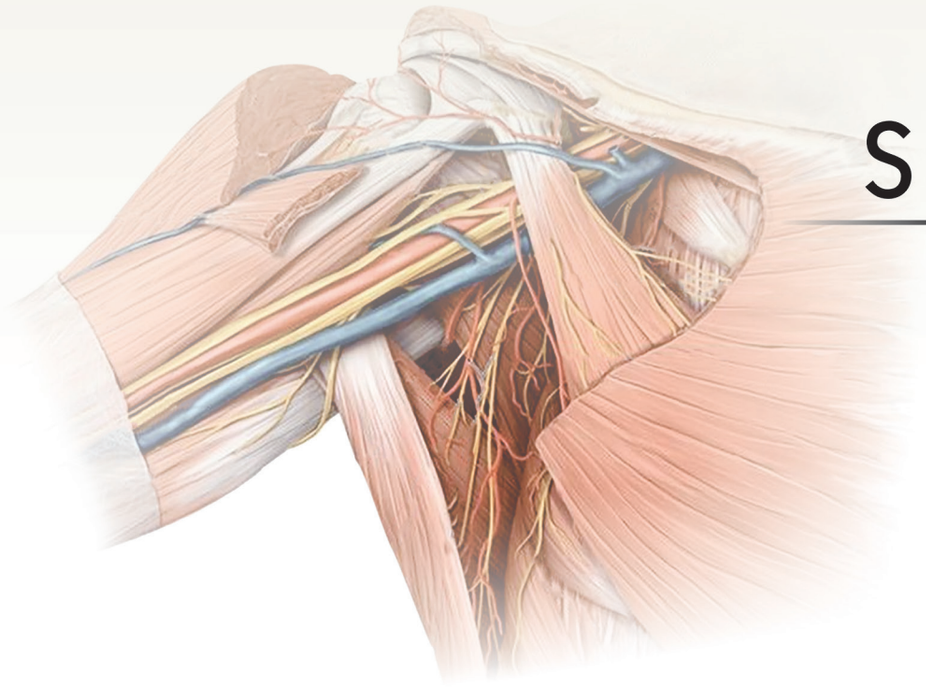
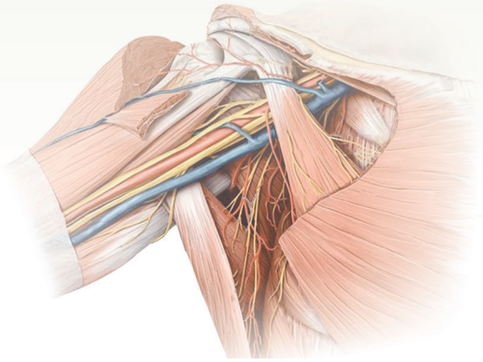


Section

1

Upper Limb



Chapter

1

Introduction

Knowledge of anatomy is essential to create a strong foundation for clinical expertise and patient care proficiency. Anatomy is about knowing the nomenclature of the human body structure and its functioning mechanism. Cadaveric dissection is a major attraction for all the students of medicine.

With the evolution of the erect posture in man, the function of weight-bearing was taken over by the lower limbs. Thus, the upper limbs, especially the hands, became free and gradually evolved with great manipulative skills. This has become possible because of a wide range of mobility at the shoulder. The whole upper limb works as a jointed lever. The human hand is a grasping tool. It is exquisitely adaptable to perform various complex functions under the control of a large area of the brain. The unique positions of humans as master mechanics of the animal world is because of the skilled movements of their hands.

PARTS OF THE UPPER LIMB

It has been seen that the upper limb is made up of four parts (Plate 1.1, Table 1.1):

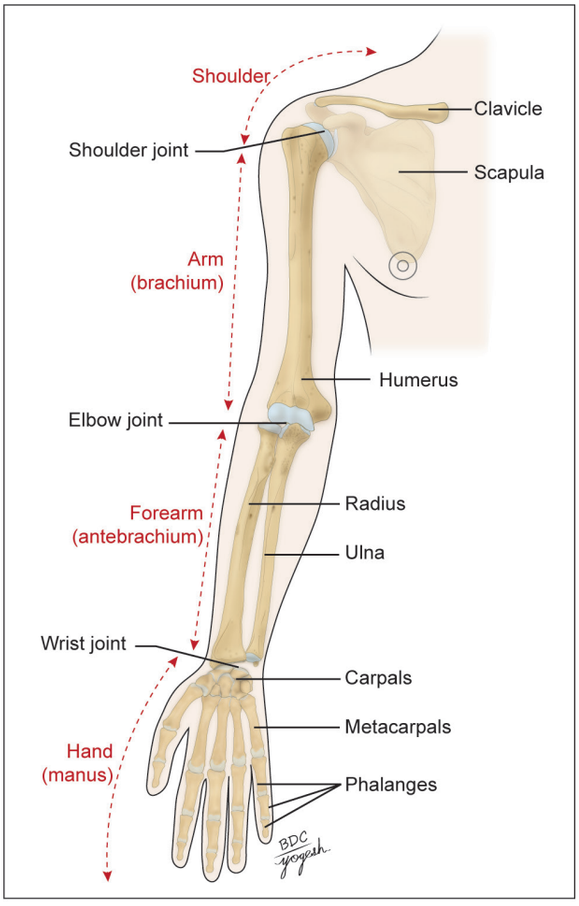
1. Shoulder region
2. Arm or brachium
3. Forearm or antebrachium
4. Hand or manus.

1. *Shoulder region*: It includes:

a. *Pectoral* or *breast region* on the front of the chest
b. *Axilla* or *armpit*
c. *Scapular region* on the back, comprising parts around the scapula
d. *Bones and joints*: The bones of the shoulder girdle are the *clavicle* and the *scapula*. Of these, only the clavicle articulates with the axial skeleton at the *sternoclavicular joint*. The scapula is mobile and is held in position by muscles. The clavicle and scapula articulate with each other at the *acromioclavicular joint*.

2. *Arm (upper arm or brachium)*: It extends from the shoulder to the elbow (cubitus). The bone of the arm is the *humerus*. Its upper end meets the scapula and forms the *shoulder joint*. The shoulder joint permits movements of the arm.

Plate 1.1: Parts and bones of upper limb



3. *Forearm (antebrachium)*: It extends from the elbow to the wrist. The bones of the forearm are the *radius* and *ulna*. At their upper ends, they meet the lower end of the humerus to form the *elbow joint*. Their lower ends meet the carpal bones to form the *wrist joint*. The radius and ulna meet each other at the *radioulnar joints*. The elbow joint permits movements of the forearm, namely *flexion* and *extension*. The radioulnar joints permit rotatory movements of the forearm called *pronation* and *supination*. In a mid-flexed elbow, the palm faces upwards in supination and downwards in pronation.

TABLE 1.1: Parts of the upper limb

Parts	*Subdivisions*	*Bones*	*Joints*
Shoulder region	a. Pectoral region b. Axilla or armpit c. Scapular region	Clavicle Scapula	Sternoclavicular joint Acromioclavicular joint
Upper arm (arm or brachium)	—	Humerus	Shoulder joint
Forearm (antebrachium)	—	Radius Ulna	Elbow joint Radioulnar joints
Hand	Wrist (carpus) Hand proper (metacarpus) 5 digits (lateral to medial): 1st – thumb or pollex 2nd – index or forefinger 3rd – middle finger 4th – ring finger 5th – little finger	8 carpal bones 5 metacarpal bones 14 phalanges: two for the thumb, and three for each of the four fingers	Wrist joint (radiocarpal joint) Intercarpal joints Carpometacarpal joints Intermetacarpal joints Metacarpophalangeal joints Proximal and distal interphalangeal joints

During the movement of pronation, the radius rotates around the ulna.

4. *Hand* (*manus*): It includes:

a. *Wrist* or carpus, supported by 8 carpal bones arranged in two rows.

b. *Hand proper* or metacarpus, supported by 5 metacarpal bones.

c. *Five digits* (thumb and four fingers). Each finger is supported by three phalanges, but the thumb has only 2 phalanges (in total 14 phalanges).

The *carpal bones* form the wrist joint with the radius, *intercarpal joints* with one another, and *carpometacarpal joints* with the metacarpals.

The phalanges form *metacarpophalangeal joints* with the metacarpals and *interphalangeal joints* with one another.

FUNCTIONAL ANATOMY OF UPPER LIMB

In human beings, the upper limb is highly evolved. The upper limb has its own peculiarities that make it different from the lower limb. Table 1.2 shows homologous parts of upper and lower limbs.

Peculiarities of the Upper Limb

- The skillful activities performed by human beings are due to the following peculiarities of the upper limb:
  1. Smaller and shorter upper limb than lower limb
  2. Freely moveable shoulder joint
  3. Long arm and forearm bones
  4. Presence of a carrying angle (angle between long axis of arm and forearm)
  5. Supination and pronation movements as adaptability to pick the food and eat using upper limb
  6. Arrangements of carpal bones in two rows
  7. Laterally placed thumb
  8. Separated long, slender digits
  9. Nail and nail bed protecting the terminal phalanx
  10. Grasping and skill movements of hand
  11. Opposition actions of thumb and little finger.

TABLE 1.2: Homologous parts of the limbs

Upper limb	*Lower limb*
Shoulder girdle	Hip girdle
Shoulder joint	Hip joint
Arm with humerus	Thigh with femur
Elbow joint	Knee joint
Forearm with radius and ulna	Leg with tibia and fibula
Wrist joint	Ankle joint
Hand with a. Carpus b. Metacarpus c. 5 digits	Foot with a. Tarsus b. Metatarsus c. 5 digits

Transmission of Force in Upper Limb

The weight transmission in upper limb occurs in the following manner (Flowchart 1.1, Plate 1.2):

Weight → hand → wrist joint → radius → interosseous membrane → ulna → elbow joint → humerus → shoulder joint → scapula → coracoclavicular ligament → clavicle → sternoclavicular joint and costoclavicular ligament → axial skeleton.

Flowchart 1.1: Lines of force transmission

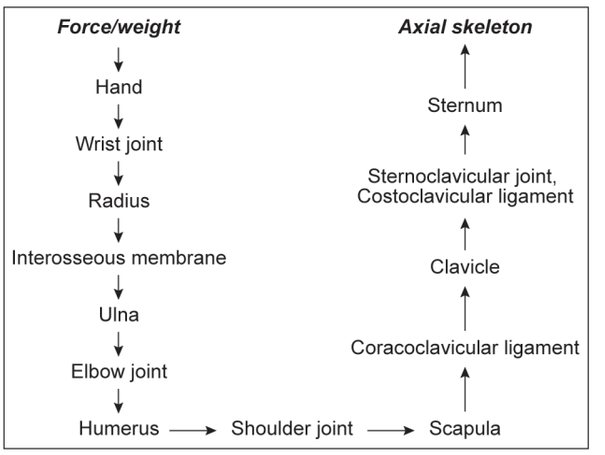
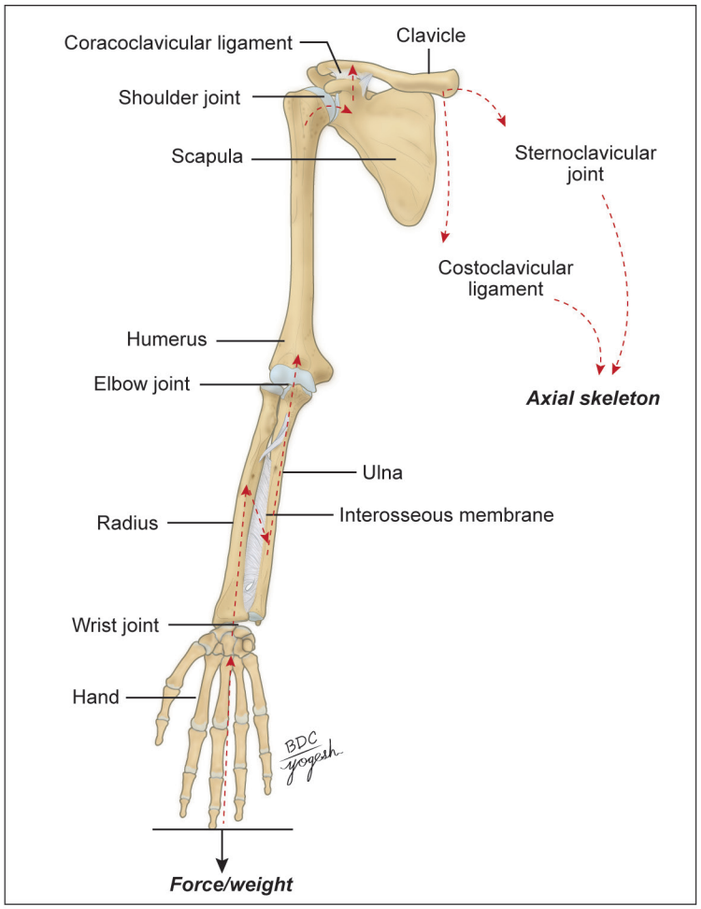


Plate 1.2: Line of force transmission in the upper limb



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