Introduction to upper limb and its bones

Curricular Objectives
By the end of this session students are expected to:

Theory

1. **Outline the parts and regions of the upper limb**
2. **Comprehend the effect of upper limb specialized function on treatment decisions**
3. **Outline the general arrangement of the of the nerves supplying the upper limb**
4. **Summarize the arterial supply and venous drainage of the upper limb**
5. **Describe the bones of the upper limb and their main markings**
6. **List the joints of the upper limb and their types**
7. **Discuss the use of X-ray in diagnoses of various upper limb conditions**

Practical

1. **Distinguish the different parts and regions of the upper limb**
2. **Identify the bones of the upper limb and label their main markings**
3. **Identify the joints of the upper limb**
4. **Trace some of the main nerves and vessels of the upper limb**
5. **Label the upper limb bones and their main markings in an X- ray film**

Selected references and suggested resources

- Clinical Anatomy by Regions, Richard S. Snell, 10th edition
- Grant's Atlas of Anatomy, 13th Edition
- McMinn's Clinical Atlas of Human Anatomy, 7th Edition
- Anatomy for Babylon medical students (Facebook page)
- Anatomy for Babylon medical students (YouTube channel)
- Human Anatomy Education (Facebook page)
- Human anatomy education (YouTube channel)

Feedback and suggestions

- http://goo.gl/forms/SjyjGeUpvH

Session check list

- **Clinical highlights:**
  - Doctors commonly face limb injuries, fractures, dislocations. In addition they frequently need to examine the upper limb to assess peripheral pulses and measuring blood pressure.
  - Thorough knowledge on the anatomy of the upper limb and the gross features of the bones, their ossification time table and the vessels and nerves crossing nearby is essential.

- **Key landmarks:**
  - Clavicle
  - Scapula
  - Humerus
  - Radius
  - Ulna

❖ The upper limb

- The upper limb is characterized by its ability to grasp, strike, and conduct fine motor skills. It is made to perform complex movements and skilled activities that influence human creativity and ability to earn jobs and therefore any treatment plan should aim to restore its function
- It consists of four major segments:
  1- **Shoulder**: includes the pectoral, scapular, and axillary regions.
  2- **Arm** (L. brachium): It extends between the shoulder and the elbow
  3- **Forearm** (L. antebrachium): It extends between the elbow and wrist
  4- **Hand**: part of the upper limb distal to the forearm
- Bones of the upper limb are clavicle, scapula (forms the pectoral girdle), humerus (bone of the arm), radius and ulna (bones of the forearm), carpal bones, metacarpals and phalanges (bones of the hand)
- Joints of the upper limb include the sternoclavicular, acromioclavicular, shoulder, elbow, proximal and distal radioulnar, wrist, carpometacarpal, metacarpophalangeal and interphalangeal joints
- The five digits of the hand are numbered 1 to 5 from lateral (thumb) to medial (little finger)
- The brachial plexus (formed by ventral rami of C5 to C8 and T1 spinal nerves) supply the upper limb. There are five main branches from the brachial plexus, they are the axillary, musculocutaneous, median, ulnar, and radial nerves. Memorizing the course and regional supply of these nerves is of great value in clinical practice.
- The blood supply to the upper limb is derived from the subclavian artery which continues into the axilla as the axillary artery
- Venous blood of the upper limb is drained through superficial and deep veins interconnected with each other. The deep veins accompany the arteries back to the axilla.
- The lymphatics of the upper limb originate in the hand. The superficial and deep lymph vessels pass superiorly to the axilla where they drain into the axillary lymph nodes.

❖ **Clavicle** (long bone)

- Is the horizontal bone on the anterior aspect of the chest at the junction of the neck and trunk
- It is the only bony attachment between the trunk and upper limb
- It keeps the arm away from the trunk (act like a strut)
- It usually fractures at the junction between medial two thirds and lateral one third
- It is used as a surface landmark in many clinical procedures

❖ **Scapula** (flat bone)

- It is the large, flat, triangular bone on the back of the chest, extending from 2nd to 7th ribs
- Its medial (vertebral) border runs approximately 5 cm lateral to the spinous processes of the thoracic vertebrae. A fact to remember when auscultating the chest from the back
- A fibrocartilage ring (glenoid labrum) rims the margin of the glenoid cavity
- The scapula is capable of considerable movement on the thoracic wall at the physiological scapulothoracic joint.

- **Humerus** (long bone)
  - It is the bone of the arm and the longest and strongest bone of the upper limb
  - It is composed of three parts: upper end, shaft, and lower end
  - The proximal (upper) end is characterized by the head and the greater and lesser tubercles
  - The head ($1/3^{rd}$ of sphere) projects medially to articulate with the glenoid cavity of scapula to form the shoulder joint
  - The surgical neck is an important feature. The humerus commonly fractures at this site
  - The greater tubercle is the most lateral part of the proximal end of humerus
  - The lower end is expanded on both sides by the medial and lateral epicondyles

- **Radius** (long bone)
  - It is the lateral bone of the forearm
  - It consists of three parts: upper end, shaft, and lower end
  - Its upper end has a disc shaped head and a constricted neck below it
  - The shaft is convex laterally and has a sharp interosseous border medially
  - The lower end is the widest part of the bone and projects laterally

- **Ulna** (long bone)
  - The ulna is the medial bone of forearm and the one forming the elbow joint with the humerus
  - It consists of three parts: upper end, shaft, and lower end
  - Its upper end is hook-like with concavity of hook (trochlear notch) facing forwards
  - The head of the ulna is in its lower end (in contrast to the radius)

- **Carpal bones** (short bone)
  - There are eight carpal bones arranged in two rows: proximal and distal, 4 in each row
  - The proximal row share the formation of the wrist joint with the radius

- **Metacarpals and phalanges** (long bone)
  - There are five metacarpal bones. They are numbered one to five from lateral to medial
  - There are 14 phalanges in each hand: two in thumb and three in each finger
  - Each bone (metacarpal and phalanx) has three parts: base (proximal end), shaft, and head (distal end)

Note: Further details on individual bones will be covered with specific upper limb regions

- **Radiographic anatomy**
  - Traumatic injuries to upper limb can cause bone fracture and joint dislocation
  - Plain x-ray examination of the upper limb concentrates mainly on the bony structures
  - A fractured bone with no displacement can show a fracture line

Lab activity list

For each task below, identify the listed structures then answer the related questions

❖ Task 1 (parts and bones of the upper limb)

- ➢ Pectoral girdle (clavicle, scapula)
- ➢ Arm (humerus)/ Forearm (radius, ulna)
- ➢ Hand (carpal bones, metacarpal bones, phalanges)

❖ Task 2 (Clavicle)

- ✓ Sternal and acromial ends/ Shaft
- ✓ Sternoclavicular joint/ Acromioclavicular joint
- ✓ Superior and inferior surfaces
- ✓ Conoid tubercle
- ✓ Coracoclavicular ligament
- ☒ Look at the sternal and acromial ends and explain how you can differentiate them
- ⌖ The coracoclavicular ligament is attached to which structures?

❖ Task 3 (Scapula)

- ✓ Costal surface (Subscapular fossa)
- ✓ Dorsal surface (Spine, Supraspinous fossa, Infraspinous fossa)
- ✓ Medial border/ Lateral border/ Superior border (Scapular notch)/ Inferior angle
- ✓ Glenoid cavity/ Glenoid labrum
- ✓ Supraglenoid tubercle/ Infraglenoid tubercle
- ✓ Coracoid process/ Acromion process
- ☒ Which is larger, the supraspinous or infraspinous fossa?
- ☒ Describe the relation between the scapular notch and the coracoid process
- ⌖ The inferior angle lies opposite which rib?

❖ Task 4 (Humerus)

- ✓ Expanded upper end (head, anatomic neck, greater and lesser tuberosities, bicipital groove)
- ✓ Surgical neck
- ✓ Shaft (Spiral groove, deltoid tuberosity)
- ✓ Shoulder joint
- ☒ Compare the size of the head of the humerus and the glenoid cavity. Which is larger? And what makes the glenoid cavity deeper?

❖ Task 5 (Forearm bones)

- ✓ Radius: Head, neck, lower end, shaft, interosseous border
- ✓ Ulna: olecranon process, trochlear notch, shaft, head
- ✓ Joints: elbow, superior radioulnar joint, inferior radioulnar join
- ⌖ The head of the radius articulate with two bones, name them
- ⌖ Which of the above two bones is larger near the elbow?

❖ **Task 6 (Hand bones)**

- ✓ Carpal bones
- ✓ First – 5th metacarpals
- ✓ Proximal, middle, and distal phalanx
- ✓ Joints: Wrist joint, carpometacarpal joint, metacarpophalangeal joint, interphalangeal joint

Review questions:

1. The region between the arm and the forearm is called _____
2. The glenoid labrum of the scapula serves to _____, it is made of _____ cartilage
3. The bicipital groove is also named _____as it is located between _____
4. Which one of the five metacarpals is the shortest?
5. Name the joint forming the knuckles of the hand

Homework

A 25 years old man was using the ladder to change the broken light bulb when he suddenly lost balance and fell badly on the ground. He felt sever pain in his left shoulder and decided to seek medical help. X-Ray film showed radiolucent line crossing the region of the upper end of the humerus just below the greater and lesser tubercles. You and your colleague disputed over the significance of this line if it is fracture line or a growth plate.

A. Define the terms fracture line, growth plate
B. Why it is possible to misdiagnose a growth plate as a fracture line in an x-ray film?