OSTEOLOGY AND ARTHROLOGY OF UPPER LIMB

Learning Objectives

Upon completion of this session, the student will be able to:

1. Identify prominent features of the clavicle, scapula, humerus, ulna, radius, and the skeleton of hand.
2. Describe the functional capabilities and limitations of the shoulder joint based on its bony structure and ligaments.
3. Describe the functional capabilities and limitations of the elbow based on its bony structure and ligaments.
4. Describe the functional capabilities and limitations of the wrist joint based on its bony structure and ligaments.
5. Name the normal bone and joint structures visible in plain x-ray and CT, and normal soft tissues in MR images of joints.
6. Identify bone fractures demonstrated with discontinuity of a bone cortex.

Required Materials

- Cadaver/ Skeleton of the Upper Limb.
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions:

- There are 3 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it. This indicates completion of the task and comprehension of this part of the assignment. The group's supervisor can question you about it and expect a correct answer. Such questions will be used in your continuous assessment.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 7.1

SKELETON OF THE UPPER LIMB

☐ Identify the ***shoulder girdle*** or ***pectoral girdle*****,** which is the set of bones that connects the arm to the axial skeleton on each side. It is formed of the ***clavicle*** and ***scapula.***

CLAVICLE

☐ Note the shape of the clavicle, like a letter S.

☐ Confirm that it has two ends:

- ☐ Expanded ***medial end*** (sternal end with sternal facet), which articulates with the sternum and first costal cartilage. Identify the impression for ***costoclavicular ligament*** in the inferior surface of the clavicle at its sternal end.
- ☐ Flattened ***lateral end*** (acromial end with acromial facet), which articulate with the ***acromion*** process of the scapula.

☐ Note that the clavicle is subcutaneous throughout its length with its medial 2/3 convex forward and its lateral 1/3 concave forward.

☐ Check the inferior surface, which has a ridge called the ***trapezoid line*** and a ***conoid tubercle*** for attachment with the trapezoid and the conoid ligaments (parts of the ***coracoclavicular ligament***).

☐ Check the attachment of the following ligaments to the inferior surface

of the clavicle: coracoclavicular and costoclavicular ligaments.

- ☐ Identify the groove for ***subclavius muscle*** at the inferior surface of the clavicle and the subclavius muscle fills the groove.
- ☐ Check the ***subclavian vessels*** and ***trunks of brachial plexus*** that pass between the ***first rib*** and clavicle.
- ☐ Note that the common site of fracture is the junction between the medial two third and the lateral third.

SCAPULA

- ☐ Note the shape of the scapula, which is the large triangular flat bone lies on the posterolateral aspect of the upper chest wall.
- ☐ Locate the following parts of the scapula:
  - ☐ ***Borders*: *superior, medial and lateral*.**
  - ☐ ***Angles*: *superior, inferior and lateral*.**
  - ☐ ***Surfaces*: *anterior (costal) and posterior*.**
  - ☐ ***Fossae*: *subscapular*** anteriorly, ***supraspinous*** and ***infraspinous*** posteriorly.
  - ☐ ***Coracoid process*:** projects upward and forward from the neck of the scapula.
  - ☐ ***Suprascapular notch* :** in the superior border for the passage of ***suprascapular nerve*** and ***vessels***.
  - ☐ ***Glenoid cavity***: facing laterally for articulation with the ***head*** of the ***humerus***, see the ***supraglenoid*** and ***infraglenoid tubercles***.
  - ☐ ***Spine*:** that project posteriorly and its lateral part is expanded to form the acromion with clavicular facet and acromion angle.

Identify the free parts of the upper limb, which is formed of:

HUMERUS

- ☐ Identify the **humerus** that is a long bone formed of ***proximal end***, ***shaft*** and ***distal end***.

- ☐ Locate the following parts of the humerus:
  - ☐ ***Head:*** forms less than1/2 ball and is directed slightly upward, backward and medially.
  - ☐ ***Greater and lesser tubercles***.
  - ☐ ***Intertubercular sulcus (bicipital groove)***: containing the tendon of long head of biceps.
  - ☐ ***Shaft of humerus*** (body of humerus): has anteromedial, anterolateral and posterior surface.
  - ☐ ***Anatomical neck*:** separates head and tubercles from the shaft.
  - ☐ ***Surgical neck*:** separate tubercles from the shaft.
  - ☐ ***Deltoid tuberosity***: lies at the half way down of the shaft at the lateral side.
  - ☐ ***Spiral groove***: on the shaft posteriorly for the radial nerve.
  - ☐ ***Trochlea***: for articulation with the ulna medially and capitulum for articulation with the radius laterally.
  - ☐ ***Medial and lateral epicondyles*** and ***supracondylar ridges***.
  - ☐ ***Radial and coronoid fossae*** anteriorly and ***olecranon fossa*** posteriorly.
- ☐ Note that the fractures of the humerus usually result from falls or direct trauma, there are three types of humeral fractures:
  - ☐ Proximal humeral fractures: results in injury of ***axillary nerve*** and ***anterior*** and ***posterior circumflex humeral arteries***.
  - ☐ Humeral shaft fractures: results in injury of ***radial nerve*** and deep brachial artery.
  - ☐ Distal humeral fractures: results in injury of ***median*** and ***ulnar nerves*** and ***brachial artery***.

ULNA

- ☐ Identify the **ulna** that is medial bone of the forearm.
- ☐ Locate the following parts of ulna:
  - ☐ ***Olecranon process***: hook-like process in the upper part of the ulna.
  - ☐ ***Trochlear notch***: it is the inner aspect of the olecranon. In elbow

flexion it inserts the trochlea of the humerus

- ☐ ***Radial notch***: on the lateral aspect of the upper end, which articulate with articular circumference of radius.
- ☐ ***Coronoid process***: anterior prominence below the trochlear notch.
- ☐ ***Supinator crest***: on the lateral aspect below the radial notch.
- ☐ ***Shaft*** (body): has anterior, posterior and medial surfaces.
- ☐ ***Interosseous***, ***anterior*** and ***posterior borders***.
- ☐ ***Head***: directed downward.
- ☐ ***Styloid process***: extend from the head downward, backward and medially.
- ☐ ***Articular circumference***.

RADIUS

- ☐ Identify the **radius** that is lateral bone of the forearm.
- ☐ Locate the following parts of the radius:
  - ☐ ***Head***: short cylinder with shallow depression on its superior surface for articulation with capitulum of humerus.
  - ☐ ***Neck***: separates the head from the shaft.
  - ☐ ***Articular circumference***.
  - ☐ ***Radial tuberosity***: located medially.
  - ☐ ***Shaft*** (body): with anterior, posterior and lateral surfaces.
  - ☐ ***Interosseous***, ***anterior*** and ***posterior borders***.
  - ☐ ***Styloid process***: extend distally downward and laterally.
  - ☐ ***Dorsal tubercle***: located distally and posteriorly.
  - ☐ ***Ulnar notch***: located distally and medially.
  - ☐ Grooves for ***extensor muscles' tendons***.
  - ☐ **Carpal articular surface**.

SKELETON OF THE HAND

- ☐ Note that each hand consists of 27 bones, which are: wrist bones (***carpals***), palm bones (***metacarpals***), and finger bones (***phalanges***).
- ☐ Identify the proximal and distal rows of the carpal bones.
  - ☐ Proximal row: ***scaphoid***, ***lunate***, ***triquetral*** and ***pisiform***.

- ☐ Distal row: ***trapezium, trapezoid, capitates*** and ***hamate***.
- ☐ Identify the parts of ***metacarpal bones***: rounded ***head***, ***shaft*** and proximal ***base***.
- ☐ Note that the first metacarpal lies at a right angle in relation to the other metacarpals.
- ☐ Note that each finger has 3 ***phalanges*** (***proximal, middle*** and ***distal phalanx***); the thumb 2 (proximal and distal phalanx). Each phalanx has a proximal ***base***, distal ***head*** and a ***shaft*** in between.

STATION 7.2

JOINTS OF THE UPPER LIMB:

(Figure 7.2.1 - 7.2.3)

- ☐ Identify the ***shoulder joint***: which is the ***synovial, ball and socket***, connects ***humerus*** and ***scapula.*** Notice that ***glenoid labrum*** deepens the socket.
  - ☐ Identify the ***coracohumeral ligament***, ***transverse humeral ligament***, and ***glenohumeral ligaments***.
  - ☐ Identify tendon of ***long head of biceps*** passes through shoulder joint.

Identify the ***elbow joint***: which is the ***synovial, hinge***, gliding and pivot complex joint consisting of ***humeroulnar***, ***humeroradial*** and ***proximal radioulnar*** articulations; strengthened mainly by radial and ulnar collateral ligaments.

- ☐ Identify ***proximal radioulnar*** joint.
- ☐ Identify ***distal radioulnar*** joint.
- ☐ Identify joints of hand:
  - ☐ Identify the ***wrist joint***: which is ***synovial, ellipsoidal*** joint. ***Radius*** articulates with the ***scaphoid*** and ***lunate*** of the proximal row of carpals, an ***intracapsular articular disk*** characterizes the joint.
  - ☐ Carpal joints and ***Intercarpal*** joints.
  - ☐ Midcarpal joint
  - ☐ Pisiform joint.
  - ☐ ***Carpometacarpal*** joints.

- ☐ Carpometacarpal joints of thumb-***Saddle*** joint.
- ☐ Intermetacarpal joints.
- ☐ ***Metacarpophalangeal*** joints.
- ☐ ***Interphalangeal*** joints.

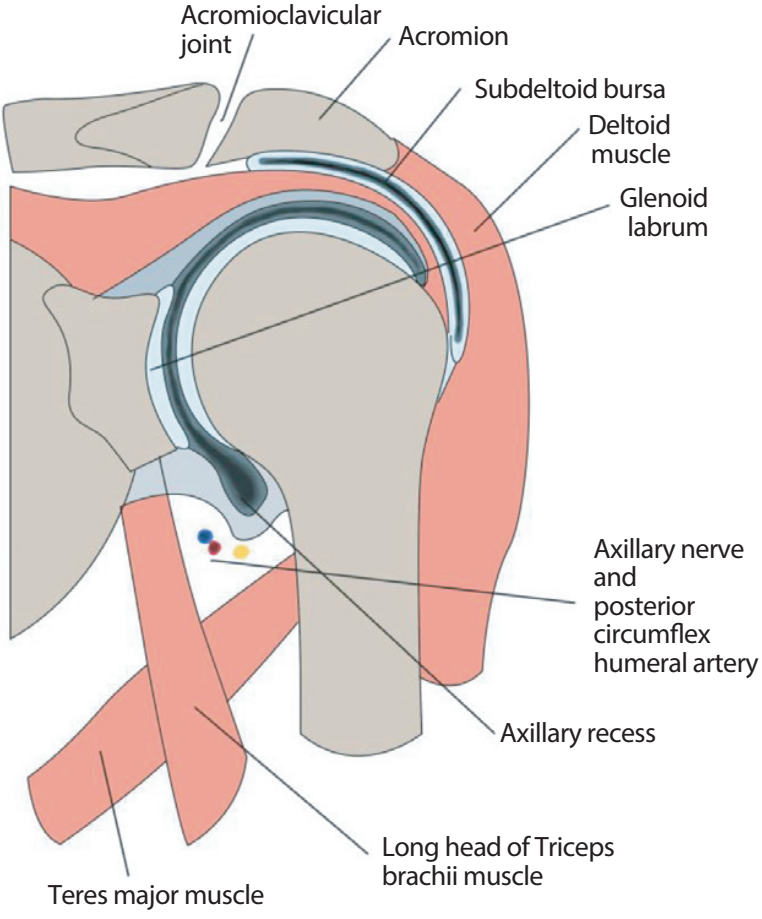

Fig. 7.2.1 Shoulder joint capsule

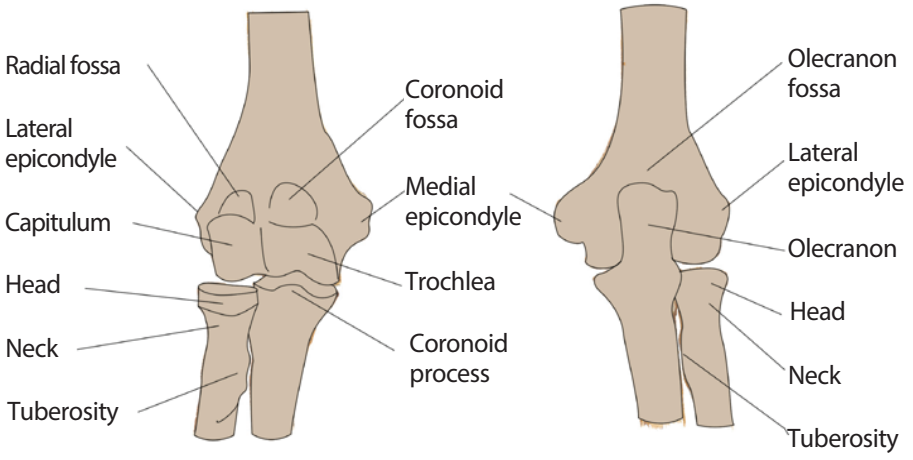

Fig. 7.2.2 Elbow joint

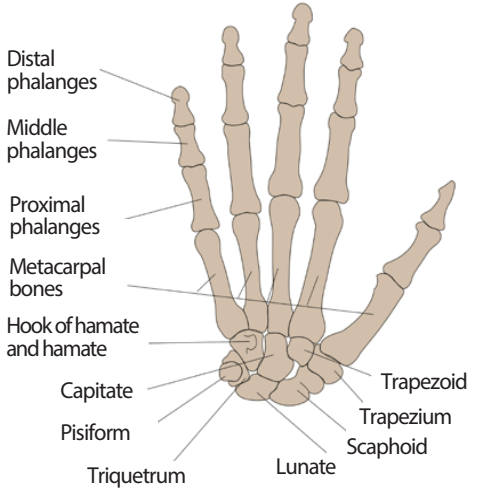

Fig. 7.2.3 Wrist joint

STATION 7.3

IMAGING OF THE UPPER LIMB

(Figs. 7.3.1- 7.3.5)

- ☐ Identify the bony structures in the ***shoulder joint*** in ***AP film***: parts of the ***scapula*** and ***clavicle***, ***upper end*** of the ***humerus*** (Fig. 7.3.2, 7.3.2).
- ☐ Name the ***soft tissue*** structures seen in ***MRI*** of the shoulder region: ligaments, muscles, labrum..etc (Fig. 7.3.3).
- ☐ Identify the bony structures in the ***elbow joint*** in ***AP*** and ***Lateral films***: ***lower end*** of the humerus and ***upper ends*** of the ***radius*** and ***ulna*** (Fig. 7.3.4).
- ☐ Identify and name in plain x-rays the parts of the ***proximal*** and ***distal radioulnar joints*** (Fig. 7.3.5).
- ☐ Identify and name in plain films the pats of the ***carpal bones*** and ***joints of wrist*** and ***hand: radiocarpal, intercarpal, carbometacarpal, metacarpophalangeal*** and ***interphalangeal***. (Fig. 7.3.5).
- ☐ Recognize ***shoulder dislocation*** and *fractures* of ***humerus***, ***radius*** and ***ulna*** (Fig. 7.3.2)..

Fig. 7.3.1 AP radiograph of the left shoulder region

Fig. 7.3.2 Shoulder dislocation and avulsion of greater tuberosity.

Fig. 7.3.3 MRI of shoulder tissues

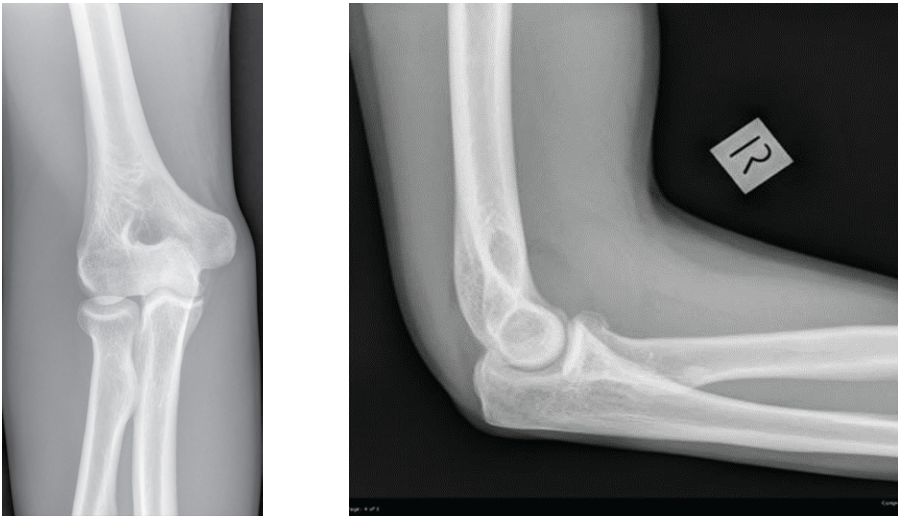

Fig. 7.3.4 AP and Lateral views of the elbow region

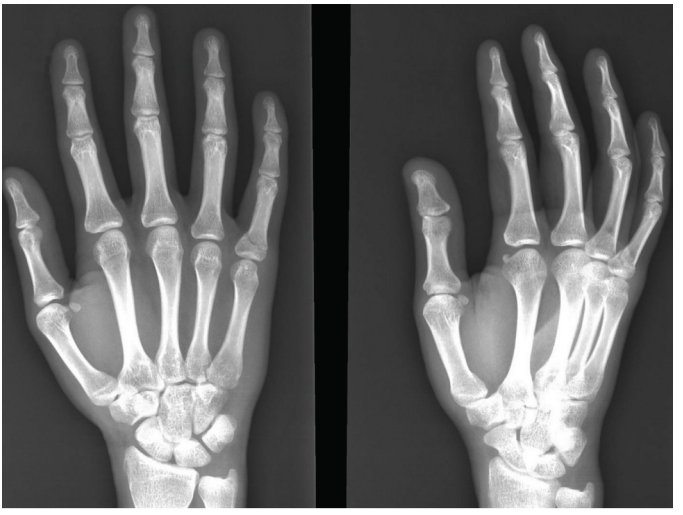

Fig. 7.3.5 AP and oblique radiographs of the wrist and hand

Questions:

1. Where is the common site of fractures of the clavicle?
2. Mention the names of the nerves in direct contact with humerus bone.
3. Mention the parts of the scapula.
4. Describe the features used to recognize the anatomical site of the humerus, ulna and radius.
5. What make the shoulder joint stable joint?
6. What is the synovial type of the wrist joint?
7. What is the synovial type of the interphalangeal joints
8. Name the bony structures seen in AP radiograph of the shoulder
9. Name the soft tissues seen in MRI of the shoulder region
10. Identify the bony structures in the lateral view of the elbow joint.
11. Name the carpal bone in AP radiograph of the wrist joint.

OSTEOLOGY AND ARTHROLOGY OF LOWER LIMB

Learning Objectives:

Upon completion of this session, the student will be able to:

1. Identify prominent features of the hip, femur, tibia, fibula, and the skeleton of foot.
2. Describe the functional capabilities and limitations of the hip join based on its bony structure and ligaments.
3. Describe the functional capabilities and limitations of the knee joint based on its bony structure and ligaments.
4. Describe the functional capabilities and limitations of the ankle joint and joints of the foot based on its bony structure and ligaments.
5. Name the normal bone and joint structures visible in plain x-ray and CT, and normal soft tissues in MR images of joints.
6. Identify bone fractures demonstrated.

Required Materials:

- Cadaver/ Skeleton of the Lower Limb/images
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions:

- There are 2 stations of activities in this practical.

- When you have completed a particular task you should put a tick in the box before to it. Thi s indicates completion of the task and comprehension of this part of the assignment. The group's supervisor can question you about it and expect a correct answer. Such questions will be used in your continuous assessment.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 8.1

SKELETON OF THE LOWER LIMB

☐ Identify the ***pelvic girdle*** is a ring-like structure, located in the lower part of the trunk. It connects the ***axial skeleton*** to the lower limbs. It consists of two hip bones:

HIP BONE

- ☐ Identify the hip bone, which is formed of three bones: ***ilium, pubis*** and ***ischium***.
- ☐ Locate the ***ilium*** and identify the following:
  - ☐ ***Body*** of ilium**.**
  - ☐ **Iliac fossa.**
  - ☐ Outer **gluteal surface** and the three ***gluteal lines*** on it (***anterior, posterior*** and ***inferior***).
  - ☐ ***Iliac crest*** and its tubercles:
    - ☐ ***Anterior superior*** and ***anterior inferior iliac spines*.**
    - ☐ ***Posterior superior*** and ***posterior inferior iliac spines***.
  - ☐ Identify ***outer lip***, ***intermediate zone*** and ***inner lip*** of the iliac crest
  - ☐ Locate the ***arcuate line*** at the medial side of ilium.
- ☐ Observe the cup shaped ***acetabulum*** and its acetabular margin, acetabular fossa and ***acetabular notch***.
- ☐ Locate the ***ischium*** and identify the following:

- ***Ischial tuberosity*.**
- ***Ischial spine*.**
- ***greater*** and ***lesser sciatic notches*.**
- ***Ischial ramus*.**

- Locate the ***pubic bone*** and identify the following:
  - ***Superior*** and ***inferior pubic rami***, note that inferior pubic ramus joins with the ischial ramus to form the ***ishiopubic ramus***, which joins the opposite side to form the ***pubic arch*.**
  - ***Pubic tubercle*.**
  - ***Pubic crest*.**
  - ***Pectineal line*.**
- Identify the ***obturator foramen***; notice the ***obturator groove*** with anterior and posterior obturator tubercle for the ***obturator nerve*** and ***vessels*** in the upper margin of the obturator foramen.
- Locate the ***obturator crest***.

Identify the free parts of the lower limb, w`ich is formed of:

FEMUR

- Identify the femur, which is the longest long bone in the body. It is formed of ***proximal end***, ***shaft*** and ***distal end***.
- Locate the following parts of the femur:
  - ***Head*** and ***fovea capitis*** for ***ligament of head***.
  - ***Neck***.
  - ***Greater*** and ***lesser trochanters***.
  - ***Trochanteric fossa*.**
  - ***Intertrochanteric line*** anteriorly and ***intertrochanteric crest*** posteriorly.
  - ***Quadrate tubercle*.**

- ☐ Identify the ***shaft of the femur***, and observe the following:
  - ☐ ***Gluteal tuberosity*** laterally.
  - ☐ ***Linea aspera*** on its posterior aspect and its upper and lower divergances (lateral and medial lip).
  - ☐ ***Pectineal line***.
- ☐ Identify the distal end, which has two condyles separated partially by an ***intertcodylar notch***. And medial and lateral ***supracondylar ridges*** that surround the ***popliteal surface*** of the femur. Locate the following:
  - ☐ ***Medial condyle*****.**
  - ☐ ***Medial epicondyle*****.**
  - ☐ ***Adductor tubercle*****.**
  - ☐ ***Lateral condyle*****.**
  - ☐ ***Lateral epicondyle*****.**
  - ☐ ***Groove for popliteus*****.**
  - ☐ ***Intercondylar fossa*****.**
  - ☐ ***Patellar surface*****.**
- ☐ Note that fractures of the femur are common. They may affect the proximal (associated with hip joint dislocation), shaft or distal (supracondylar) part of the femur (results in injury of the sciatic nerve).

PATELLA

- ☐ Identify the patella which is the largest ***sesamoid*** bone in the body and it is found in the tendon of the ***quadriceps femoris*** muscles. It is formed of:
  - ☐ ***Base*** of patella.
  - ☐ ***Apex*** of patella.
  - ☐ ***Articular*** surface.
  - ☐ ***Anterior*** surface.

TIBIA

- ☐ Identify the tibia, which is the larger and medial bone of the leg.

- ☐ Locate the following structures of the tibia:
  - ☐ Expanded upper end (***superior articular surface***): consists of ***medial*** and ***lateral condyles*****.** Having a flat articular surface or ***plateau*** with rough ***intercondylar areas*** anterior and posterior to a sharp projection (***intercondylar eminence***) with ***medial*** and ***lateral intercondylar tubercles.***
  - ☐ Identify the ***shaft*** (body), which is formed of:
  - ☐ ***Medial***, ***lateral*** and ***posterior*** surfaces
  - ☐ ***Anterior***, ***medial*** and ***interosseous borders***
  - ☐ ***Tibial tuberosity***.
  - ☐ ***Soleal line***.
- ☐ Identify the ***distal end of the tibia***, which is formed of:
  - ☐ ***Medial malleolus*****.**
  - ☐ ***Malleolar groove***.
- ☐ Note that the bone has articular facets for the fibula medially on its upper ends (articular facet) and lower ends (fibular notch).
- ☐ Identify ***inferior articular surface***.

FIBULA

- ☐ Identify the fibula, the slender long lateral bone of the leg.
- ☐ Locate the following structures of the fibula:
  - ☐ ***Head*** (with articular facet and apex).
  - ☐ ***Neck***.
  - ☐ Long ***shaft*** (body with a ***lateral, medial*** and ***posterior*** surfaces, the ***medial crest***, and the ***anterior, interosseous*** and ***posterior*** borders).
  - ☐ ***Lateral malleolus*** that shows a ***malleolar fossa*** on its inner posterior aspect, articular facet and ***malleolar groove***.

SKELETON OF THE FOOT

- ☐ Note that each foot consists of 26 bones, which are: ankle bones (***tarsals***), middle bones (***metatarsals***), and toes bones (***phalanges***).
  - ☐ Identify the 7 tarsal bones: ***talus, calcaneus, navicular, three cuneiform*** bones (***medial, intermediate*** and ***lateral***), and ***cuboid***.
  - ☐ Identify the 5 metatarsal bones (each with ***base***, ***shaft*** and ***head***).
  - ☐ Identify the 14 phalanges as in the hand three for each ***toe*** (***proximal, middle*** and ***distal***) and two for the ***big toe*** (***proximal*** and ***distal***).
  - ☐ Put the foot on a flat surface and observe that it has some arches:
    - ☐ ***Medial arch*** is formed from the calcaneum, talus, navicular, and the three cuneiforms and first three metatarsals.
    - ☐ ***Lateral arch*** is formed by the calcaneum, cuboid, and lateral two metatarsals.
    - ☐ ***Transverse arch*** is formed of the five metatarsals.

STATION 8.2

JOINTS OF THE LOWER LIMB:

(Figure 8.2.1 - 8.2.6)

- ☐ Identify the ***hip joint***: the ***synovial ball and socket***, between the ***head of the femur*** and the ***acetabulum*** of the hip bone.
- ☐ Locate the following:
  - ☐ ***Iliofemoral*** ligament
  - ☐ ***Pubofemoral*** ligament
  - ☐ ***Ischiofemoral*** ligament
  - ☐ ***Transverse acetabular*** ligament
  - ☐ ***Ligament of head of femur***
- ☐ Identify the ***zona orbicularis*** which covers the neck of femur

- ☐ Identify the relationship between the ligament of head of femur (***ligamentum teres***) and the acetabular branch of obturator artery
- ☐ Identify the ***knee joint***: which is the largest synovial joint in the body. It is an ***atypical hinge synovial joint*** due to the presence of the fibrocartilagenous ***menisci*** and ***intraarticular ligaments***.

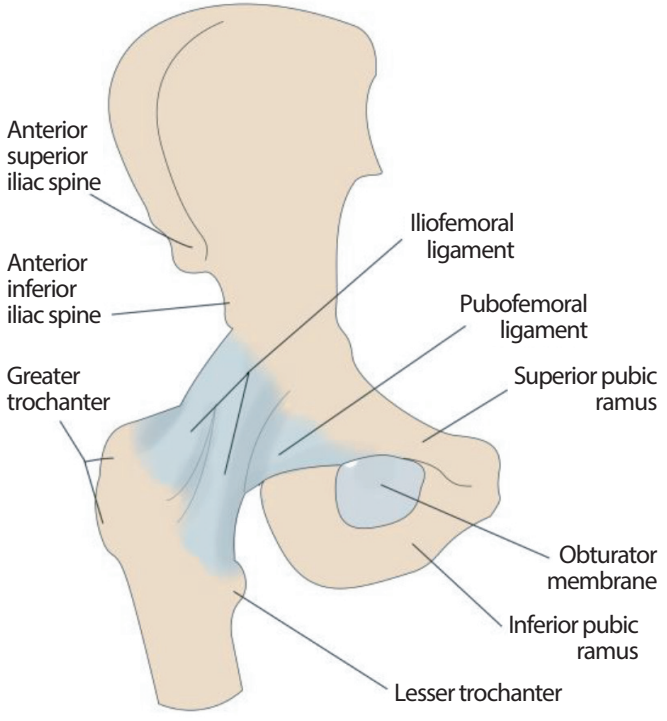

Fig. 8.2.1 Anterior ligaments of the hip joint

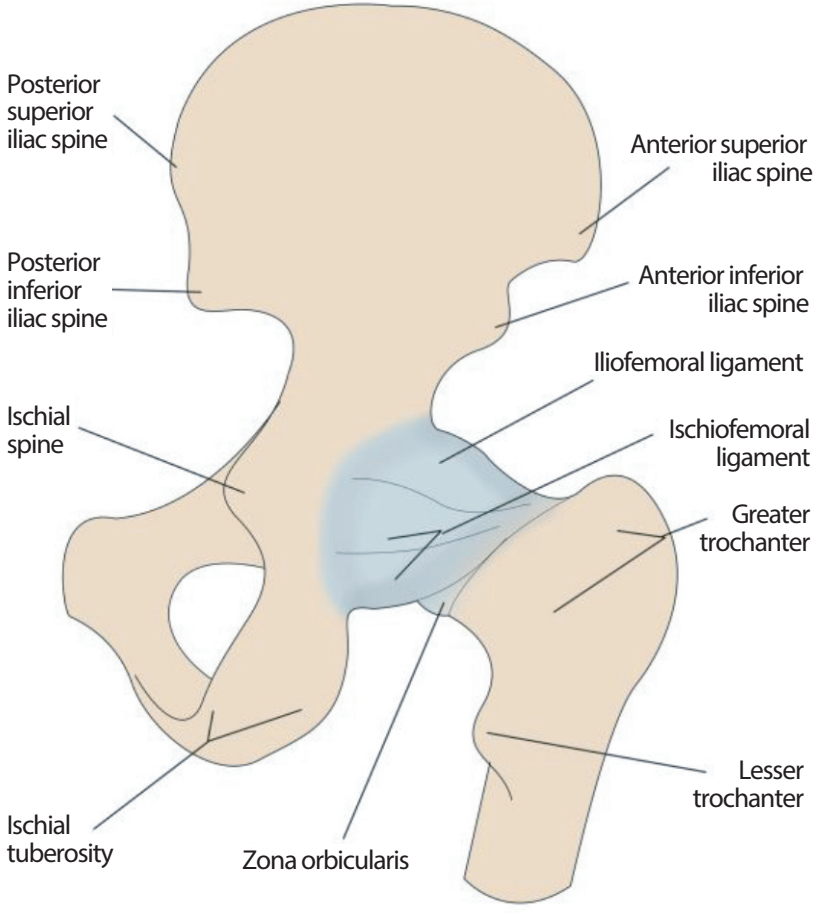

Fig. 8.2.2 Posterior ligaments of the hip joint

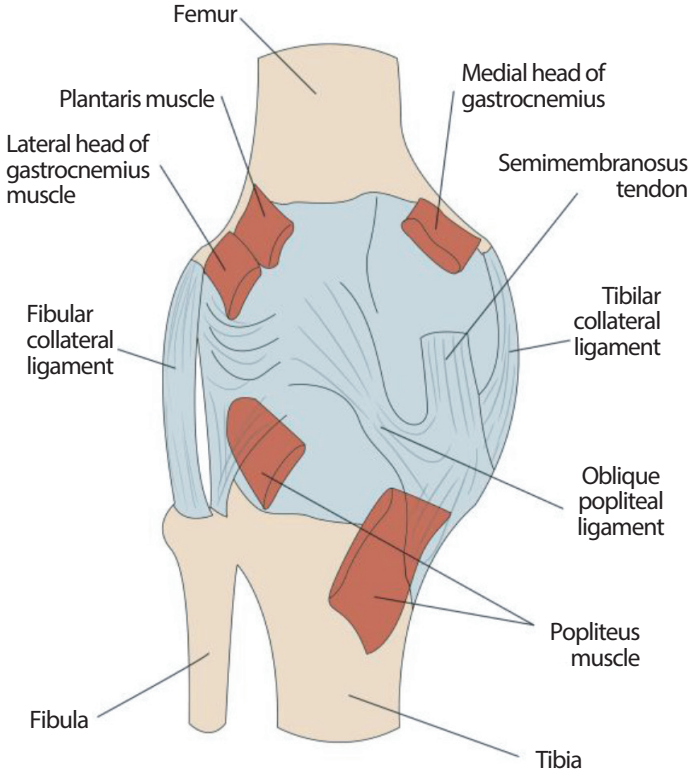

Fig. 8.2.3 The knee joint capsule and ligaments

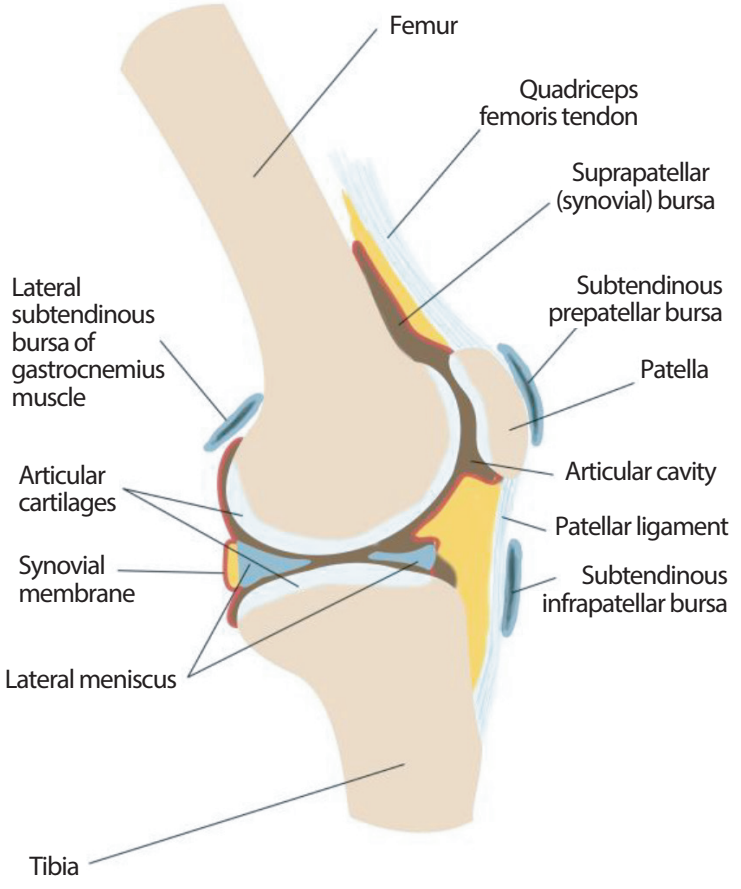

Fig. 8.2.4 Knee joint cavity and bursae

☐ In the specimen provided examine the following:

- ☐ ***Quadriceps tendon*** forming the anterior wall of the joint and its downward continuation as the ***patellar ligament***.
- ☐ ***Articular surfaces*** of the ***two femoral*** and ***two tibial condyles***.

- ☐ ***Medial*** (tibial) and ***lateral*** (fibular) ***collateral ligaments***.
- ☐ ***Oblique popliteal ligament.***
- ☐ ***Arcuate popliteal ligament***.
- ☐ ***Two semilunar cartilages or menisci.***
- ☐ ***Two cruciate ligaments. (anterior*** and ***posterior)***
- ☐ ***Anterior*** and ***posterior meniscofemoral ligaments***
- ☐ ***Transverse popliteal ligament.***
- ☐ ***Patella***.
- ☐ ***suprapatellar bursa***, a synovial recess that extends superiorly deep the quadriceps tendon.

☐ Identify the ***proximal tibiofibular joint*****:** which is the joint between the proximal part of tibia and head of fibula. The concave articular surfaces are fibular articular facet on tibia, and convex articular facet on a head of fibula.

☐ Identify the following ligaments which provide strength for the joint:

- ☐ ***Anterior*** ligament of fibular head
- ☐ ***Posterior*** ligament of fibular head

☐ Identify ***distal tibiofibular joint*****:** which is the joint between the distal part of tibia and fibula, a small, very limited movements are possible.

☐ Identify the ***Joints of foot*****:**

- ☐ The ***ankle joint***: a ***synovial, hinge joint***, is the articulation between distal end of tibia, medial malleolus, lateral malleolus and talus. The joint strengthen by:
  - ☐ ***Deltoid*** ligament.
  - ☐ ***Anterior talofibular*** ligament.
  - ☐ ***Posterior talofibular*** ligaments.
  - ☐ ***Calcaneofibular*** ligament.
- ☐ ***Subtalar*** or ***talocalcaneal joint***: talus is oriented slightly obliquely on

the anterior surface of the calcaneus.

- Transverse tarsal joint:
  - Talocalcaneonavicular joint.
  - Calcaneocuboid joint.
- Cuneonavicular joint.
- Intercuneiform joint.
- Tarsometatarsal joint.
- Intermetatarsal joint.
- Metatarsophalangeal joint.
- Interphalangeal joint of foot.
- Note that the subtalar and transverse tarsal joints, between the bones of the tarsus; are responsible for ***eversion*** and ***inversion.***

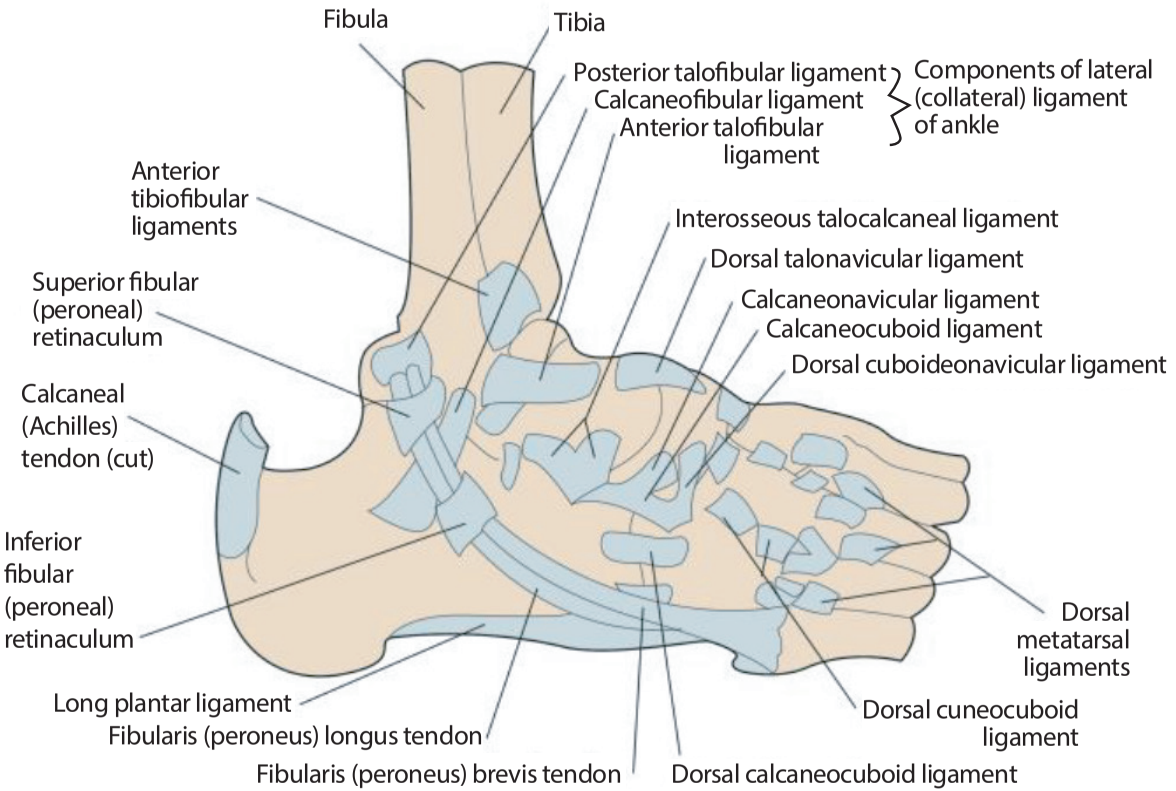

Fig. 8.2.5 : ***Joints and ligaments of foot - lateral side***

PRACTICAL 8

Fig. 8.2.6 ***Joints and ligaments of foot - medial side***

STATION 8.3

IMAGING OF THE LOWER LIMB:

(Figure 8.3.1 - 8.3.8)

- ☐ Identify the bony structures in the ***hip joint*** in ***AP and Lateral films***: parts of the pelvic bone, lower lumber vertebrae, sacrum, coccyx, upper end of the femur (Fig. 8.3.1).
- ☐ Name the soft tissue structures seen in the hip region: ligaments, muscles, labrum..etc seen in ***MRI*** and ***CT images***.
- ☐ Identify the bony structures in the ***knee joint*** in ***AP and Lateral films***: lower end of the femur and upper ends of the tibia and fibula. (Fig. 8.3.2).
- ☐ Identify and name in MRI knee the parts of the menisci, anterior and posterior cruciate ligaments, patellofemoral joint (Fig.8.3.3 - 8.3.6).
- ☐ Identify and name in plain films the parts of the **joints of ankle and foot:** ankle, ***tarsal bones, intertarsal, tarsometatarsal, metatarsophalangeal*** and ***interphalangeal*** (Fig. 8.3.7, 8.3.7).

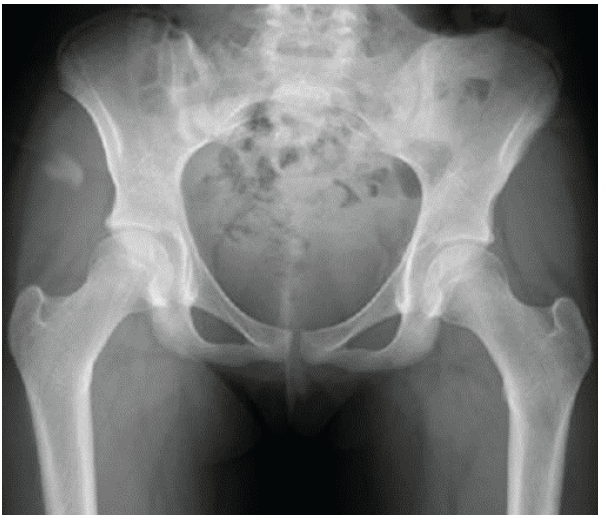

Fig. 8.3.1 Pelvis and hip joints

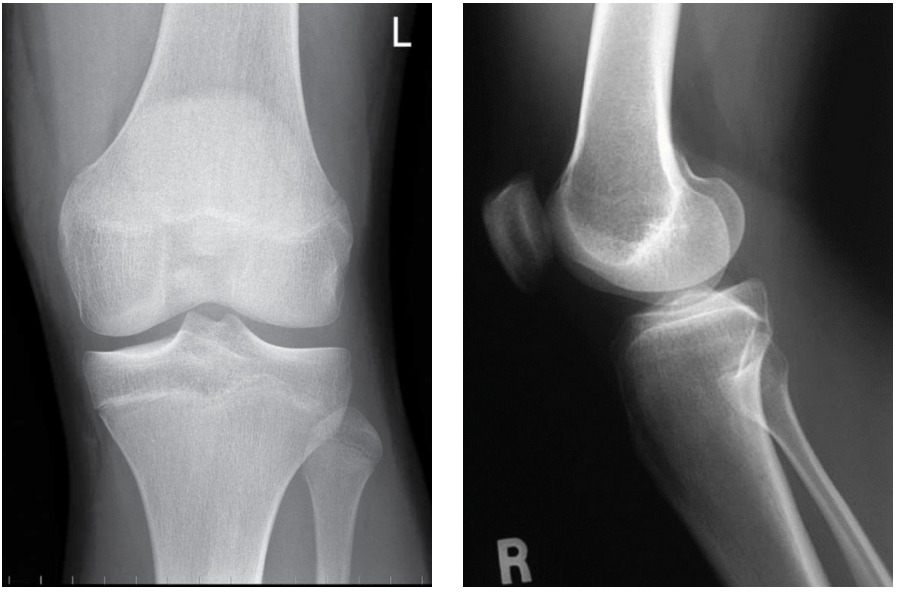

Fig. 8.3.2 Right AP and lateral knee radiographs

Fig. 8.3.3 Anterior cruciate ligament (MRI)

Fig. 8.3.4 Posterior cruciate ligament (MRI)

Fig. 8.3.5 Knee joint showing the medial and lateral menisci (MRI)

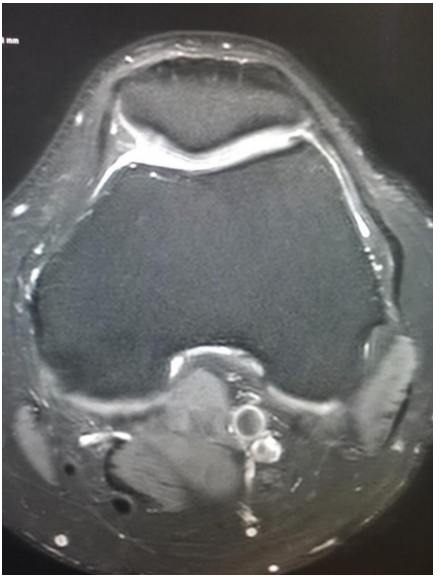

Fig. 8.3.6 Patellofemoral joint and popliteal contents (MRI)

Fig. 8.3.7 Lateral radiograph of right ankle joint and foot

Fig. 8.3.8 AP radiograph of right foot

Questions:

1. Mention the parts of hip bone.
2. Mention the arterial supply of the head of the femur.
3. Mention the palpable areas of the tibia.
4. Describe the features used to recognize the anatomical (right or left) side of the femur, tibia and fibula.
5. What contributes to hip joint stability?
6. What is the intra-articular ligaments of the knee joint?
7. What is the function of knee joint ligaments?
8. What is the synovial type of the ankle joint?
9. Name the boney structures in x-rays of the hip, knee and ankle.
10. Identify the soft tissue structures in MRI of the knee region

STRUCTURES OF UPPER LIMB

Learning Objectives:

Upon completion of this session, the student will be able to:

1. Identify the axilla as a space, its boundaries and its contents.
2. Illustrate and describe the brachial plexus, its parts, and the nerves arising from it and their distribution.
3. Identify the axillary artery and vein, and their relationships to each other and to the brachial plexus.
4. Review the posterior shoulder muscles and related rotator cuff muscles, the nerves and vascular supply, and their significant function.
5. Identify the muscles of each of the compartments of the arm, the nerves and vascular supply, and their significant function.
6. Identify the relationships of all associated muscular and neurovascular structures within the cubital fossa.
7. Identify the muscles of the flexor compartment of the forearm and hand, the nerves and vascular supply, and their significant function.
8. Identify the muscles of the extensor compartment of the forearm, the nerves and vascular supply, and their significant function.
9. Define the thenar, hypothenar, central, and interosseous compartments of the hand, the nerves and vascular supply, and their significant function.
10. Identify structures in the normal CT and/or MR images of the shoulder region and carpal tunnel, and identify regions in the mid-arem, elbow, mid-forearm and hand.

Required Materials:

- Cadaver/ Skeleton of the Upper Limb/ Dissected Upper Limb
- Handouts/ Atlases of Human Anatomy
- Visual and Electronic Media
- Images.

Instructions:

- There are 5 stations of activities in this practical.
- When you have completed a particular task you should put a tick in the box before to it. This indicates completion of the task and comprehension of this part of the assignment. The group's supervisor can question you about it and expect a correct answer. Such questions will be used in your continuous assessment.
- Keep these sheets for future reference and revision.
- Make sure that you answer the questions at the end of the activities.

STATION 9.1

SHOULDER REGION:

(Figure 9.1.1)

☐ Identify the following muscles and verify their action(s):

- ☐ ***Pectoralis major***.
- ☐ ***Pectoralis minor***.
- ☐ ***Serratus anterior***.
- ☐ ***Subclavius.***
- ☐ ***Deltoid***.
- ☐ ***Subscapularis***.

- ☐ ***Supraspinatus***.
- ☐ ***Infraspinatus.***
- ☐ ***Teres major*** and ***teres minor***.
- ☐ ***Trapezius***.
- ☐ ***Latissmus dorsi***.
- ☐ ***Rhomboideus major*** and ***minor***
- ☐ ***Levator scapulae***.

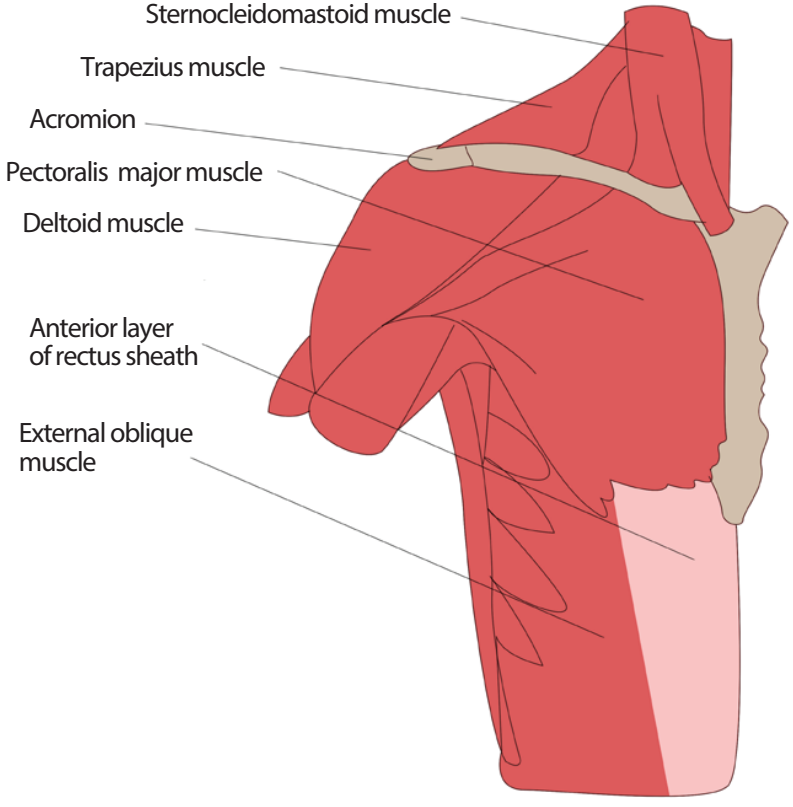

Fig. 9.1.1 Muscles of shoulder region

STATION 9.2

ARM, AXILLA, AND CUPITAL FOSSA:

(Figure 9.2.1+ 9.2.2)

ARM

- ☐ Identify the following arm muscles, indicate their attachment and review their innervation and action(s):
  - ☐ ***Biceps brachii***.
  - ☐ ***Coracobrachialis***.
  - ☐ ***Brachialis.***
  - ☐ ***Triceps***.
- ☐ Identify the following nerves and vessels in the arm, and review their root values:
  - ☐ ***Median nerve***.
  - ☐ ***Ulnar nerve***.
  - ☐ ***Musculocutaneous nerve***.
  - ☐ ***Radial nerve***.
  - ☐ ***Brachial Artery***.
  - ☐ The major superficial veins of the arm include the ***cephalic*** and ***basilic veins***, as well as the ***median cubital vein*** that joins the two at the elbow.
  - ☐ The major deep veins of the arm are the ***radial*** and ***ulnar veins***, which run along the length of their respective bones and merge at the elbow to form the paired ***brachial vein***. The brachial vein runs from the elbow up to the shoulder parallel to the ***brachial artery***.

AXILLA

- ☐ Notice that the ***axilla*** is the pyramidal shape space between thoracic wall and upper arm. Examine the axilla in the specimen in front of you and identify the following:

- ***Anterior wall***, which is formed of the pectoral fascia, pectoralis major muscle, clavipectoral fascia, pectoralis minor muscle and subclavius muscle.
- ***Medial wall*** formed by the upper ribs (1st – 4th ribs) with the corresponding intercostal spaces and intercostal muscles covered by the serratus anterior.
- ***Posterior wall***, which is formed by the scapula and subscapularis on its anterior surface and inferiorly by the teres major and latissimus dorsi.
- ***Lateral wall*** is the narrowest and it's represented by the bicipital groove at the upper part of the shaft of the humerus that occupied by the long head of the biceps and accompanied by the coracobrachialis.
- ***Apex of axilla*** is the cervicoaxillary canal, the passageway between the neck and axilla, bounded by the 1st rib, clavicle, and superior edge of the scapula. The arteries, viens, lymphatics, and nerves pass though this superior opening of the axilla from the neck to the arm and vise versa.
- ***Base of the axilla***, which is formed by the skin and the superficial fascia.

The lower posterior boundary is called the ***posterior axillary fold*** and this is a complex structure consisting of the latissimus dorsi and teres major muscles. The anterior boundary is called the ***anterior axillary fold*** and this is curved in shape and formed by the lower border of the pectoralis major.

Within the axilla identify the following:

- ***Axillary fat*** that fills the space.
- ***Axillary lymph nodes*** and lymphatic vessels. The axillary lymph nodes are arranged in ***five principal groups***:
  - ***Apical nodes***.
  - ***Central nodes***.
  - ***Pectoral (anterior) nodes***.
  - ***Subscapular (posterior) nodes***.
  - ***Humeral (lateral) nodes***.

- ☐ ***Axillary artery*** and its branches and axillary vein its tributaries.
- ☐ ***Brachial plexus cords*** and notice the following:
  - ☐ ***Anterior division*** of the inferior trunk continues as the medial cord, which is situated medial to the axillary artery. Identify its following branches:
    - ☐ ***Medial pectoral nerve***.
    - ☐ ***Medial cutaneous nerve of the arm*** and ***medial cutanoeous nerve of the forearm***.
    - ☐ ***Ulnar nerve*** which is the largest branch of the cord.
    - ☐ ***Medial root of the median nerve***.
  - ☐ ***Anterior divisions*** of the superior and middle trunks unite to form the lateral cord, which is situated lateral to the axillary artery. Identify its branches:
    - ☐ ***Lateral pectoral nerve***.
    - ☐ ***Musculocutaneous nerve***.
    - ☐ ***Lateral root of the median nerve*** that joins with the medial root from the medial cord to form the median nerve.
  - ☐ ***Posterior divisions*** of all three trunks unite to form posterior cord of the brachial plexus, which is situated exactly posterior to the axillary artery. Identify its branches:
    - ☐ ***Radial nerve*** that is the largest branch of the cord.
    - ☐ ***Axillary nerve***.
    - ☐ ***Upper*** and ***lower subscapular nerves***.
    - ☐ ***Thoracodorsal nerve.***

QUADRANGULAR SPACE (Lateral axillary space)

- ☐ Identify the quadrangular spaces, which are located posteriorly at the arm and shoulder region of right and left upper limbs.
- ☐ Observe the ***borders*** of the quadrangular spaces: ***humerus laterally, long head of triceps brachii muscle medially, teres minor*** and ***subscapularis muscles*** at the superior and ***teres major*** at the inferior sides .

- ☐ Note that the ***axillary nerve*** and ***posterior circumflex artery*** and vein are traverse the quadrangular space.

TRIANGULAR SPACE (Medial axillary Space)

- ☐ Identify the triangular spaces are located medial to the quadrangular spaces at the posterior of right and left upper limbs.
- ☐ Observe the ***borders*** of the triangular space: ***long head of triceps brachii laterally, teres minor muscle superior*** and ***teres major muscle inferior***.
- ☐ Indentify the ***circumflex scapular artery*** as it passes through the triangular space.

CUBICAL FOSSA

- ☐ Identify the cubital fossa, which is a shallow triangular depression in front of the elbow joint, and define its ***borders***:
  - ☐ Medial border of ***brachioradialis laterally***.
  - ☐ Lateral border of **pronator teres medially**.
  - ☐ Base of this triangle is an imaginary line between the two ***humeral condyles.***
  - ☐ Floor is formed by the ***supinator muscle laterally*** and the ***brachialis muscle medially.***
  - ☐ Roof is formed by the ***skin, superficial, and deep fasciae*** reinforced by the ***bicipital aponeurosis***.
- ☐ Examine its ***contents:***
  - ☐ ***Median nerve***.
  - ☐ ***Brachial artery, bifurcation*** of the brachial artery into ***radial*** and ***ulnar arteries.***
  - ☐ ***Radial nerve*** and its deep branch
  - ☐ Tendon of the **biceps muscle**.
  - ☐ Lymph nodes

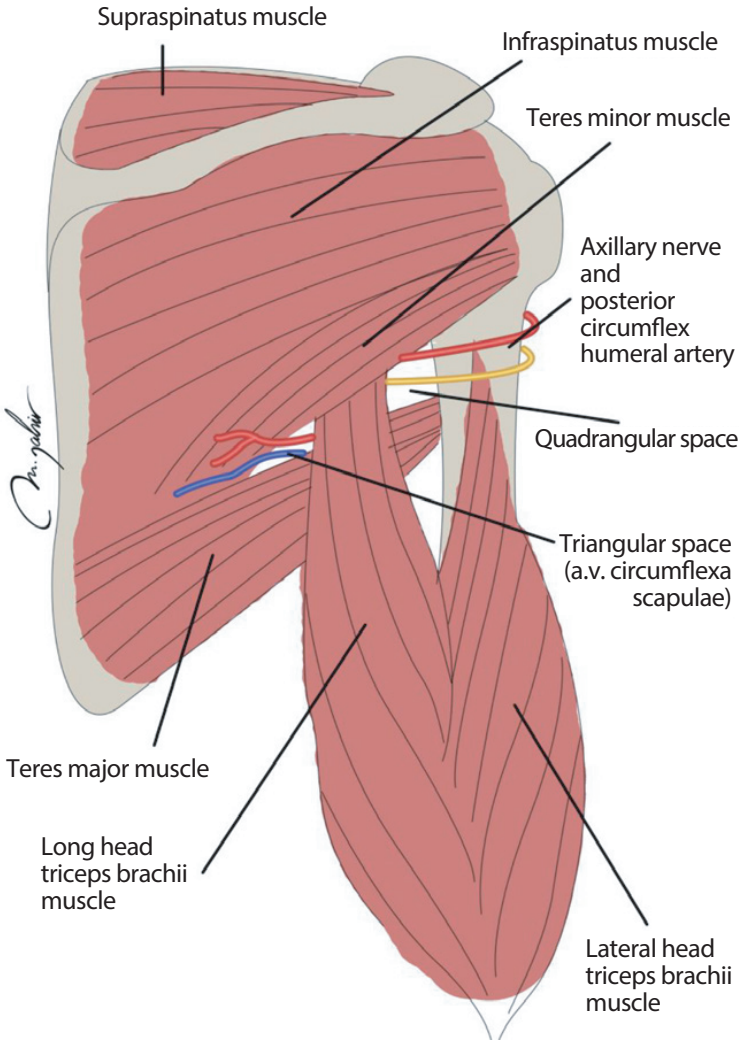

Fig. 9.2.1 Right triangular and quadrangular spaces

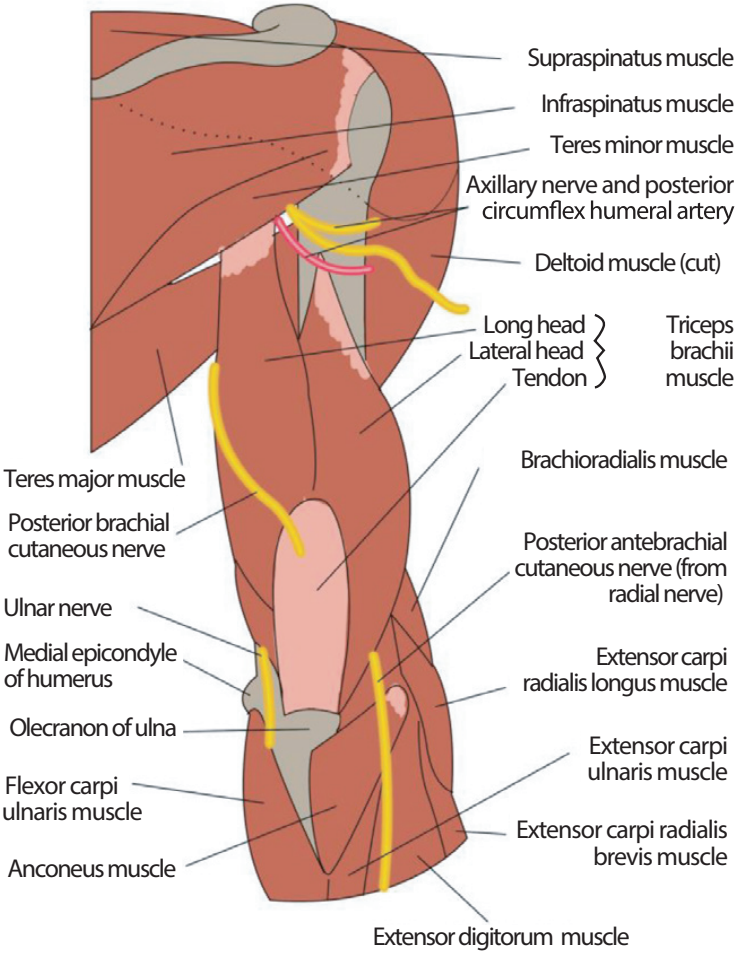

Fig. 9.2.2 Posterior muscles and nerves of the arm

STATION 9.3

FOREARM:

(Figure 9.3.1 - 9.3.3)

- ☐ Identify the following muscles, located superficially in the ventral aspect of the forearm and review their attachments, innervation and actions:
  - ☐ ***Pronator teres***.
  - ☐ ***Flexor carpi radialis***.
  - ☐ ***Palmaris longus***.
  - ☐ ***Flexor digitorum superficialis.***
  - ☐ ***Flexor carpi ulnaris.***
- ☐ Identify the following muscles, located deeply in the ventral aspect of the forearm and review their attachments, innervation and actions:
  - ☐ ***Flexor digitorum profundus***.
  - ☐ ***Flexor pollicis longus***.
  - ☐ ***Pronator quadratus***.
  - ☐ Identify the ***radial artery***.
  - ☐ Identify the ***ulnar artery***.
  - ☐ Locate the ***median nerve***.
  - ☐ Identify the ***radial nerve***.
  - ☐ Identify ***ulnar nerve***.
  - ☐ Identify the ***anterior interosseous nerve*** and ***artery***.
- ☐ Identify the following muscles, located superficially in the dorsal aspect of the forearm and review their common attachments, innervation and actions:
  - ☐ ***Brachioradialis***.
  - ☐ ***Extensor carpi radialis longus***.

- ☐ ***Extensor carpi radialis brevis***.
- ☐ ***Extensor digitorum***.
- ☐ ***Extensor digiti minimi.***
- ☐ ***Extensor carpi ulnaris***.
- ☐ ***Anconeus.***

☐ Identify the following muscles, located deeply in the dorsal aspect of the forearm and review their common attachments, innervation and actions:

- ☐ ***Supinator***.
- ☐ ***Abductor pollicis longus***.
- ☐ ***Extensor pollicis brevis***.
- ☐ ***Extensor pollicis longus***.
- ☐ ***Extensor indices***.

☐ Identify the ***extensor retinaculum***.

☐ Identify the ***radial nerve.***

☐ Identify the ***posterior interosseous nerve*** and ***artery.***

☐ Locate the **common interosseous artery**, which is a branch of the ulnar artery, arises in the distal part of the cubital fossa. It divides into **anterior and posterior interosseous arteries.**

Anatomical snuffbox

☐ Locate the borders of t he shallow fossa called snuffbox are formed by: extensor pollicis brevis tendon laterally, extensor policis longus tendon medially and extensor retinaculum superiorly.

☐ Observe the ***radial artery***, within the anatomical snuffbox.

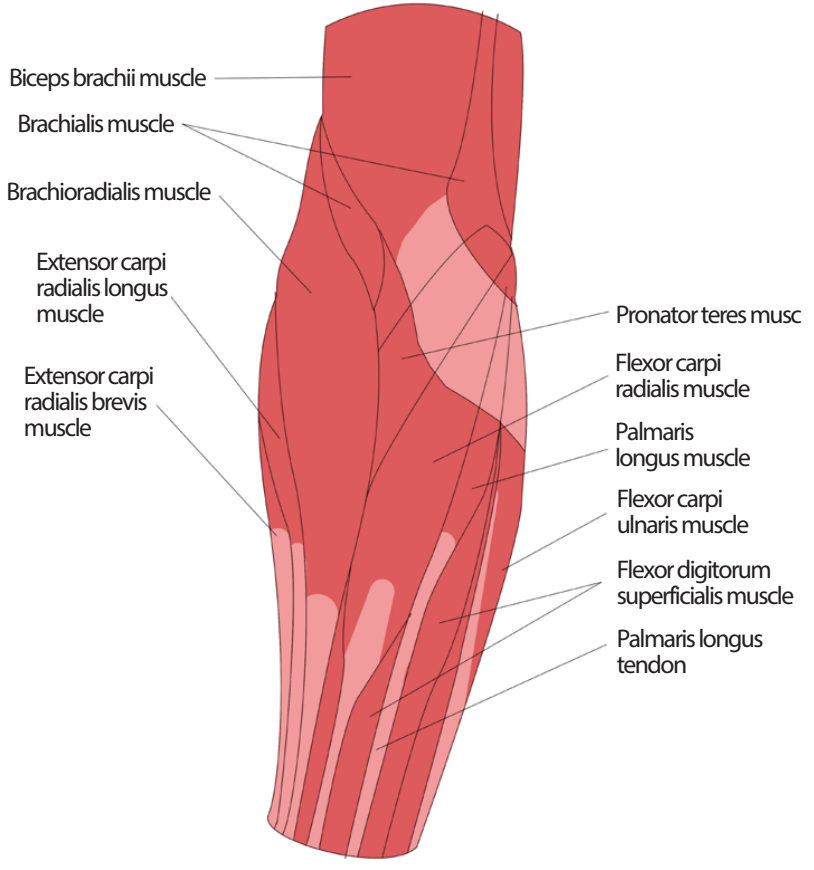

Fig. 9.3.1 Superficial muscles of forearm

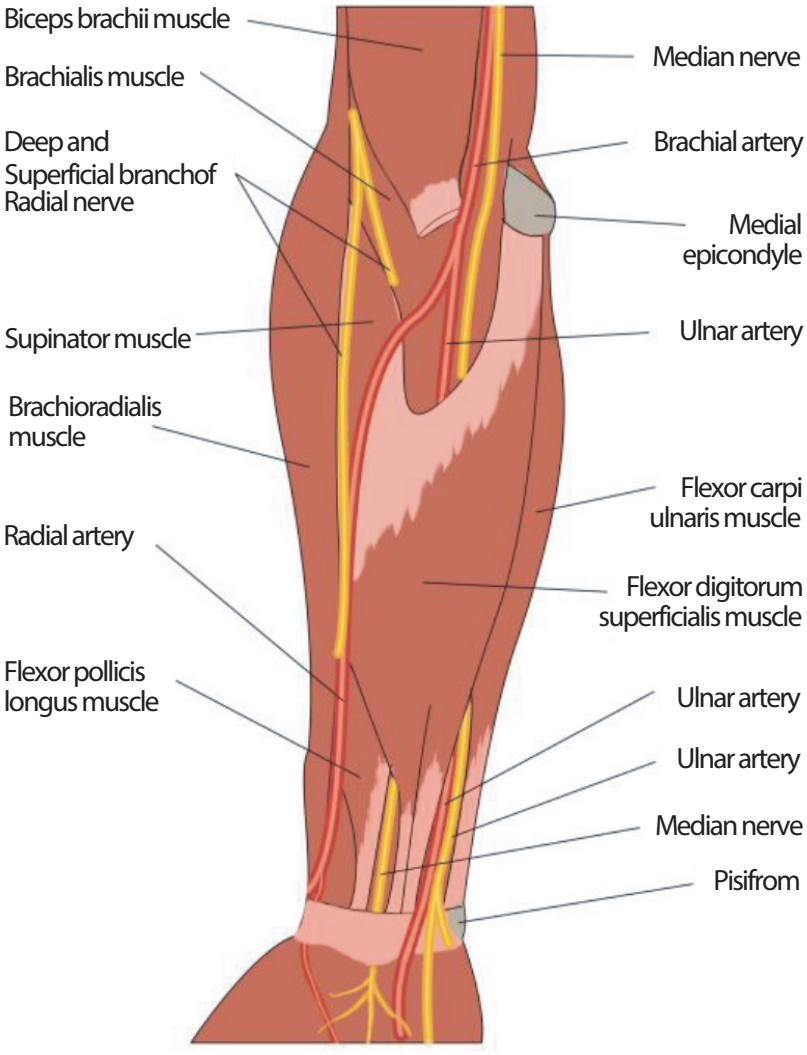

Fig. 9.3.2 Deep structures of the forearm

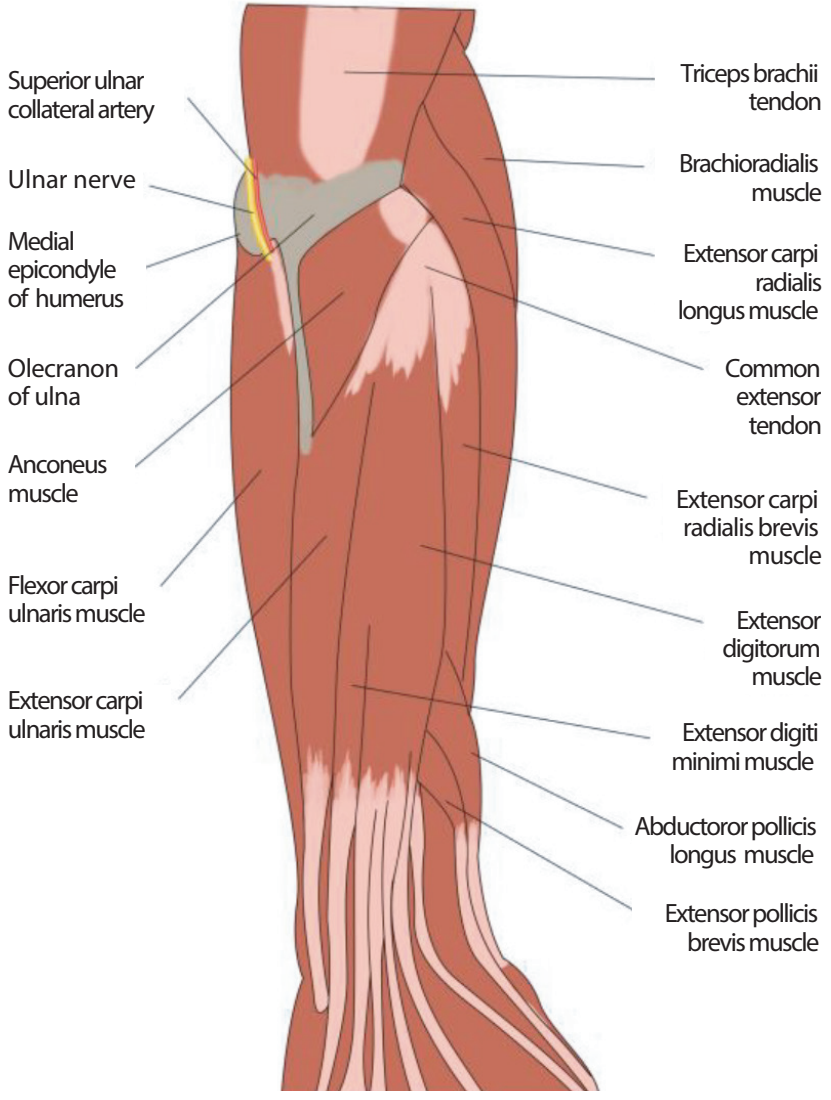

Fig. 9.3.3 Posterior muscles of the elbow and forearm

STATION 9.4

HAND AND CARPAL TUNNEL

(Figure 9.4.1)

- ☐ Identify the extensor expansion on the dorsal aspect of the fingers. This is the common insertion for the ***extensor digitorum, lumbricals*** and ***interossei.***
- ☐ Identify the four ***dorsal interossei***, their action is to abduct the fingers.
- ☐ Identify the fibrous ***flexor sheath*** on the digits ventrally. Notice the arrangement of the flexor tendons in the sheath: ***flexor digitorum superficialis*** splits to allow ***flexor digitorum profundus*** to pass through.
- ☐ Identify the muscles of the hand: ***palmaris brevis***, ***adductor pollicis, thenar, hypothenar, interossei*** and ***lumbrical muscles***. Locate the position of the following:
  - ☐ ***Palmaris brevis***.
  - ☐ ***Adductor pollicis***.
  - ☐ ***Thenar muscles***:
    - ☐ ***Abductor pollicis brevis***.
    - ☐ ***Flexor pollicis brevis***.
    - ☐ ***Opponens pollicis***.
  - ☐ ***Hypothenar muscles:***
    - ☐ ***Flexor digiti minimi brevis***.
    - ☐ ***Abductor digiti minimi brevis***.
    - ☐ ***Opponens digiti minimi.***
  - ☐ ***Lumbricals***: Note that there are four lumbricals (worm – like) muscles. Follow their orign proximally in the tendons of flexor digitorum profundus and insertion distally to the extensor expansions, they participate in flexing the metacarpophalangeal joints and extending the interphalangeal joints.
  - ☐ ***Palmar interossei***: there are three for the index, ring and little fingers,

they adduct those fingers.

- ☐ Identify the ***superficial palmar arch*** and its branches.
- ☐ Identify the ***deep palmar arch*** and its branches.
- ☐ Identify the dorsal venous network.
- ☐ Note that the hand is supplied by the ulnar, median and radial nerves. All three nerves contributed to the general sensory innervation of the hand.
- ☐ Identify an ***osteofascial (carpal) tunnel*** also known as the ***flexor retinaculum***. In the specimen provided identify:
  - ☐ Eight tendons of the ***superficial and deep finger flexors***.
  - ☐ Tendon of ***flexor pollicis longus***.
  - ☐ Median nerve.
  - ☐ Tendon of ***flexor carpi radialis.***

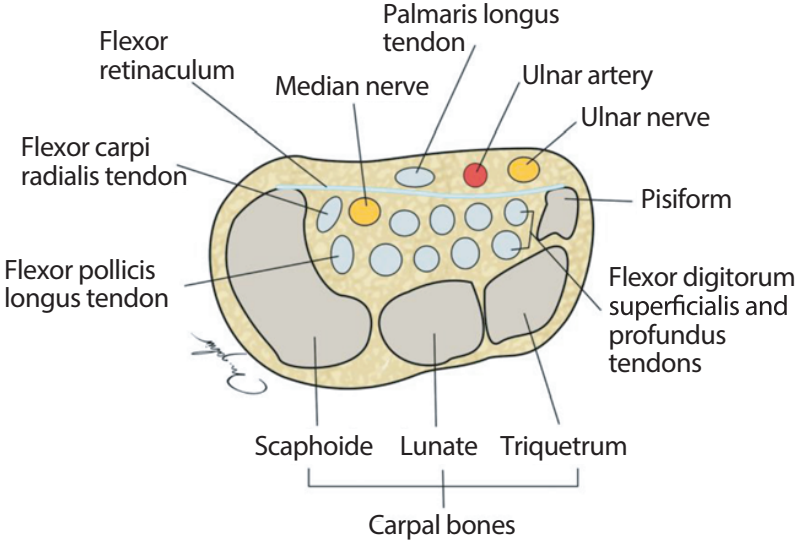

Fig. 9.4.1 Right carpal tunnel

STATION 9. 5

IMAGING

(Figure 9.5.1)

- ☐ Identify the muscles shown in Figures 7.3.5 (review) 9.5.1.
- ☐ In 9.5.1, identify S, P, MN, FDS, PFL, FLR.

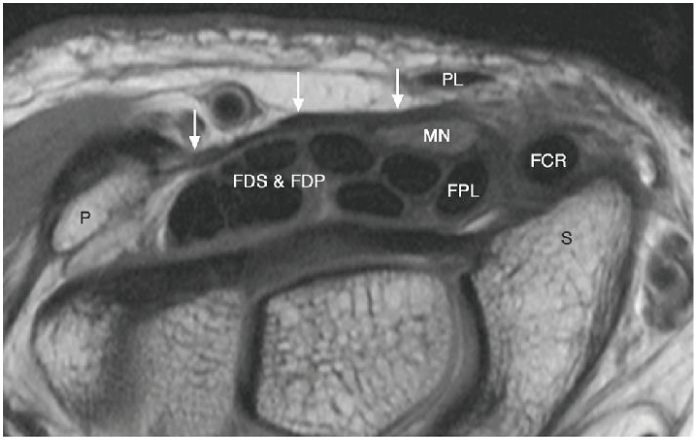

Fig. 9.5.1 Right carpal tunnel

Questions:

1. What are the possible outcomes regarding the fracture of the surgical neck of the humerus?
2. What are the possible outcomes regarding the fracture of the mid-shaft of the humerus?
3. What are the possible outcomes regarding the fracture of the distal end of the humerus?
4. What are the possible outcomes regarding fractures or deep cuts of the fore-arm with functional disruptions of associated muscular or neurovascular structures?
5. What are the possible outcomes regarding fractures or deep cuts of the hand? with functional disruptions of associated muscular and neurovascular structures.
6. Identify the muslces shown in images number 9.5.3, 95.4