brothers.com, for detailed information on anatomy books, visit our website www.jaypeebrothers.com, for detailed information on anatomy boo



Anatomy at a Glance

An Exam-Oriented Text

As per the Competency-based Medical Education Curriculum (NMC)

3rd Edition



Sibani Mazumdar

Scan to Download the App

diginerve
A Jaypee Initiative
Your Guide at Every Step
Video Lectures | Notes | Self-Assessment

Forewords
Subodh Kumar Bhattacharya
Rahul Majumder

JAYPEE

Contents

CHAPTER 1: Introduction 1

- Definition of Anatomy 1
- Positioning 1
- Anatomical Terms 2
- Anatomical Planes 3
- Terminology Used in Description of Bones 3
- Terms Used of Hollow Organ 4
- Regional Terms for Specific Body Areas 4
- Terms used in Movement of Synovial Joint 5

CHAPTER 2: General Anatomy 6

- Skeletal System 6
- Cartilages 6
- Bones 7
- Joints 11
- Must Know Factor of Joint 14
- Muscular System 14
- Nervous System 18
- Autonomic Nervous System 20
- Arterial System 21
- Venous System 23
- Lymphatic System 24

CHAPTER 3: Upper Limb 26

- Bones of Superior Extremity 26
- Articulated Skeleton of Hand 31
- Superficial Venous Drainage of Upper Limb/Superior Extremity 32
- Deep Veins of Upper Limb 33
- Nerves of the Upper Limb 33
- Arterial Blood Supply of Upper Limb 38
- Regions of Upper Limb 40
- Front Clavipectoral Fascia 40
- Axilla 42
- Cubital Fossa 44
- Front of ARM 46
- Front of Forearm 48
- Palm 50
- Intrinsic Muscles of Hand 52

- Back 53
- Back of ARM 54
- Back of Forearm and Dorsum of Hand 54
- Joints of Upper Limb 58
- Breast 64
- Surface Anatomy of Upper Limb 66
- Radiology 68
- X-Ray Plates/Views of Upper Limb 69
- Ossification of Upper limb bones 71

CHAPTER 4: Lower Limb 73

- Bones of lower limb 73
- Articulated Skeleton of Foot 82
- Venous Drainage of Inferior Extremity 83
- Superficial Venous Drainage of Lower Limb 84
- Nerves of the Lower Limb 85
- Lymphatic Drainage of Lower Limb 89
- Arteries of Lower Limb 90
- Regions of Lower Limb 92
- Regions of Lower Limb (Front) 92
- Lower Limb (Back) 100
- Joints of Lower Limb 108
- Radiology of Lower Limb 115
- Questions Commonly Asked in the Oral Examination 117
- Surface Marking of Lower Limb 118
- Questions Commonly Asked in the Oral Examination 119
- Lower Limb Summary 120

CHAPTER 5: Abdomen 121

- Osteology (Bones) 121
- Types of Pelvis 124
- Vertebral Column 124
- Umbilicus or Omphalos 125
- Muscles of Abdomen 126
- Inguinal Canal 128
- Hesselbach's Triangle 129
- Rectus Sheath 129
- Peritoneum and its Cavity 130
- Position of Abdominal Viscera in Relation to Regions of Abdomen 133
- Incisions of Anterior Abdominal Wall 133
- Structures of Posterior Abdominal Wall 134
- Veins and Arteries of Abdomen 135
- GI Tract 138
- Esophagus and Stomach 138
- Small Intestine 141
- Abdominal Organs 143
- Large Intestine 148
- Urinary System 151

- Male Urethra 156
- Female Urethra 156
- Female Reproductive System 157
- Male Reproductive System 160
- Perineum 163
- Pelvic Floor Muscles 165
- Pelvic Fascia 166
- Pelvic Cellular Tissue 166
- Radiology 166
- Hysterosalpingography 169
- Questions Asked in Radiology 169
- Surface Marking 169
- Questions Asked in Surface Marking 171

CHAPTER 6: Thorax 173

- Bones of the Thorax 173
- Respiratory Movements with its Mechanism 176
- Intercostal Space 178
- Arteries of Thorax 180
- Veins of Thorax 181
- Autonomic Nervous System and its Thoracic Parts 182
- Thoracic Duct 185
- Pleural Cavities 185
- Mediastinum 186
- Pericardial Cavity 187
- Trachea 188
- Lungs 188
- Heart 192
- Artery Supply to Heart 195
- Venous Drainage of Heart 196
- Conducting System of Heart 196
- Fallot's Tetralogy 197
- Radiology 197
- Questions Asked in Radiology 198
- Surface Marking 199
- Questions Asked in Surface Marking 200

CHAPTER 7: Head, Neck and Neuroanatomy 202

- Skull as a Whole 202
- Bones of Skull 203
- Mandible 208
- Maxilla 210
- Hyoid Bone 211
- Important Landmarks in Cranium 212
- Foramina at the Base of Skull and Their Contents 212
- Important Points/Peculiarities About Skull Bones 214
- External Surface of Base of Skull 214
- Bony Orbit 214
- Important Spongy Bone of Skull 215

- Cervical Vertebrae 216
- Vertebral Column, as a Whole 218
- Joints of Head and Neck 219
- Arteries of Head and Neck 221
- Veins of Head and Neck 223
- Cranial Dural Venous Sinuses 224
- Cervical Plexus and its Branches 225
- Lymph Nodes of Head and Neck 226
- Scalp 226
- Dissection of Face 227
- Neck 231
- Triangles of Neck 232
- Viscera of Head and Neck 238
- Ear 250
- Brain 252
- Cerebral Hemispheres 255
- Ventricles of Brain 266
- Eyeball 274
- Lacrimal Apparatus 277
- Cranial Nerves 278
- Important Cranial Nerves 284
- Parasympathetic Ganglia of Head and Neck 287
- Radiology 287
- Surface Marking 288

CHAPTER 8: Histology 291

- Parts of Binocular Light Microscope 291
- Electron Microscope 291
- Cell 291
- Cell Cycle 293
- Types of Tissue 294
- Epithelial Tissue 294
- Connective Tissue 296
- Muscle Tissue 298
- Sclerous Tissue 299
- Blood Vascular System 301
- Systemic Histology 301
- Clinical Anatomy of GI Tract 310
- Glands of GI Tract 311

CHAPTER 9: Embryology 312

- Stages of General Embryology 312
- Different Types of Placenta 315
- Clinical Anatomy 315
- Short Note on General Embryology 315
- Development of Heart 320
- Development of Respiratory System 323
- Development of Alimentary System 324

- Development of Face 324
- Development of Palate 325
- Branchial (Pharyngeal) Arches and its Derivatives 325
- Derivatives of Pharyngeal Pouches 326
- Development of Tongue 326
- Development of Individual Organ in Short 327
- Development of Placenta at a Glance 332
- Oogenesis at a Glance 332
- Spermatogenesis at a Glance 332
- Nomenclature Used in Embryology 333

CHAPTER 10: Genetics 334

- Chromosome 334
- Turner Syndrome 336
- Superfemale 336
- Klinefelter Syndrome 336
- Barr Body 336
- Allelic Gene 337
- Abnormalities of Human Chromosome 337
- Genetic Counseling 338
- Prenatal Diagnosis 338
- Terms Used in Genetics 339
- Questions 339

Appendix 341

Glossary 343

Index 347

CHAPTER 3

Upper Limb

INTRODUCTION

Early animal is unicellular amoeba. But gradually there is development of multicellular organism. In case of mammals they possess 4 limbs—two hind and two fore limbs for locomotion only. Gradually the upper limb is free for prehension purpose and lower limb is solely adopted for locomotion. So lower limb has more stable joint. But upper limb is mainly meant for doing precise movement and range of movement is more. So it is unstable. The upper limb is an extension of the upper part of trunk and is specialized to grasp, and produce fine movements. It helps the individual to hold and carry things and perform intricate movement.

BONES OF SUPERIOR EXTREMITY (UPPER LIMB)

The skeleton of upper limb comprises of clavicle scapula, humerus, two forearm bones radius and ulna, articulated skeleton of hand.

Names (AN8.1 to AN8.6)	*Comments*	*Important features*	*Anatomical positions*
Clavicle (Collar bone) **(Figs. 3.1A and B)**	Modified long bone; horizontally placed, shape like 'f'. Clavicle is palpable along its whole length. First bone to ossify in the body. Due to its presence arm can swing clearly away from the trunk. It has two ends and an intervening portion known as shaft.	**Two ends:** 1. **Sternal**: Quadrangular 2. **Acromial**: Flat **Shaft:** 1. Medial 2/3rd (convex in front) has 4 surfaces: a. **Anterior surface**: Gives origin of clavicular head of **pectoralis major**. b. **Posterior surface**: Origin of **sternohyoid**. c. **Superior surface**: Near sternal end **sternocleidomastoid, arises**. d. **Inferior surface**: - A rough area medially gives attachment to costoclavicular ligament. - A subclavian groove laterally gives attachment to **clavipectoral fascia** (in anterior and posterior margins) near the insertion of **subclavius** muscle. 2. Lateral 1/3rd (concave in front) has: a. **Two borders**: i. Anterior: Concave, gives attachment of **deltoid**. ii. Posterior: Rough, convex, and gives attachment of **trapezius**. b. **Two surfaces**: i. Superior, subcutaneous (palpable). ii. Inferior, present conoid tubercle and trapezoid ridge. Conoid tubercle gives attachment to conoid part and trapezoid ridge gives attachment to trapezoid part of coracoclavicular ligament. It helps in transmission of weight to axial skeleton	◆ Place convex medial 2/3rd of clavicle in front. Subclavian groove on inferior surface. ◆ Sternal end lies more in anterior plane.
Scapula (shoulder blade) **(Fig. 3.2)**	It is a flat triangular bone; lies in back opposite second to seventh rib. It has a head or glenoid (lateral angle). Constricted neck and body. 17 muscles are attached to scapula.	Body of scapula presents (two surfaces): a. **Ventral:** Hollowed out and **subscapularis** is originated b. **Dorsal:** Marked by projected **spine** which divides the surface into two fossae: i. Supraspinous: **Supraspinatus** is attached ii. Infraspinous: **Infraspinatus** is attached	◆ Place superior border with suprascapular notch above. ◆ Spine is on dorsal surface.

Contd...

JAYPEE BROTHERS

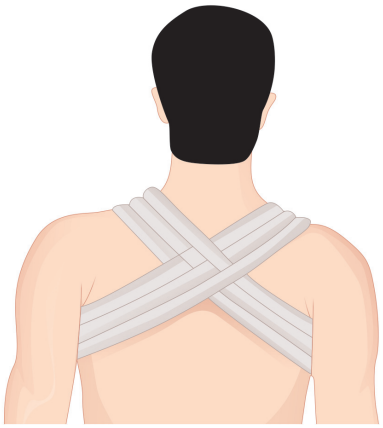


FIGURE 3.1A: 8 bandage in fracture clavicle.

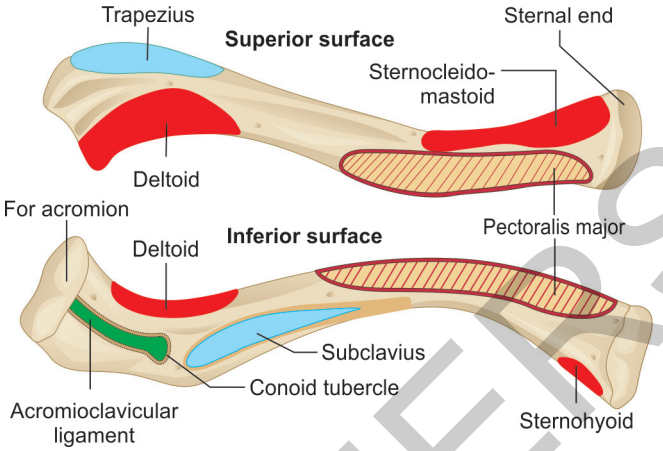


FIGURE 3.1B: Clavicle.

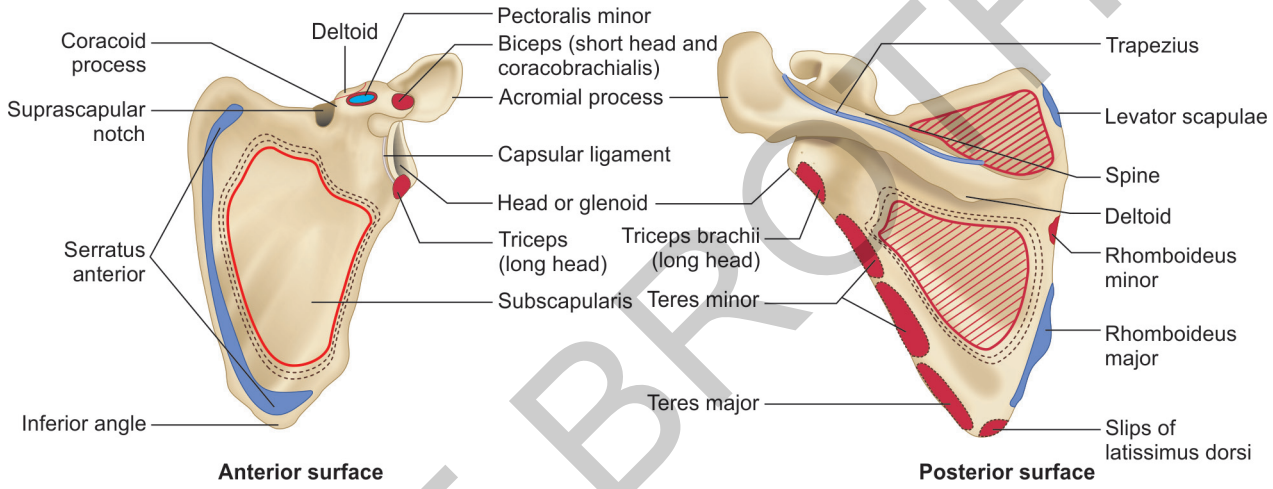


FIGURE 3.2: Scapula.

Contd...

Names (AN8.1 to AN8.6)	***Comments***	***Important features***	***Anatomical positions***
	Palpable portion of scapula are spine, acromion, tip of coracoid process, inferior angle and much of medial border of scapula. Joints contributed by the scapula; i. Glenohumeral joint ii. Acromioclavicular, and iii. Scapulothoracic joint	Three borders: a. **Superior:** Shortest; marked medially by suprascapular notch. Notch is bridged by suprascapular ligament. b. **Medial or vertebral:** Longest in the: i. **Ventral aspect:** It gives attachment to **serratus anterior** throughout its whole length. ii. **Dorsal aspect:** From above downwards: gives attachment to **levator scapulae, rhomboideus minor** and **major**. c. **Lateral or axillary:** Thickest border in the: i. **Ventral aspect:** It gives attachment of subscapularis. ii. **Dorsal aspect:** From above downwards: Teres minor and major are attached. There is a gap between origins of teres minor for the passage of circumflex scapular vessels. Three angles: a. **Superior:** Meeting of superior and medial borders—covered by muscle. It lies over 2nd ribs and is wider than inferior angle. b. **Inferior angle:** Meeting of lateral and medial borders—it lies over seventh rib. c. **Lateral angle or glenoid:** Provide a shallow-socket for head of humerus—forming	◆ Tip of the coracoid process directed forward and slightly laterally. ◆ Glenoid looks laterally and upwards.

Contd...

JAYPEE BROTHERS

Contd...

Names (AN8.1 to AN8.6)	*Comments*	*Important features*	*Anatomical positions*
		glenohumeral or shoulder joint—which is synovial, ball and socket joint. The capsule of shoulder joint are attached at the margin of the glenoid. In the upper part it will include the supraglenoid tubercle and in the lower part the capsule excludes the infraglenoid tubercle. Three processes: a. **Spinous process:** Dorsal border or crest of spine—**deltoid** is originated at lower lip, **trapezius** is inserted at upper lip. b. **Coracoid process:** It is an example of atavistic type of epiphysis—it gives attachment of **pectoralis minor, short head of biceps, coracobrachialis muscle** and coracoclavicular ligament. c. **Acromial process:** Projecting forwards from spine. It has a medial and lateral border and upper and lower surfaces. Acromian angle is the junction of lateral border of acromian and inferior border of crest of spine. Acromian process gives attachment of deltoid in its lateral border and medial border gives attachment of **trapezius**.	
Humerus (arm bone) **(Figs. 3.3A to C)**	Longest and largest bone of upper limb. In the upper part of humerus all the muscles from scapula and trunk are inserted. From the lower end all the muscles of forearm arises. It forms shoulder joint with scapula and elbow joint with upper end of radius and ulna.	It has **upper end**, **lower end** and **shaft**. **Upper end presents** *Head:* Globular, articular, forms shoulder joint. It is directed upwards, medially, and slightly backwards. *Neck-anatomical:* Constriction adjoining head, capsular ligament is attached here except in its medial aspect (where it dips down 1 cm) and the line of attachment of capsule is interrupted at intertubercular sulcus. *Morphological:* Junction between epiphysis and diaphysis (epiphyseal line). In adult its position is above the surgical neck. *Surgical:* It is the most constricted portion, in the upper part of shaft and is vulnerable to trauma. This part is related to axillary nerve. *Tubercles:* Greater–lies in lateral part; covered by deltoid, produces rounded contour of shoulder. There are three impressions for insertion of **supraspinatus, infraspinatus and teres minor** muscles. *Lesser:* Separated from greater tubercle by bicipital groove. It gives insertion to **subscapularis**. **Shaft has** Three borders—Anterior, medial and lateral. Lower part of lateral and medial border is prominent and known as lateral and medial supracondylar line (ridge).	◆ Place globular head above. ◆ Place bicipital groove coronoid and radial fossa in front. ◆ Place greater tubercle on laterally aspect.

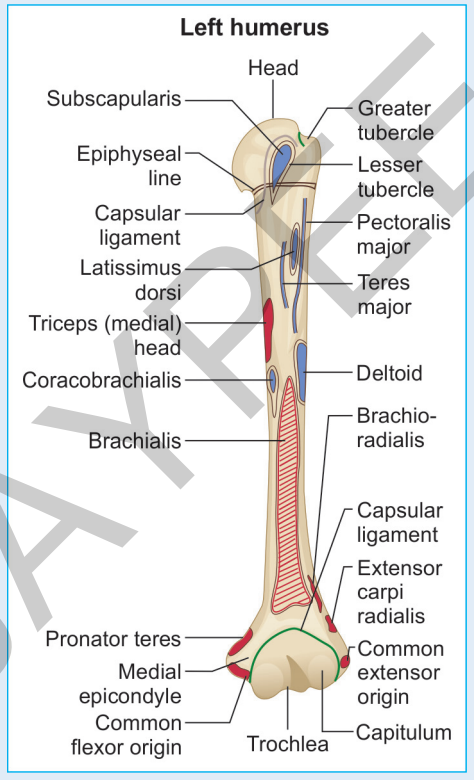


FIGURE 3.3A: Humerus (anterior aspect).

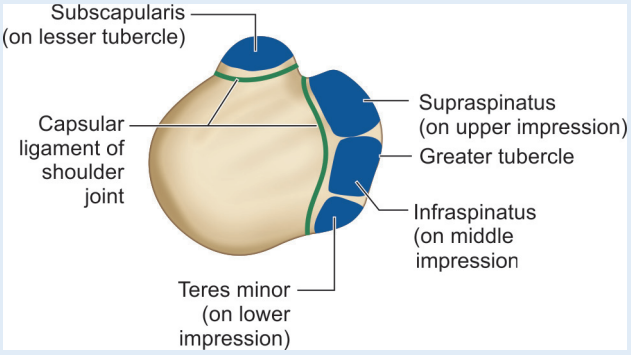
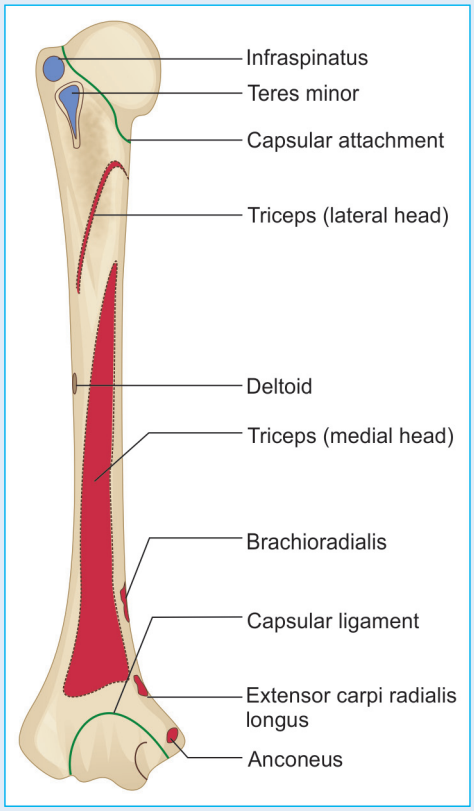


FIGURE 3.3B: Upper end of right humerus showing attachments seen from above.

Contd...

JAYPEE BROTHERS

Contd...

Names (AN8.1 to AN8.6)	*Comments*	*Important features*	*Anatomical positions*
 **FIGURE 3.3C:** Humerus (posterior aspect).		Three surfaces: a. Anteromedial surface: Marked by bicipital groove. It presents two lips: i. **Pectoralis major** is inserted in lateral lip ii. **Teres major** is inserted at medial lip. In its floor lies latissimus dorsi. b. Anterolateral surface: Marked in the middle, rough-muscle impression known as deltoid tuberosity. **Deltoid muscle** is inserted. Below the insertion of deltoid the anteromedial and anterolateral surface of shaft of humerus gives origin to brachialis. c. Posterior surface: In the middle-third. There is shallow spiral groove (lodges radial nerve and arteria profunda brachii). Lower 1/3rd surface is flat, gives origin to **medial head of triceps**. Linear origin of **lateral head of triceps lies above the spiral** groove. **Lower end presents** 1. Articular part: Pulley-shaped articular surface medially (trochlea), rounded articular surface laterally (capitulum). Capitulum means little head. 2. Nonarticular part: It consists of coronoid fossa, radial fossa in front and olecranon fossa behind. Coronoid fossa accommodates the coronoid process of ulna when elbow is flexed. The olecranon fossa accommodates the olecranon process of ulna when elbow is extended. Capsular ligament of elbow joint attached at the margin of articular area and it includes three fossae. i. Medial epicondyle gives common origin to **flexor muscle from** its anterior part. ii. Ulnar nerve lies behind the medial epicondyle. iii. Lateral epicondyle gives origin of **common extensor** from anterior aspect.	
Radius **(Figs. 3.4A and B)**	Lateral bone of forearm. It has upper end, shaft and lower end. Forms elbow joint, wrist joint, superior, middle, and inferior radioulnar joint. It crosses the ulna during pronation.	**Upper end consists of:** Head: Cup-shaped upper surface forms joint with capitulum of humerus—forms part of elbow joint. Neck: Constricted part below head. Tuberosity: Rough projection below and medial side of neck—it gives insertion to biceps brachii muscle in its rough part. **Shaft** has three borders: a. Anterior border: It starts from below the anterior margin of radial tuberosity and end to the styloid process of radius. Upper part form anterior oblique line. Flexor digitorum superficialis muscle is originated. b. Posterior border: Upper part form posterior oblique line and it ends below at dorsal tubercle. c. Interosseous border: Sharp; starts from radial tuberosity. Interosseous membrane is attached in this border. Three surfaces: a. Anterior surface: Hollow out in upper part. Flexor pollicis longus is attached here. Pronator quadratus muscle is attached in the lower part. b. Posterior surface: Supinator, abductor pollicis longus, extensor pollicis brevis is attached. c. Lateral surface: Pronator teres, supinator is inserted above pronator teres.	◆ Place dorsal tubercle on posterior aspect. ◆ Disc-like head should be placed above. ◆ Styloid process should be on lateral aspect. ◆ Styloid process will determine the side of bone.

Contd...

JAYPEE BROTHERS

Contd...

Names (AN8.1 to AN8.6)	*Comments*	*Important features*	*Anatomical positions*
		Lower end—enlarged; presents five surfaces: a. Anterior surface: Concave. Radial artery is related here and radial pulse is palpated. b. Posterior surface: Marked by ridges and grooves; dorsal tubercle is present in the middle. From lateral to medial-abductor pollicis longus, extensor pollicis brevis, extensor carpi radialis longus and brevis, extensor digitorum is related. c. Medial surface: A notch is present for head of ulna. d. Lateral surface: Projected and forms styloid process. It gives insertion of brachioradialis. Radial styloid process is at lower level than ulnar styloid process. e. Inferior surfaces: Articular; lateral triangular impression articulate with scaphoid, medial one to lunate bone.	
Ulna **(Figs. 3.4A and B)**	Medial bone of forearm. It has expanded upper end and small lower end and intervening shaft. It forms elbow joint; superior, middle and inferior radioulnar joint. It is longer than radius.	**Upper end:** It has enlarged hook-like process known as olecranon, and in between olecranon and coronoid process there is a notch: a. Shelf-like horizontal coronoid process: Lateral surface present radial notch. It accommodates the head of radius and ends of annular ligament. Anterior surface present rough ulnar tuberosity gives attachment to brachialis muscle. b. Hook-like vertical olecranon process: Superior surface gives insertion of **triceps**. Triangular posterior surface is subcutaneous. c. Trochlear notch is situated between olecranon and coronoid process. It articulates with the trochlea of humerus.	◆ Place more expanded end with olecranon process and coronoid process above. ◆ Head with styloid process below. ◆ Place trochlear notch anteriorly. Sharp interosseous border is laterally.

Contd...

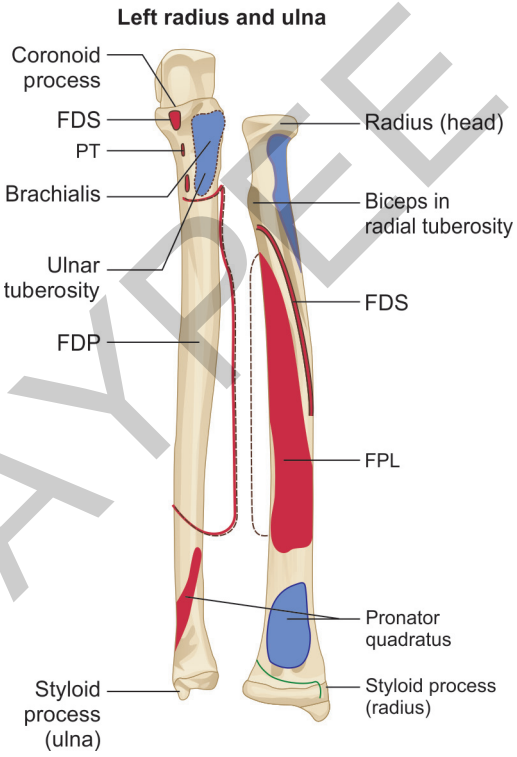


FIGURE 3.4A: Radius and ulna (anterior aspect).
(FDP: flexor digitorum profundus; FPL: flexor pollicis longus; FDS: flexor digitorum superficialis; PT: pronator teres)

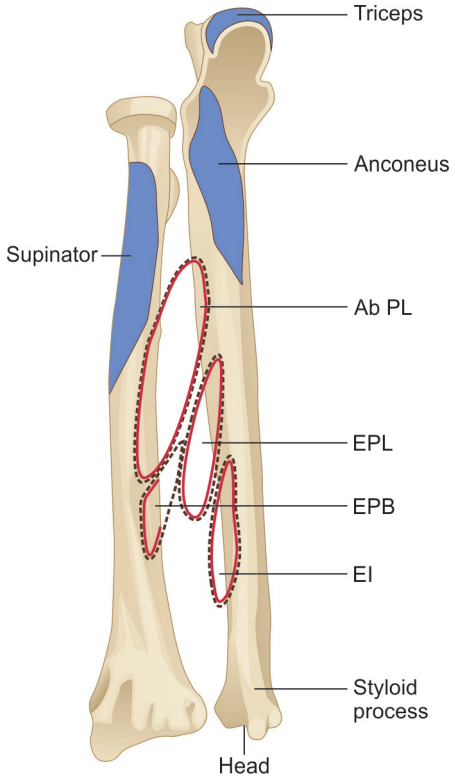


FIGURE 3.4B: Radius and ulna (posterior aspect).
(EPL: extensor pollicis longus; EPB: extensor pollicis brevis; EI: extensor indicis; Ab PL: abductor pollicis)

JAYPEE BROTHERS

Contd...

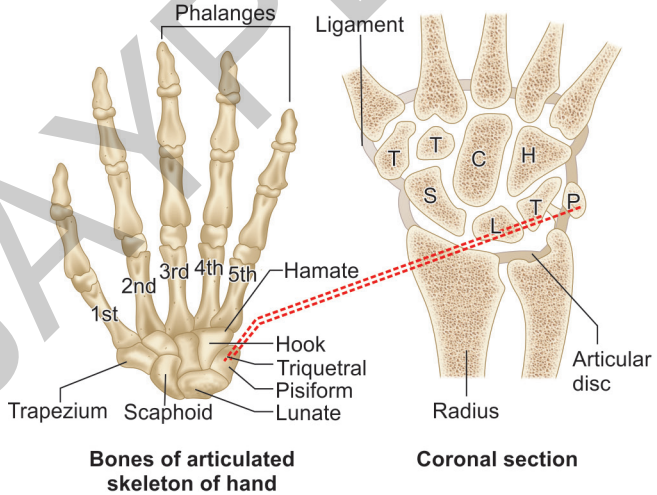
Names (AN8.1 to AN8.6)	Comments	Important features	Anatomical positions
		Shaft: Gradually narrows from above down-wards. It has three borders: a. **Anterior border:** Ill-defined begins from lower part of ulnar tuberosity and extends up to the base of ulna. b. **Posterior border:** Sharp palpable; gives common aponeurotic origin of **flexor and extensor carpi ulnaris**. c. **Interosseous border:** Prominent lateral border. Above it is continuous with supinator crest. It gives attachment to interosseous membrane through out its whole extent. **Three surfaces**: a. **Anterior:** It lies between anterior and interosseous border. Nutrient foramen present here. It gives origin to flexor digitorum profundus in upper 3/4th and pronator quadratus in lower 1/4th (ridge-like). b. **Posterior:** Surface lies between posterior and interosseous border divided into: i. Upper oval area: Anconeus is inserted. ii. Lower lateral area: It gives origin to abductor pollicis longus, extensor pollicis longus and extensor indicis muscle. c. **Medial:** Surface lies between anterior and posterior border. It is smooth, faces medial side of forearm. Lower end presents a palpable small rounded head for articulation with radius and small styloid process. Styloid process is the site of attachment of the articular disc of distal radioulnar joint.	◆ Interosseous border on which side the bone belong, will determine the side of bone.

ARTICULATED SKELETON OF HAND (FIG. 3.5) (AN8.5)

The hand is divided into volar or palmar and dorsal aspect.

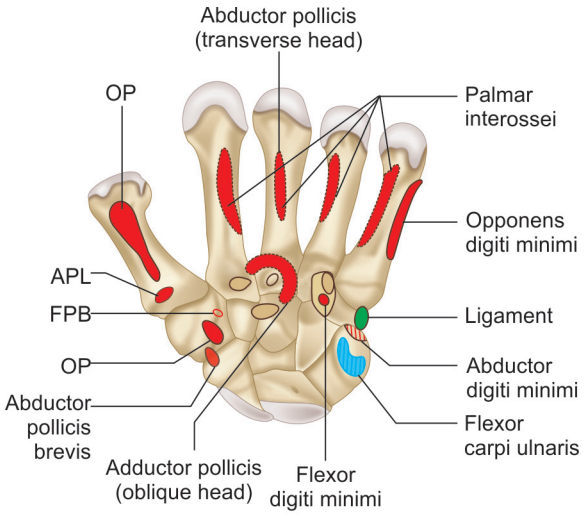
It comprises of 8 marble size short bones of carpals closely united by ligaments, 5 metacarpals (numbered from thumb to little finger as 1 to 5) and phalanges (comprising of 14 bones), 3 in each (2 to 5 finger) except first (consists of 2 phalanges). Gliding movements occur between the carpal bones. So it is flexible (can be assessed during wearing of short bangles inside the hand). The carpal bones are arranged into two rows:

1. *Proximal row (from lateral to medial side)*—Scaphoid (boat-shaped), lunate (crescentic moon like), triquetral (triangular), pisiform (pea seed like). Scaphoid and lunate bones transmits forces from the hand to the forearm.



Bones of articulated skeleton of hand

Coronal section



Attachment of muscles in carpals and metacarpals

FIGURE 3.5: Skeleton of hand.
(OP: opponens pollicis; FPB: flexor pollicis brevis; APL: abductor pollicis longus)

JAYPEE BROTHERS

Therefore these bones are most commonly fractured in a fall on the out stressed hand.

2. *Distal row (from lateral to medial side)*—Trapezium (distal articular surface, saddle-shaped), trapezoid (boot-shaped), capitate (largest carpal bone with a head), hamate (hammer-like with hook). The carpal tunnel: the carpal bones are so arranged that the palmar surface is deeply concave. This concavity is converted into carpal tunnel by flexor retinaculum.

Injury of upper limb bone	
Bone involved	***Comments***
Fracture of clavicle	It is common, particularly in children and young adults, due to fall in outstretched hand. Fracture is usually in mid-shaft region in children.
Fracture of scapula	It is very uncommon fracture in the body of scapula is due to direct blow. Fracture in the neck of scapula is due to fall on shoulder.
Fracture of surgical neck of humerus	It can occur with a fall on the outstretched hand, particularly in the elderly woman. Axillary nerve may be damaged in this fracture
Fracture of shaft of humerus	It is produced when a fall is accompanied by twisting injury. It may involve the radial nerve and there is wrist drop.
Supracondylar fracture	It is common injury to children and adolescents due to fall on the outstretched hand. The structures at risk are brachial artery and median nerve.
Forearm fracture	Fracture in the middle of shaft of radius and ulna. These fractures interfere with pronation and supination.
Colles fracture (most common fracture of radius)	Fracture in the lower end of the radius with or without 'dinner fork' deformity due to fall on the outstretched hand.
Scaphoid fracture	Above 70% of carpal fractures, only the scaphoid is broken, due to fall on the outstretched hand. Palpation in anatomical snuffbox is more painful. High rate of nonunion and avascular necrosis (in proximal part) is common.
First metacarpal fracture	Also known as Bennett's fracture, occurs at the base of the thumb.

SUPERFICIAL VENOUS DRAINAGE OF UPPER LIMB/SUPERIOR EXTREMITY (FIG. 3.6) (AN13.7)

The principal superficial vein of upper limb are cephalic (on lateral side) and basilic (on medial side) vein. These veins communicate with deep veins via perforating veins. The both sets of veins possess valves to assist returning of blood to the heart. The deep veins of upper limb follows the paths of their arteries and have the same names. Most are paired that lies by the side of the artery except longest one.

Name	***Formation***	***Course***	***Termination***	***Tributaries***	***Area of drainage***
Cephalic vein (AN12.2)	It is formed over the anatomical snuff box as a continuation of lateral part of dorsal venous network.	Lateral side of dorsal venous network. ↓ Spiral course upward around radial border of lower part of forearm. ↓ In front of elbow ↓ Connected with basilic vein by median cubital vein ↓ Upward along lateral side of biceps ↓ In deltopectoral groove ↓ Pierces deep fascia, then pierces clavipectoral fascia ↓ Bend at right angle	It crosses the axillary artery and end in subclavian vein below the clavicle.	Many tributaries from lateral and posterior surface of limb.	Many tributaries from lateral and posterior surface of limb.
Basilic vein (AN12.2)	Continuation of medial part of dorsal venous network.	Medial side of dorsal venous network ↓ Ascends along medial side of forearm. ↓ In front of medial epicondyle it is connected with cephalic vein by median cubital vein. ↓ Upward along medial border of biceps ↓ Pierces deep fascia at middle of the arm and become deep ↓ Joins with venae comitantes of brachial artery at lower border of teres major	Continues as axillary veins.	Medial cubital vein. Various tributaries on medial and posterior surface of limb.	Medial and posterior surface of limb.

JAYPEE BROTHERS

Contd...

Name	Formation	Course	Termination	Tributaries	Area of drainage
Medial veins of forearm	It arises from palmar venous plexus.	Goes upward in front of forearm ↓ Joins median cubital vein or basilic vein or bifurcate to join both cephalic and basilic vein	Terminate either in basilic or cephalic vein or into median cubital vein	Numerous tributaries.	Palm and front of forearm.
Median cubital vein (AN11.2 and AN11.3)	Communication between cephalic and basilic vein just below the crease of elbow. It is used in intravenous injection, blood transfusion and withdrawal of blood for diagnostic purpose.	Lies in front of elbow, joins cephalic and basilic vein ↓ Lies in front of bicipital aponeurosis ↓ Directed upwards and medially			

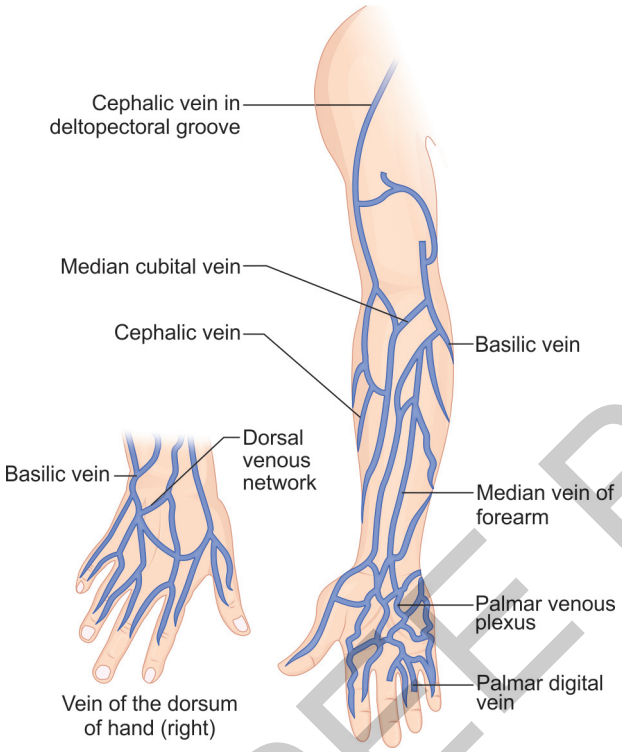


FIGURE 3.6: Veins of upper limb.

Clinical Anatomy

Intravenous Injection

Common site:

- Median cubital vein in front of elbow as it is fixed by perforator.
- Cephalic vein (near its formation in hand) also used for ***diagnostic purpose***, e.g. blood for TC, DC, ESR, sugar, urea, etc., and for ***therapeutic purpose,*** e.g., fluid transfusion.

DEEP VEINS OF UPPER LIMB

It follows the artery and named accordingly. Ultimately all veins drain into axillary vein.

NERVES OF THE UPPER LIMB

Brachial Plexus and its Branches (Fig. 3.7) (AN10.3)

The large important brachial plexus is situated partly in the neck and partly in the axilla. The plexus is formed by the ventral rami of the C5, C6, C7, C8 and the major part of T1. When C4 ventral rami contributes to the formation of bracial plexus, it is known as prefixed plexus. Similarly when T2 nerve gives branches in the formation of plexus, it is known as post fixed plexus. The C5 and C6 route unite to form upper trunk.

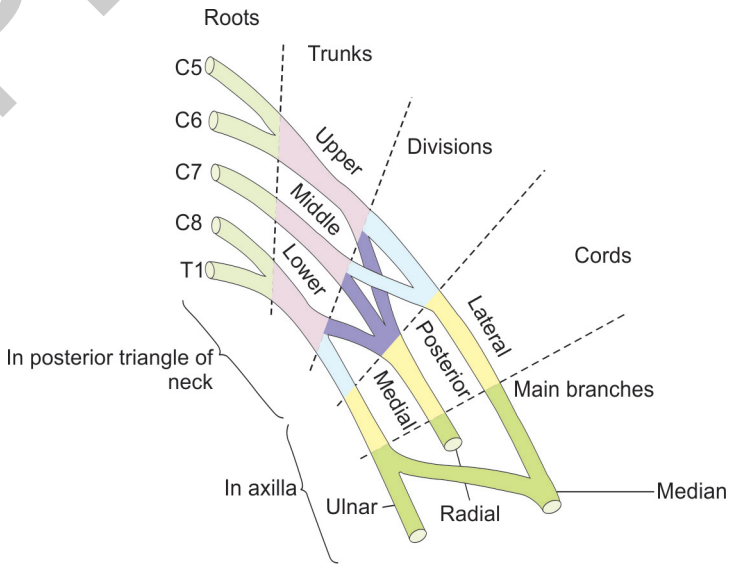


FIGURE 3.7: Brachial plexus.

JAYPEE BROTHERS

The C7 is continued as middle trunk, C8 and T1 unite to form the lower trunk of bracial plexus. Routes and trunk are situated in the neck.

The trunks dividing to anterior (ventral) and posterior (dorsal) division. The anterior division of the upper two unite and form lateral cord. The anterior division of lower trunk continued as medial cord of the bracial plexus. The posterior division of all the three trunk unite and form the posterior cord. The name of the cord is given according to the position along the 3rd part of axillary artery. The cord and the branches of bracial plexus is located in intraclavicular region that is in axilla.

Nerves	*Origin and course*	*Structures served*
Branches from root		
Dorsal scapular (NV to rhomboids C5)	Arises from the root of brachial plexus, pierce the scalenus medius muscle.	Rhomboid muscles.
Long thoracic (NV to serratus anterior)	Arises from the root of brachial plexus.	Serratus anterior muscle.
Branches from trunk		
Nerve to subclavius	Arises from the trunk of brachial plexus. Very slender nerve.	Subclavius muscle.
Suprascapular nerve	Arises from the trunk of brachial plexus. Large branch.	Shoulder joint; supraspinatus and infraspinatus muscle.
Branches from the lateral cord		
Musculocutaneous	Arises opposite lower border of pectoralis minor.	Biceps brachii, brachialis, pectoralis major and minor.
Lateral pectoral	Small branches; pierces the clavipectoral fascia.	Muscle of thumb, skin of lateral 2/3rd of palm.
Lateral root of median	Discussed along with the medial root. The two roots combine to form the median nerve.	
Articular branches to elbow and wrist		
Branches from the medial cord		
Medial pectoral	Small branches, arise from medial cord, where it lies posterior to axillary artery.	Pectoralis minor.
Medial cutaneous nerve of arm	Communication with intercostobrachial nerve coming from T2.	Supplies skin of upper and medial side of the arm.
Medial cutaneous branch of forearm	The nerve situated medial to brachial artery.	Supplies skin of upper and medial side of the front of forearm and skin over front of arm.
Median nerve (medial root)	Arises as two roots from lateral and medial cord of brachial plexus lies in front of slightly lateral to the axillary artery.	It gives no branch in arm muscular branches to pronator teres, pronator quadratus, flexor carpi radialis, the palmaris longus and flexor digitorum superficialis, lateral half of flexor digitorum profundus.
Ulnar nerve	It is the terminal branch of medial cord; run along the medial aspect of arm and passes behind the medial epicondyle to enter forearm.	Flexor carpi ulnaris, medial half of flexor digitorum profundus, most intrinsic muscles (about 20) of hand, skin of medial 1/3rd of hand (Both palm and dorsum).
Branches from posterior cord		
Upper subscapular	It is a slender nerve, passes posteriorly and difficult to trace in axilla dissection; when clavicle is present.	Subscapular muscle.
Thoracodorsal	It arises between upper and lower subscapular, and runs inferolaterally.	Latissimus dorsi.
Lower subscapular	It passes inferolaterally deep to subscapular artery and vein.	Inferior portion of subscapularis and teres major.
Axillary	Terminal branches, passes to posterior aspect of arm through quadrangular space, winds round the surgical neck of humerus.	Deltoid, teres minor, shoulder joint, skin over the inferior part of deltoid.
Radial	Terminal and largest branch; passes posterior to axillary artery enters radial groove with arteria profunda brachii.	Triceps, anconeus, brachio-radialis and extensor muscles of forearm. Skin of posterior aspect of arm and forearm.

Erb's Point

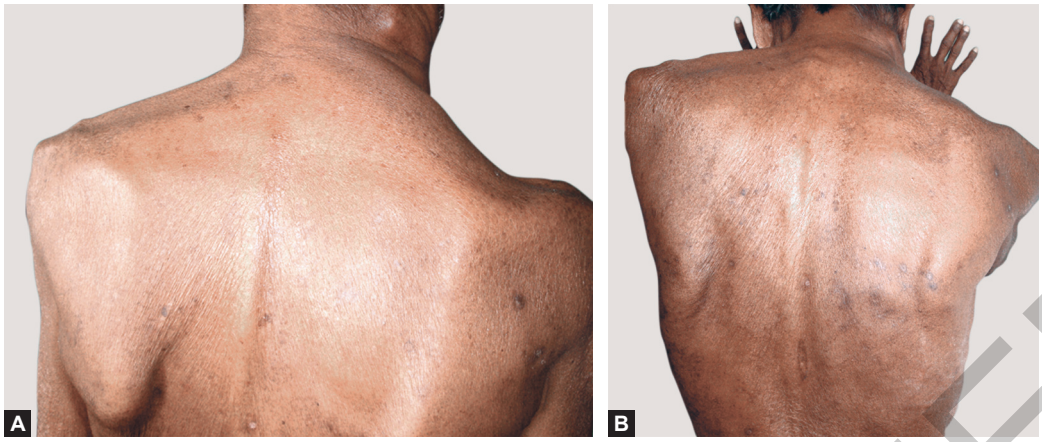
It is the meeting point of 6 nerves in the upper trunk of brachial plexus, i.e., C5,6 spinal nerve, suprascapular nerve, nerve to subclavius, ventral and dorsal divisions of upper trunk.

Importance of this point: injury to the point causes Erb-paralysis.

Lesion of Important Nerves of Brachial Plexus (Figs. 3.8A and B)

The brachial plexus is deeply placed in the root of the neck, but can be injured in penetrating injuries (in war) can be avulsed (in birth trauma and motorcycle accident).

JAYPEE BROTHERS



FIGURES 3.8A AND B: (A) Winging of left scapula; (B) Normal scapula disposition.

Contd...

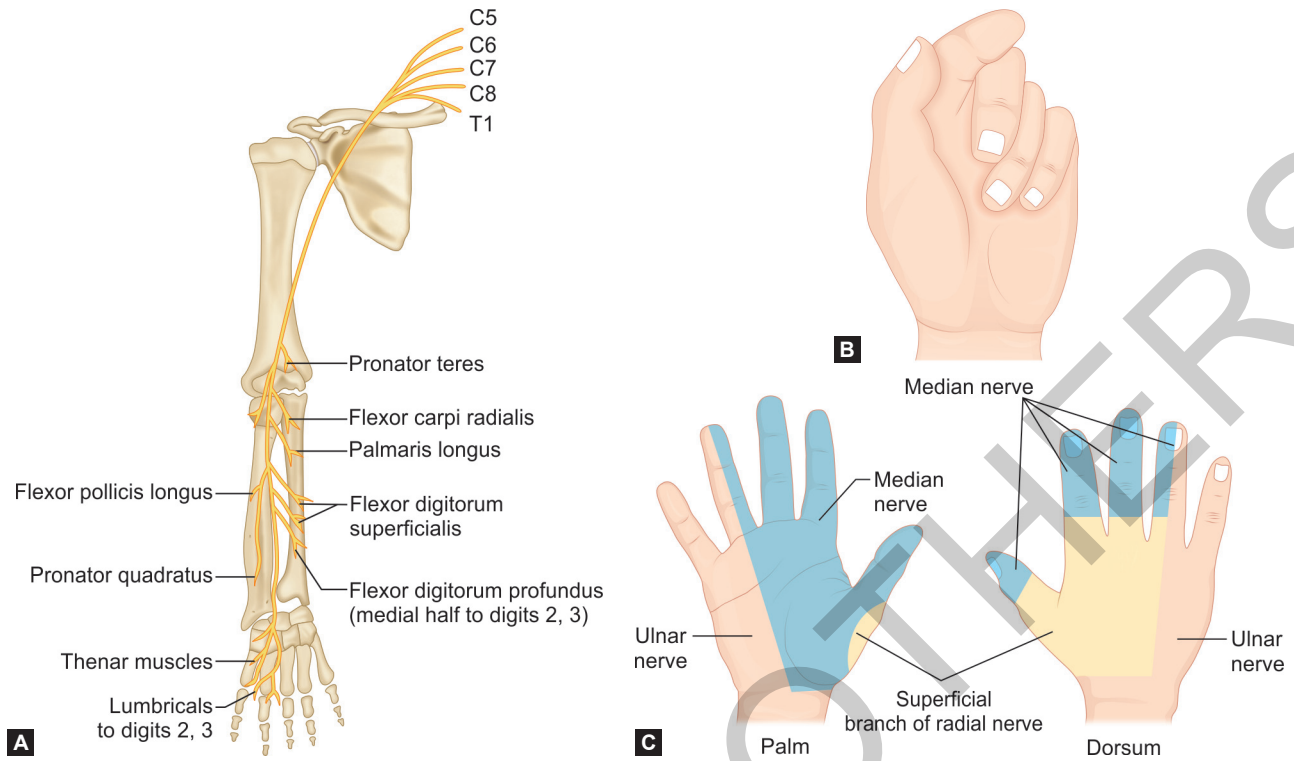
Names	*Site of injury (Causes)*	*Effect (Manifestation)*
Suprascapular nerve	At the suprascapular notch, (entrapment neuropathy) or trauma in this region.	Weakness of supraspinatus and infraspinatus muscle and gradually muscle wasting.
Long thoracic nerve	Blow in the posterior triangle of the neck or during surgical procedure	Paralysis of the serratus anterior muscle. So there is difficulty in raising arm above head. There is winging of scapula.
Upper lesion of brachial plexus or Erb-Duchenne palsy [mainly C5 and partly C6 is involved] (AN10.6)	In motorbike accident or when there is abnormal separation of head and shoulder, during delivery, the region of Erb's point (meeting of six nerve) is involved.	Muscles involved: Supraspinatus, infraspinatus, subclavius, biceps brachii and greater part of brachialis, coracobrachialis and deltoid are paralyzed. Effects and features: So the arms hang by the side of the trunk and rotated medially, elbow extended and forearm pronated, as if some body is taking the tips. Movements of the wrist and fingers are not lost.
Lower plexus paralysis [Klumpke] involves C8 and T1 (AN10.6)	It occurs in the lower part of the neck, and axilla (upper part) by cancerous infiltration from apex of lung, of breast, cervical rib, etc.	Progressive weakening of small muscles of hand and wasting of muscle gradually. Hypothenar eminence become wasted. This is known as claw hand [due to hyperextension of metacarpophalangeal joint and flexion of interphalangeal joint] and Horner syndrome.
Axillary nerve lesion	Fracture at the surgical neck of humerus.	Paralysis of deltoid with dropping of shoulder as first initiator of abduction is lost (deltoid).

Important Nerves of Brachial Plexus (in detail)

Median nerve (Figs. 3.9A to C) (AN10.3, AN12.2):

Origin	*Course*	*Branches*	*Applied*
From lateral and medial cord of brachial plexus in axilla. Usually gives no branch in arm.	It embraces the third part of axillary artery in the axilla. In the arm it is lateral to brachial artery, near the insertion of coracobrachialis it crosses in front of the artery and in cubital fossa it is medial to the artery. It enters the forearm by passing between two heads of pronator teres, separated from ulnar artery by deep head of pronator teres. In the forearm, it lies deep to flexor digitorum superficialis and profundus. The nerve enters the hand by passing deep to flexor retinaculum (in the carpal tunnel) and it divides into two, to supply the lateral 3½ digits	Muscular to the superficial flexor muscles of forearm except the flexor carpi ulnaris. Anterior interosseous branch, supplies flexor pollicis longus. Palmar cutaneous branch – arises above the flexor retinaculum, supplies the skin of thenar eminence. It gives articular, branches to elbow joint, the proximal radioulnar joint, vascular branches to radial and ulnar artery.	Injury, above elbow, (as in the supracondylar fracture)—produce paralysis of all the flexor muscle of forearm except, flexor carpi ulnaris. In the hand, thenar muscle and first and second lumbricals are paralyzed. So forearm lies in the supine position, hand is adducted; flexion at interphalangeal joints of index and middle finger is lost. When the patient tries to make a fist, the index and middle finger tend to remain straight. The muscles of thenar eminence are paralyzed and the eminence if flattened. The thumb is adducted and laterally rotated (ape-like hand). There is sensory loss of lateral 3½ finger.

JAYPEE BROTHERS



FIGURES 3.9A TO C: (A) Median nerve and its course; (B) Median nerve palsy; (C) Sensory supply of hand.

Ulnar nerve (Figs. 3.10 and 3.11) (AN10.3, AN12.2):

Origin	*Course*	*Branches*	*Applied*
It is the continuation of medial cord of brachial plexus. Gives it no branch in axilla and arm.	In the axilla, it runs downwards between axillary artery and vein; then medial to brachial artery in the arm. At the middle of the arm the nerve pierces the medial intermuscular septum, descends in the back of arm up to medial epicondyle. Here nerve can be felt against the bone. The nerve enters the forearm between two heads of flexor carpi ulnaris, runs between flexor digitorum profundus (on medial aspect) and flexor digitorum superficialis. The nerve enters the palm by passing superficial to flexor retinaculum lateral to pisiform bone.	◆ Articular to elbow, wrist. ◆ Muscular to flexor carpi ulnaris and flexor digitorum profundus. ◆ Superficial—sensory supply to medial 1½ digit and muscular to palmaris brevis. ◆ Deep terminal branch—muscular to adductor pollicis, all palmar and dorsal interossei and third and fourth lumbricals.	Ulnar nerve paralysis commonly occurs behind the medial epicondyle of humerus. ◆ There is impairment of power of adduction at the wrist due to paralysis of flexor carpi ulnaris and medial ½ of flexor digitorum profundus flattening of medial side of forearm. ◆ Paralysis of interosseous muscle produces claw hand (hyperextension of metacarpophalangeal joint and flexion of interphalangeal joint). ◆ Inability to adduct the thumb. ◆ Wasting of hypothenar muscle. ◆ Sensation is impaired in the ulnar 1½ fingers on both palmar and dorsal surfaces.

All muscles of hand are supplied by ulnar nerve except muscle of thenar eminence and first and second lumbricals (supplied by median nerve).

Radial nerve (Figs. 3.12A and B) (AN12.2):

Origin	*Course*	*Branches*	*Applied*
It arises from posterior cord; largest branch of brachial plexus.	In axilla it descends behind the third part of axillary artery. In between long and lateral head of triceps, it enters the spiral groove with arteria profunda brachii. It pierces the lateral intermuscular septum to enter the anterior compartment. In front of lateral epicondyle it divides into superficial and deep branches. The superficial branch lies in front of supinator muscle deep to brachioradialis and descends lateral to radial artery. In the middle third of arm the artery is medially situated; it quits the artery about 7 cm above the styloid process of radius. Deep terminal branch is known as posterior interosseous nerve.	Muscular: 1. Triceps 2. Anconeus 3. Brachioradialis 4. Brachialis (lateral part) 5. Extensor carpi radialis longus 6. Posterior interosseous nerve supplies. – Supinator – Extensor carpi radialis brevis – Extensor digitorum – Extensor carpi ulnaris – Extensor pollicis longus – Abductor pollicis longus 7. Articular to radiocarpal joint.	Radial nerve palsy commonly occurs due to compression of nerve in axilla (malfitted crutches at armpit); arm thrown carelessly by drunkers over a chair [saturday night palsy]. ◆ Elbow and wrist extension is impaired. ◆ So there is wrist drop, finger drop due to weakness of extensor tendon. ◆ Sensory impairment in lower part of arm, back of forearm, lateral part of dorsum of hand. Posterior interosseous palsy. This is due to compression of nerve within the extensor muscles. ◆ No sensory impairment since the superficial branch arises above this level. ◆ There is weakness in finger and thumb (extension and abduction).

JAYPEE BROTHERS

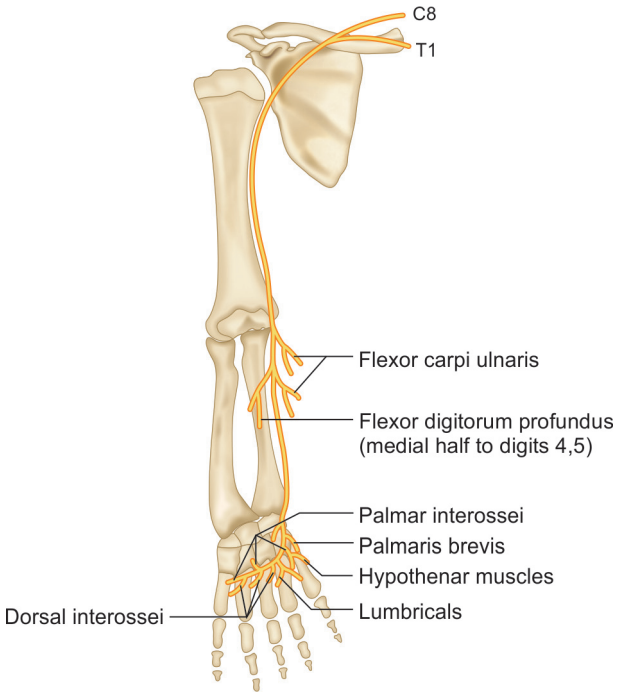


FIGURE 3.10: Ulnar nerve and its course.

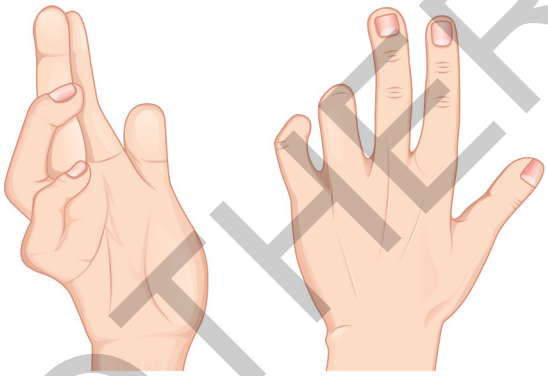
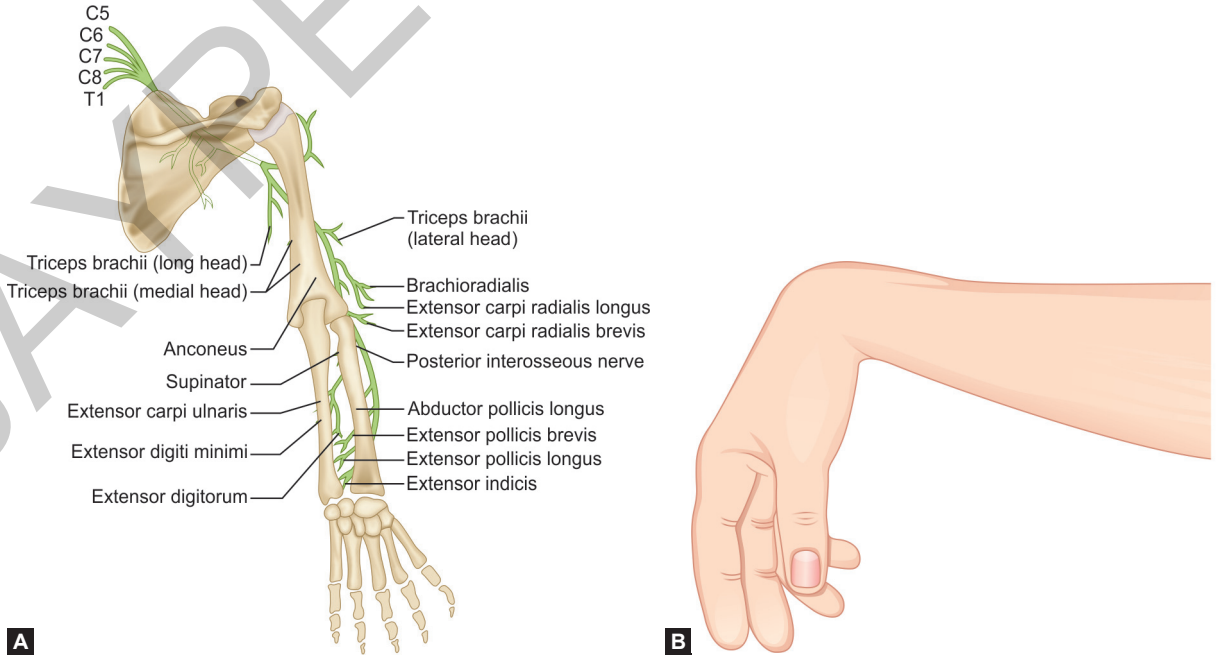


FIGURE 3.11: Ulnar claw hand.

Musculocutaneous nerve (AN11.2):

Origin	*Course*	*Branches*	*Applied*
Arises from lateral cord of brachial plexus at the level of lower border of pectoralis minor	It runs down between the axillary artery and coracobrachialis, leaves the axilla by piercing the coracobrachialis. It descends laterally between biceps and brachialis to the lateral side of the arm; just below elbow it pierces the deep fascia, lateral to tendon of biceps, continued as lateral cutaneous nerve of forearm.	• Muscular to biceps brachii. • Lateral half of brachialis. Cutaneous branch to forearm.	Rarely injured, as it is protected by biceps brachii. If it is injured, it is injured high up in the arm. Biceps and coracobrachialis will be paralyzed resulting in marked weakness in elbow flexion. Sensory impairment on the extensor aspect of forearm in the lateral part.

Note: The radial nerve courses with arteria profunda brachii, the median nerve courses with brachial artery.



FIGURES 3.12A AND B: (A) Radial nerve and its course; (B) Wrist drop due to radial nerve palsy.

JAYPEE BROTHERS

r detailed information on anatomy books, visit our website www.jaypeebrothers.com, for detailed information on anatomy books, visit our web

Anatomy at a Glance
An Exam-Oriented Text

Salient Features

- The book is thoroughly revised based on region wise anatomy.
- It is updated on competencies as per the National Medical Council (NMC) curriculum.
- Illustrated pictures, flowcharts, and tables for better understanding and easy to remember.
- All branches of anatomy, such as general anatomy, gross anatomy, radiology, surface making, histology, genetics, embryology are covered in one book.
- The key concepts are presented in an exam-oriented approach in easy-to-understand language.
- Chapter summary highlighting the salient features of each chapter.
- Important PG entrance topics are marked in blue and symbolized as NEET.

Sibani Mazumdar MBBS MS is currently working as a Professor, Department of Anatomy at Gouri Devi Institute of Medical Sciences and Hospital, Rajbandh, West Bengal, India. She has been teaching anatomy for the last 40 years. She is the thesis examiner of MD and PhD degree programs of different universities. She is also the examiner of undergraduate and postgraduate examinations in several medical colleges in India.

The first edition of this book was translated in Chinese language and became popular in China. She received Lifetime Achievement Award by the Anatomical Society of India (West Bengal Chapter). She has been appointed as reviewer of IP Innovative Publication Pvt Ltd.

She has authored two other books—*Surgical Anatomy: A Student's Manual* and *Dissection Manual, Living and Cross Sectional Anatomy* published by Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, India. Besides, she has published several papers in national and international journals of repute.

Printed in India

Available at all medical bookstores
or buy online at www.jaypeebrothers.com



JAYPEE BROTHERS
Medical Publishers (P) Ltd.
EMCA House, 23/23-B, Ansari Road,
Daryaganj, New Delhi - 110 002, INDIA
www.jaypeebrothers.com

Join us on facebook.com/JaypeeMedicalPublishers

Shelving Recommendation
ANATOMY

