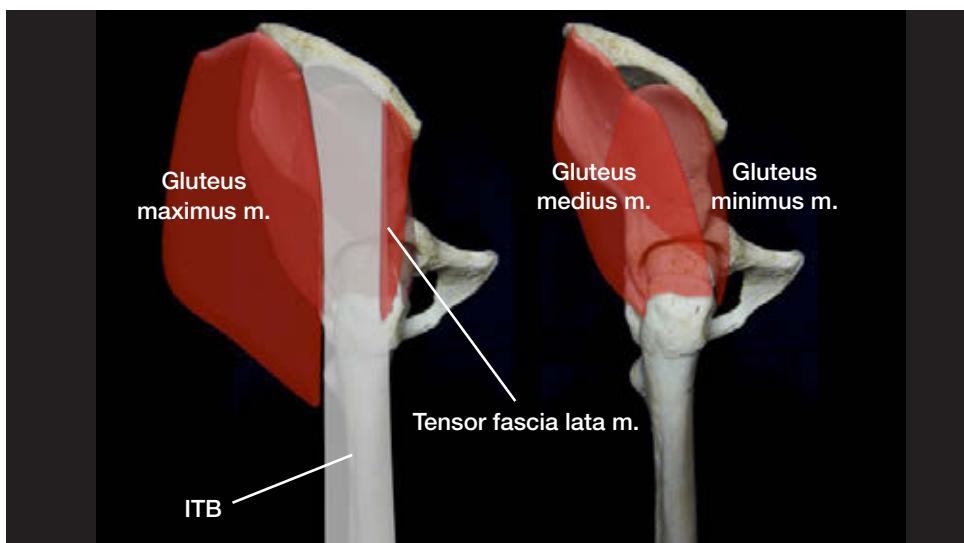
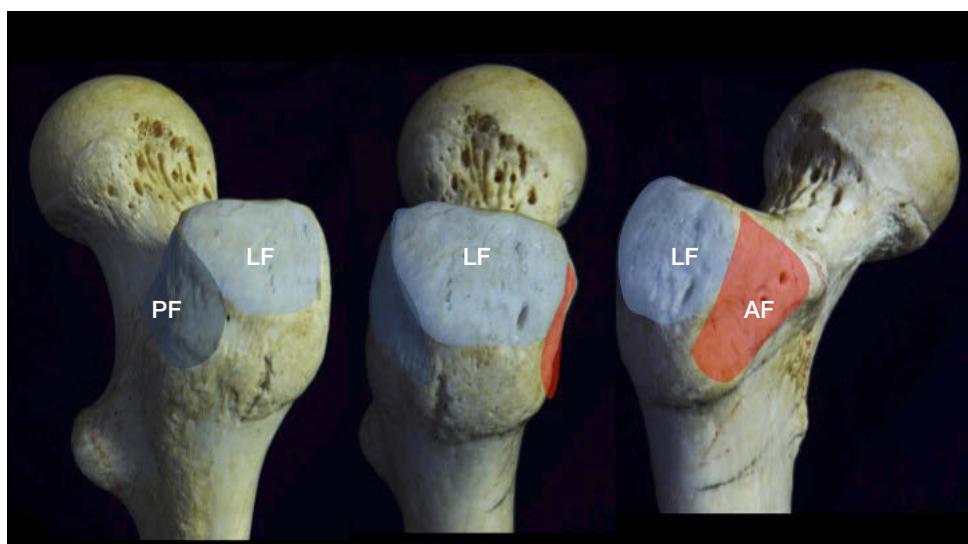
- The articulation between femoral head and acetabulum forms a ball and socket joint, commonly known as the hip [A].
- The acetabulum is formed by the fusion of pubis, ischium and ilium. 25 of the total acetabular surface area is from ilium, 25 from ischium and 1/5 from pubis. Together it covers 40% of the femoral head. [B]
- The margin of the bony acetabulum is lined by a labrum. The joint is in turn covered by joint capsule and ligaments (iliofemoral ligament, pubofemoral ligament and ischiofemoral ligament). [C]
- The iliofemoral ligament which originates from anterior inferior iliac spine (AIIS) and upper edge of acetabulum and attaches between greater and lesser trochanters acts to reinforce the anterior joint capsule and is the strongest ligamentous structure in the body.
- The areas of interest are relatively superficial for anterior and lateral aspects, but deep structures are the main areas of examination on the medial and posterior aspects.
- Gluteus minimus takes up the posterior 1/3 of the iliac wing, where gluteus medius takes up the anterior 2/3. These two muscles are strong hip abductors [D]. Gluteus minimus inserts into the anterior facet (AF) of the greater trochanter; the anterior fibers of gluteus medius into lateral facet (LF), and posterior fibers into postero-superior facet (PSF) [E]. Because of the difference in insertion sites, gluteus minimus can act as a flexor, while gluteus medius an extensor.
- The iliobial band is a blend of tensor fascia lata anteriorly, part of the fibers of gluteus maximus (deltoid of Farabeuf) posteriorly. Its thicker proximal portion is known as the bandellette of Massiat.
- In the posterior aspect, gluteus maximus and fascia lata are located, gluteus medius in the middle layer, and minimus is the deepest structure.

A: Hip Joint



B: Acetabulum



**C: Three ligamentous structures covering the hip****D: Gluteus muscles and Iliotibial Band (ITB)****E: Three facets of greater trochanter**

# Anterior Aspect

Master Point

The main structures of interest are hip joint, iliopsoas, neurovascular structures, rectus femoris, sartorius and tensor fascia lata.

## Positioning

**Positioning** - Patient should lie supine, be sure to shift the undergarment proximally not obstructing the probe.

Anterior inspection of the hip



## ■ Procedure ■

### Step 1 Hip Joint

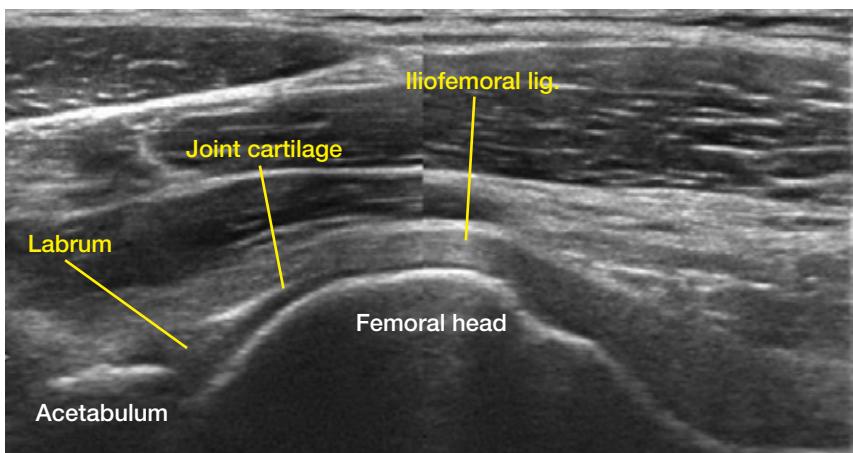
**Probe use** - Place probe 45° from the femoral shaft over the femoral neck.



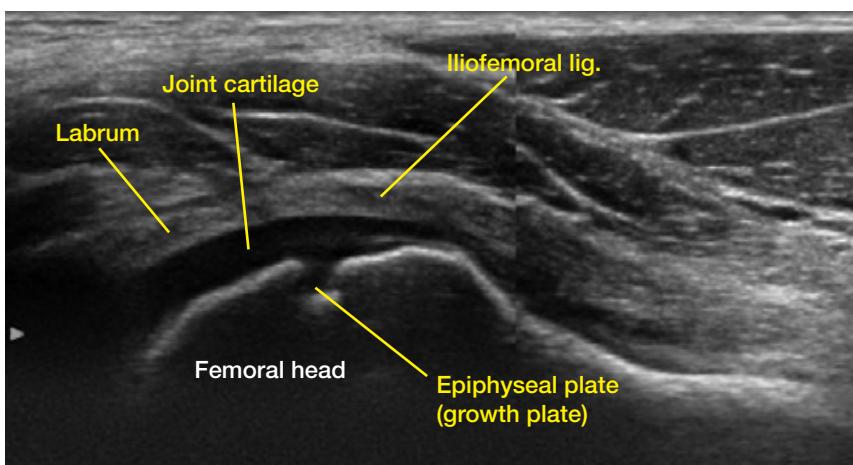
#### Long axis view of hip joint

At the margin of the acetabulum and femoral head, the band-like hyperechoic joint capsule and iliofemoral ligament can be seen covering the joint. A triangular area at the acetabular bony margin beneath the joint capsule lies the labrum. Paediatric patients have thicker cartilage layer than adults and the presence of epiphysis.

#### a: Adult



#### b: Age 12



#### c: Age 2

