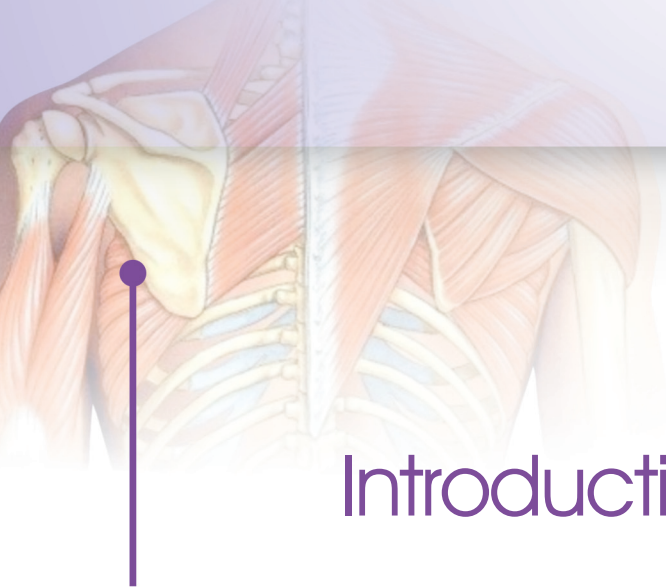




Introduction to Upper Limb

INTRODUCTION

- Learning anatomy is essential to create a base for clinical exposure and patient care. Anatomy is nothing but the alphabets (ABC) or nomenclature of the human body and its functioning mechanism. Here, a lot of new terminologies and names need to be learnt.
- Cadaveric dissection is a major attraction of all the students of medicine.
- Anatomy is having various small essential facts that form a building of knowledge.
- The best way to learn anatomy is

Read the subject



Dissect and observe the cadaver

- More you dissect and observe the cadaver, more easily you understand and remember the anatomy.
- Human anatomy is divided into the following sections for learning purposes:
 1. Upper limb
 2. Lower limb
 3. Thoracic region
 4. Abdomen and pelvis
 5. Head, neck, and face
 6. Brain
- This book deals with the Anatomy of Upper Limb.

Parts of Upper Limb

- The upper limb consists of four parts (Fig. 1.1):
 1. Shoulder
 2. Arm or brachium
 3. Forearm or antebrachium
 4. Hand or manus

Shoulder region

- It includes
 - Pectoral region
 - Axilla

- Scapular region
- Shoulder girdle (pectoral girdle): It consists of two bones: Clavicle and scapula.

Arm (brachium)

- *Extent:* It extends from shoulder to the elbow.
- *Bones:* Humerus.

Forearm (antebrachium)

- *Extent:* It extends from elbow to the wrist.
- *Bones:* Radius and ulna.

Hand (manus)

- It includes
 - *Wrist:* It is formed by 8 carpal bones that are arranged in two rows.
 - *Hand proper:* It consists of 5 metacarpals.
 - *Digits:* There are 5 digits from lateral to medial: Thumb, index finger, middle finger, ring finger, and little finger. Each finger is supported by three phalanges, except thumb that has two phalanges.

Bones of Upper Limb

- Each upper limb consists of 32 bones as follows (Fig. 1.1):

Pectoral girdle	
Scapula	1 bone
Clavicle	1 bone
Bone of arm	
Humerus	1 bone
Bones of forearm	
Radius	1 bone
Ulna	1 bone
Carpals	8 bones
Metacarpals	5 bones
Phalanges	14 bones

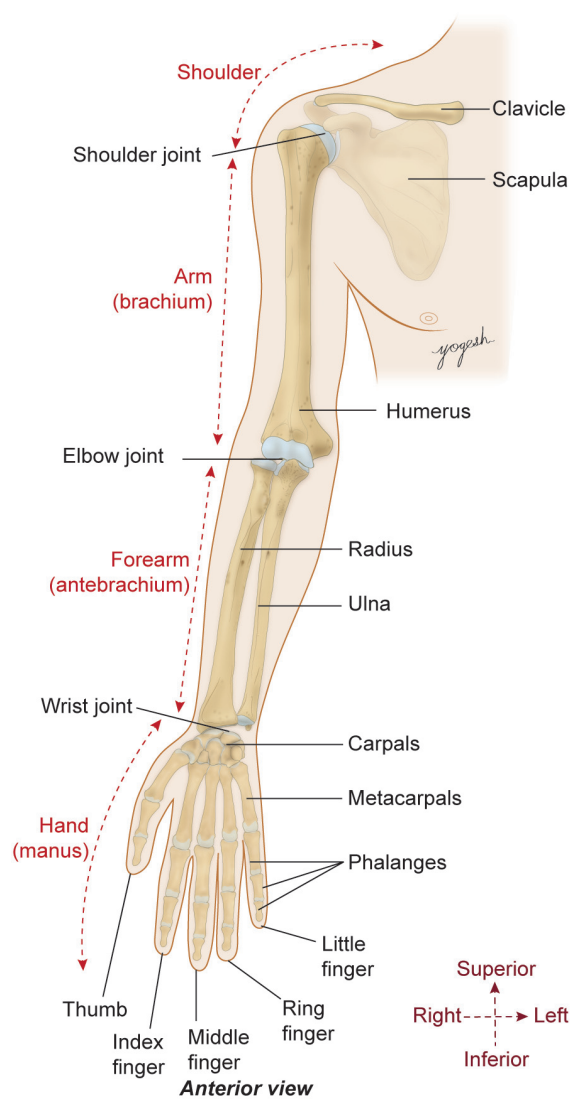


Fig. 1.1: Parts and bones of upper limb (right, anterior view)

Joints of Upper Limb

- The bones of upper limb form the following joints:
 1. Sternoclavicular joint
 2. Acromioclavicular joint
 3. Shoulder joint
 4. Elbow joint
 5. Radioulnar joints (superior, middle, and inferior)
 6. Wrist joint
 7. Intercarpal joints
 8. Carpometacarpal joints
 9. Metacarpophalangeal joints
 10. Interphalangeal joints (proximal and distal)
- Learner should keep in mind that these joints are present in his/her own body. Hence, it is advised to perform the movements of these joints to understand their functional anatomy. *Practical guide*

Muscles of Upper Limb

- Muscles of the upper limb include:
 - Muscles attached to pectoral girdle
 - Muscles of arm, forearm, and palm

- Arm and forearm are divided into anterior and posterior muscular compartments.
- Hand is divided into palm and dorsum.

Vessels of Upper Limb

Arteries of upper limb

- Major arteries of upper limb include:
 - Axillary artery
 - Brachial artery
 - Radial artery
 - Ulnar artery
- In the palm, arterial network form superficial and deep palmar arches.

Veins of upper limb

- Veins of upper limb are grouped as
 - Superficial veins*
These include dorsal venous arch, cephalic vein, basilic vein, and median cubital vein.
 - Deep veins*
These include
 - Venae comitantes of major arteries of upper limb
 - Brachial vein
 - Axillary vein
- Superficial veins are commonly used for intravenous injections.

Innervation (Nerve Supply) of Upper Limb

- Upper limb is supplied by a nerve plexus called *brachial plexus*.
- Major nerves of upper limb include
 - Axillary nerve
 - Musculocutaneous nerve
 - Ulnar nerve
 - Median nerve
 - Radial nerve

FUNCTIONAL ANATOMY OF UPPER LIMB

- In human beings, the upper limb is highly evolved.
- Upper limb has its own peculiarities that make it different from the lower limb.

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 to 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

Homologous Parts of Upper and Lower Limbs

- Developmentally the limbs are derived from limb buds, but due to rotation and functional differences both the limbs are different from each other.
- Still upper and lower limbs show homologous parts (Table 1.1).

Table 1.1: Homologous parts of upper and lower limbs

	Upper limb	Lower limb
Girdle	Pectoral girdle	Pelvic girdle
Parts	Arm Forearm Hand Fingers	Thigh Leg Foot Toes
Bones	Humerus Radius Ulna Carpals	Femur Tibia Fibula Tarsals
Joints	Shoulder joint Elbow joint	Hip joint Knee joint
1st digit	Thumb (on lateral side)	Great toe (on medial side)

Transmission of Force in Upper Limb

- The weight transmission in upper limb occurs in the following manner (Fig. 1.2, Flowchart 1.1)
Weight → hand → wrist joint → radius → interosseous membrane → ulna → elbow joint → humerus → shoulder joint → scapula → coracoclavicular ligament → clavicle → sternoclavicular joint and costoclavicular ligament → axial skeleton.

ARE YOU READY FOR DISSECTION?

- Dissection is the most important part to understand the anatomy. It gives experience of exploring the structure of human body and relationship of various parts with other.

Instructions for the Dissection

- **Health and safety rules**
 - Always put on your laboratory coat before entering the dissection hall.
 - Never eat or drink in the dissection hall.
 - Cut your nails, and tie your hair properly.
 - Wash hands with soap after each dissection.

All above instructions will help to keep you healthy and away from infections.
- **Cadaver and specimen handling instructions**
 - **Ethics:** Respect the cadaver as it is the most useful material for learning medical sciences.
 - Preservation of cadaver

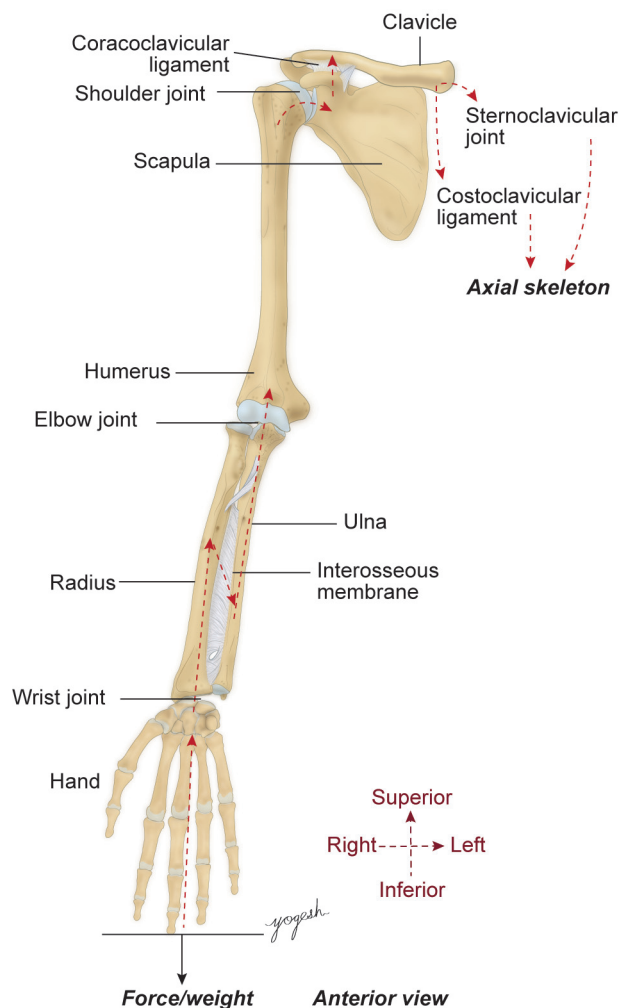
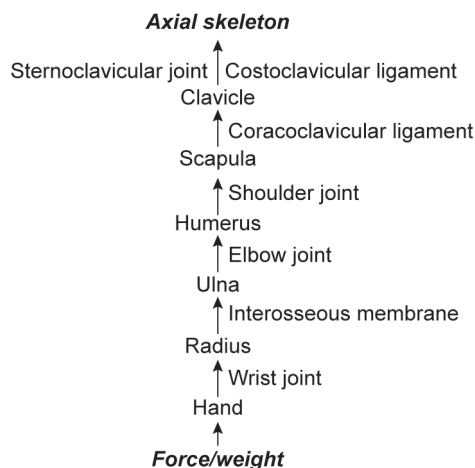


Fig. 1.2: Transmission of force or weight in the upper limb (right, anterior view, red dotted lines are indicative of direction of weight transmission)

Flowchart 1.1: Transmission of force or weight in the upper limb



Cadavers are preserved using formalin and glycerol along with other chemicals.

Formalin causes discoloration (darkening) of the skin. Formalin hardens the body parts, hence passive movements of body parts become difficult and require more pressure to cut the body parts than that in living state. *Practical guide*

- **Preservation of dissected parts**

As the dissected parts become dry due to exposure to the atmosphere, hence it is advised

- To keep it covered with dissected skin on completion of the dissection.
- To moisturize the dissected part with water or glycerin.
- To cover the dissected part with wet cloth or cotton.

Always preserve the dissected structures so that others can use it for further study.

- **First aid and emergency**

- Any accident during dissection should be immediately reported to the concerned in charge or teacher.
- If feeling giddiness, glucose solution can be taken on advice of the in charge or teacher.
- Videography and photography should be done only with a permission from the concerned teacher.

Instruments Required for the Dissection

- A set of instruments are required for routine dissection that includes
 - Scalpel
 - Forceps
 - Scissors
 - Hand lens and so on.

Scalpel

- It has two components (Fig. 1.3, 1.4):
 1. Scalpel handle (Number 4)
 2. Scalpel blade (Number 24 or 23)
- Fit the blade carefully to the handle. Some scalpels have in-built blades.

Use

- It is used to cut the skin.
- It is used to cut the connective tissue, fascia, muscles, vessels, nerves, and other structures as and when required.

Care

- Use clean and new blade everytime as formalin (used for cadaver preservation) causes rusting of scalpel blades.
- The method to hold the scalpel is shown in Fig. 1.4.

Forceps

- For dissection, use forceps of 6 inches length (Fig. 1.5). With short length forceps such as 4 inches, handling of hard cadaveric tissue will be difficult.

Use

- To hold, lift, or retract the structures.
- Also useful for blunt dissection.

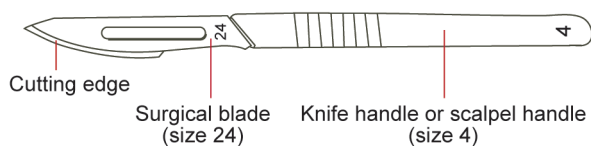
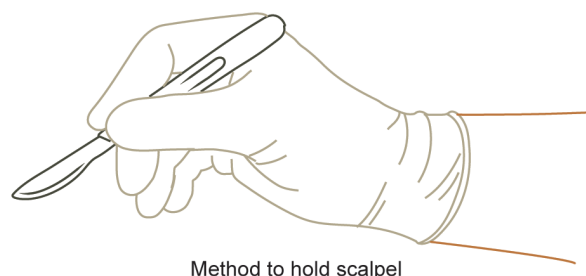
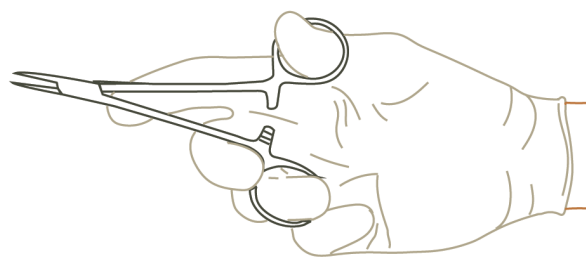


Fig. 1.3: Surgical knife (scalpel)



Method to hold scalpel



Method to hold needle holder, artery forceps, and scissors

Fig. 1.4: Instrument handling

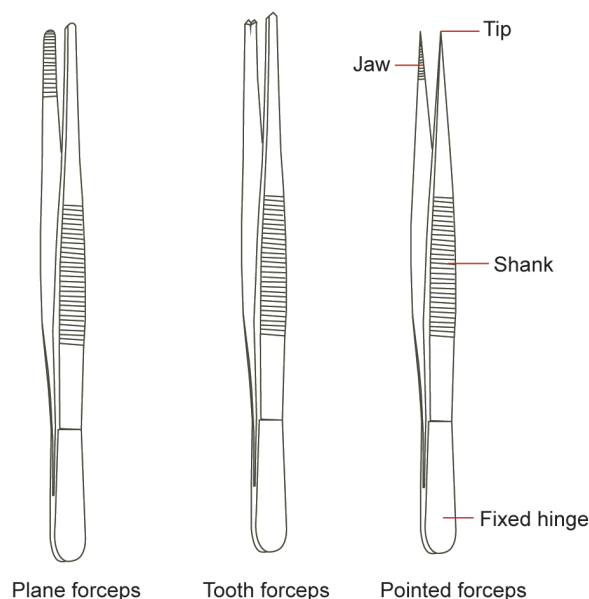


Fig. 1.5: Plane, tooth, and pointed forceps

- **Plane forceps**
Use: To hold the delicate structures such as vessels, nerves, and muscles.
- **Tooth forceps**
Use: To hold the skin and hard structures.
- **Pointed forceps**
Use: To show the dissected structures during discussion and for fine dissection or to hold thin nerves.

Scissors

- Use: To cut the tissue such as fascia, ligaments, tendons, and so on.
- There are two types of scissors commonly used for dissection (Fig. 1.6):
 1. **Straight scissors:** Use: For blunt dissection.
 2. **Curved scissors:** Use: For delicate dissection and cutting less accessible structure and also for trimming the tissue and cutting the fascia.

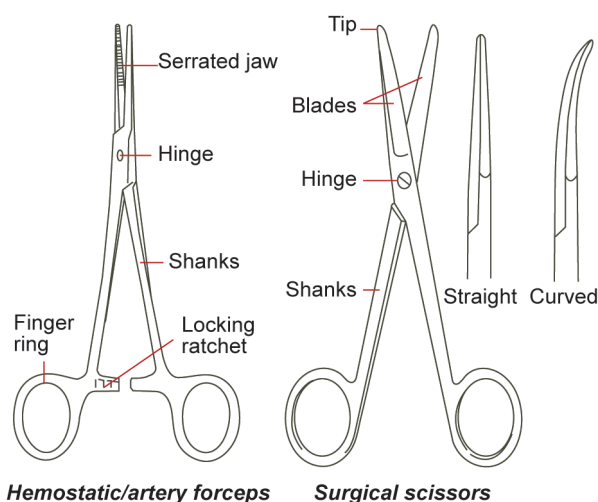


Fig. 1.6: Hemostatic forceps and surgical scissors

Artery forceps or hemostatic forceps

- It has catch or ratchet that helps in catching, clamping, and crushing the tissue.
- *Use:* For strong grasping, holding, and catching the structures. For example, to hold and reflect the skin.
- Do not use it for holding the delicate structures as it crushes the structure.

Other instruments

- For specific purpose, other instruments are required. These are as follows:
 1. *Saw:* To cut the bone. To take the section of body part.
 2. *Bone cutter or bone nibbler:* To cut the bone into small pieces (Fig. 1.7).
 3. *Chisel and hammer:* To cut the strong bones (Fig. 1.7).
 4. *Hammer:* To hit the chisel for cutting the bones.
 5. *Brain knife:* To take the section of brain.

Structures Encountered in Dissection

Q. How to differentiate artery, vein and nerve in cadaver?^{Viva}

The following structures are encountered during the dissection:

Skin

- It is harder and darker in cadaver than the living state due to the action of formalin.

Superficial fascia

- It contains various amount of fat (yellowish), superficial veins, and loose connective tissue (whitish).
- Blunt bisection is required to remove superficial fascia.

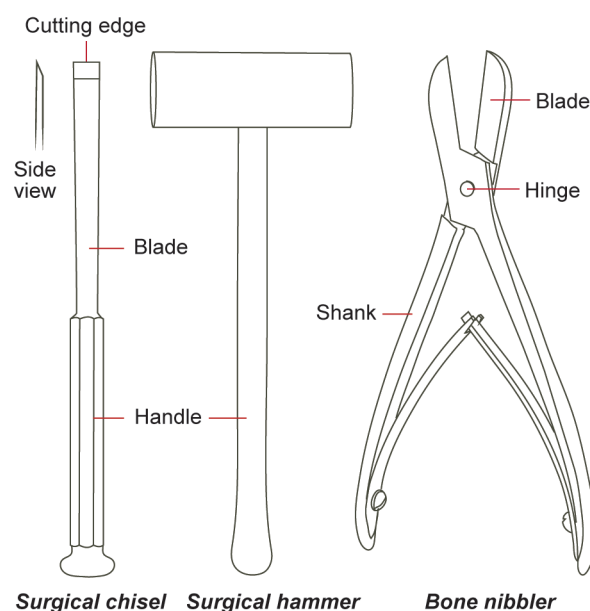


Fig. 1.7: Surgical chisel, surgical hammer, and bone nibbler

Deep fascia

- It is the tough sheet of connective tissue (whitish) that encloses deeper structures.

Muscles

- They have muscle fibers (brown in color) and tendons (white in color). Some muscles do not have long slender tendons.

Arteries

- They are thick walled than veins.^{Viva}
- They have circular lumen (can be felt by rolling between fingers).^{Viva}
- In cadaver, arteries are empty (do not have clotted blood). Due to their thick wall and empty lumen, they look white in color.^{Viva}

Veins

- They are thin walled than arteries.^{Viva}
- They have irregular lumen.^{Viva}
- They mostly contain blood in their lumen.
- Deep veins usually follow major arteries.

Nerves

- They are pale-looking cord-like structures.
- They can be differentiated from arteries by rolling in fingers. (Arteries have lumen, nerves do not have.)^{Viva}

Other structures

- Other structures include bones, ligaments, bursae, joints, lymph nodes, organs (lung, heart, liver, and so on).