CHAPTER

6

The Ulna

Competencies: ■ AN8.1; ■ AN8.4

It is the medial bone of forearm and is homologous with fibula of lower limb.

SIDE DETERMINATION (Fig. 6.1)

1. Keep the bone vertically in such a way that the hook-like end is upwards.
2. The concavity of hook and the coronoid process are looking forwards.
3. Sharp crest like border of shaft is directed laterally.

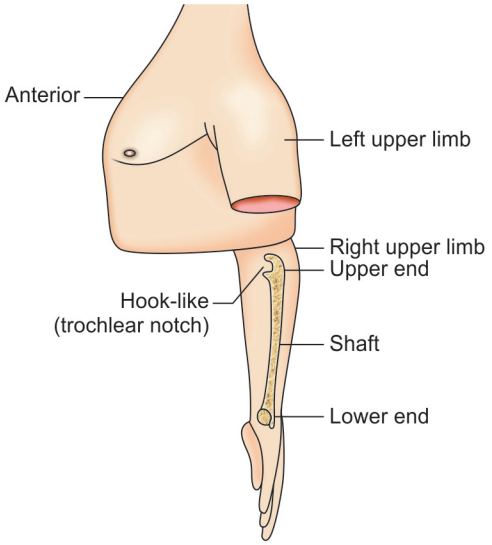

Fig. 6.1: Determination of side of ulna

ANATOMICAL POSITION

Ulna is the medial bone of forearm lying vertically in such a way that the concavity at the upper end faces forwards and interosseous border is directed towards lateral bone of forearm, i.e. radius.

FEATURES AND ATTACHMENTS

It has two ends (upper and lower) and a shaft.

I. Upper end

It has two processes (olecranon and coronoid) and two notches (trochlear and radial).

A. Processes

a. Olecranon process (Figs 6.2 and 6.4)

It projects upwards from shaft. It has 5 surfaces:

i. *Superior surface*

1. *Triceps* is attached to its rough posterior 2/3rd.
2. *Capsular ligament* is attached anteriorly to the margins.
3. A *bursa* is located between tendon of triceps and capsule.

ii. *Anterior surface*

It forms the upper part of trochlear notch.

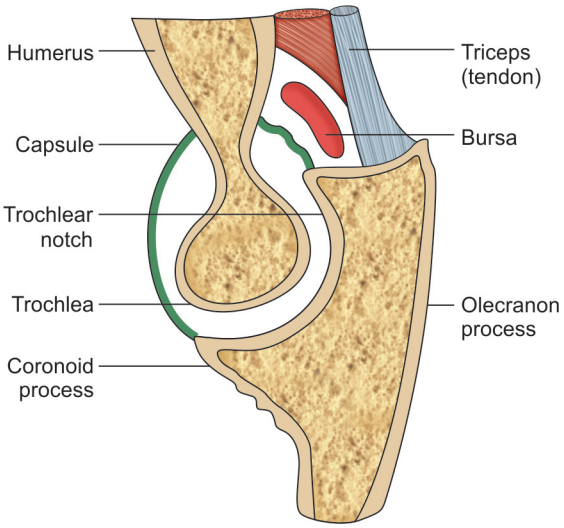

Fig. 6.2: Relations of olecranon process

iii. *Posterior surface*

1. It forms a triangular subcutaneous area (Fig. 6.3).
2. A *bursa* separates the posterior surface of the olecranon from the skin.
3. Its upper part forms the *point of elbow*.

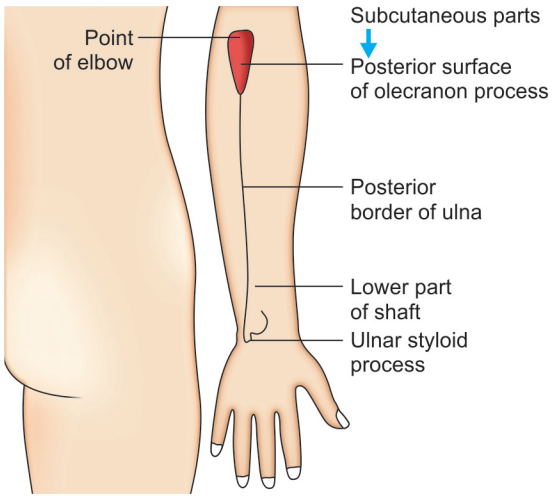

Fig. 6.3: Subcutaneous parts of right ulna

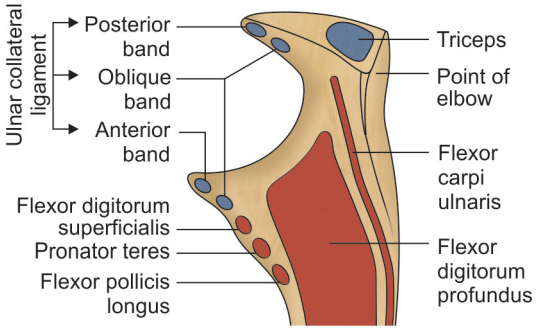

Fig. 6.4: Medial aspect of upper end of right ulna

iv. *Medial surface*

1. *Flexor carpi ulnaris* originates from its upper part.
2. *Flexor digitorum profundus* (upper fibres) arises from its lower part.
3. *Ulnar collateral ligament* (posterior and oblique bands) is attached to its upper part.

v. *Lateral surface: Anconeus* is inserted on this surface.

b. Coronoid process

It projects forwards from the shaft just below the olecranon process. It has 4 surfaces:

i. Superior surface

It forms the lower part of *trochlear notch*.

ii. Anterior surface

1. At the lower corner of this surface there is *ulnar tuberosity* (Fig. 6.5).
2. *Brachialis* is attached to the whole of the anterior surface including ulnar tuberosity.
3. The medial margin of the anterior surface is sharp and provides attachments to following from proximal to distal:
   - *Anterior band of ulnar collateral ligament.*
   - *Oblique band of ulnar collateral ligament.*

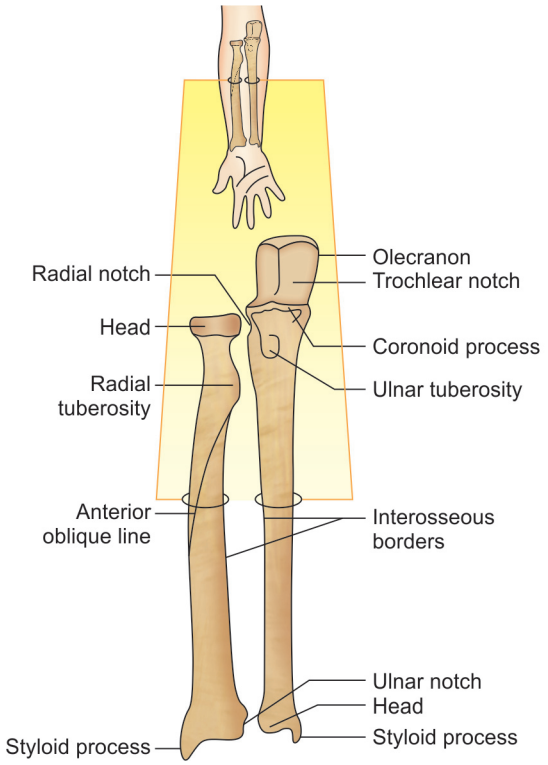

Fig. 6.5: The bones of right forearm: Anterior aspect

- *Lower part of humero-ulnar head of flexor digitorum superficialis.*
- *Ulnar head of pronator teres.*
- Very rarely the *ulnar head of flexor pollicis longus.*

iii. Medial surface

It receives attachment of *flexor digitorum profundus*.

iv. Lateral surface

1. The upper part of this surface is articular for the circumference of head of radius and therefore called *radial notch.*
2. *Annular ligament* is attached to the anterior and posterior margins of the radial notch.
3. The lower part of the lateral surface forms a depressed area called *supinator fossa*. The supinator fossa accommodates radial tuberosity.
4. Supinator fossa is limited posteriorly by *supinator crest*. Supinator crest and posterior part of fossa are meant for the origin of deep part of supinator.

B. Notches (articular surfaces)

a. Trochlear notch

1. It articulates with the trochlea of humerus.
2. The capsule of elbow joint is attached to the margins of trochlear notch except laterally where trochlear notch is continuous with the radial notch.

b. Radial notch

1. It articulates with the head of radius to form the superior radio-ulnar joint.
2. *Annular ligament* is attached to the anterior and posterior margins of the notch.

II. Shaft

It has 3 borders (lateral, anterior and posterior) and 3 surfaces (anterior, medial and posterior).

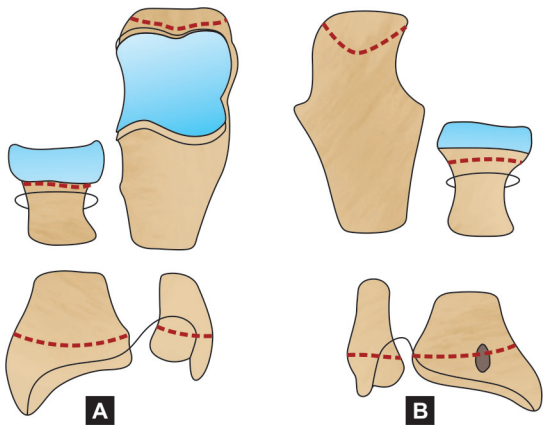

Fig. 6.6: Capsular attachments (continuous lines) and epiphyseal lines (dotted lines) of the radius and ulna. (A) Anterior view; (B) Posterior view.

A. Borders

a. Lateral border

1. This is also called *interosseous border*.
2. It is sharpest in its middle 2/4th.
3. *Interosseous membrane* is attached to it, except at its upper end (Fig. 6.7). The direction of fibres in interosseous membrane is downwards and medial.

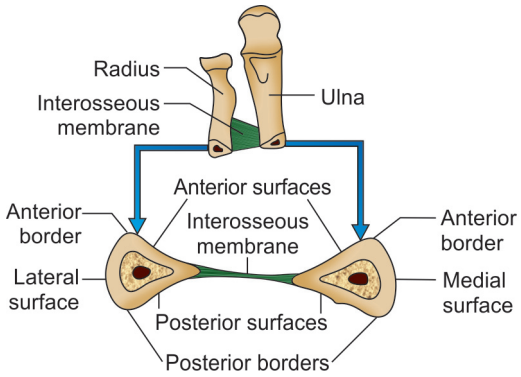

Fig. 6.7: Borders and surfaces of radius and ulna

b. Anterior border

1. It is thick and round.
2. Its upper 3/4th is covered by the originating fibres of the *flexor digitorum profundus*.

c. Posterior border (Figs 6.3 and 6.8)

1. It is subcutaneous.
2. The deep fascia of forearm is attached to it. The deep fascia acts as common aponeurosis for the attachment of following 3 muscles:
   i. *Flexor digitorum profundus* from its upper 3/4th.
   ii. *Flexor carpi ulnaris* from its upper 3/5th.
   iii. *Extensor carpi ulnaris* from its middle 1/3rd.

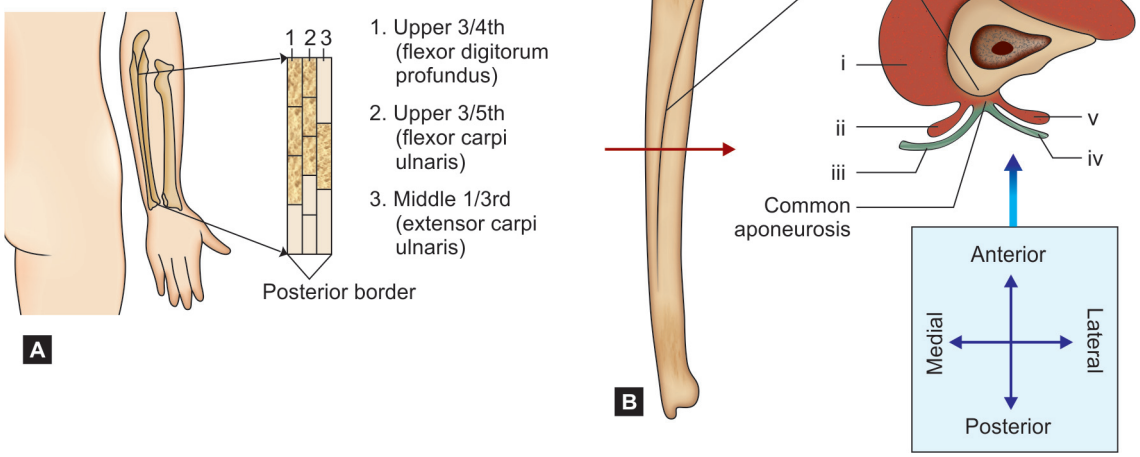

Fig. 6.8: Common aponeurotic attachment to the posterior border of right ulna. (A) Muscles attached; (B) Attachments from medial to lateral; (i) flexor digitorum profundus; (ii) flexor carpi ulnaris; (iii and iv) deep fascia; (v) extensor carpi ulnaris

B. Surfaces

a. Anterior surface (Fig. 6.9)

1. *Flexor digitorum profundus* arises from its upper 3/4th.
2. *Pronator quadratus* originates from an oblique ridge in its lower 1/4th.
3. *Nutrient foramen* is located in its upper part which leads into nutrient canal directed upwards.

Note: *Nutrient canal is directed opposite to the growing end therefore upwards in ulna because lower end is growing end.*

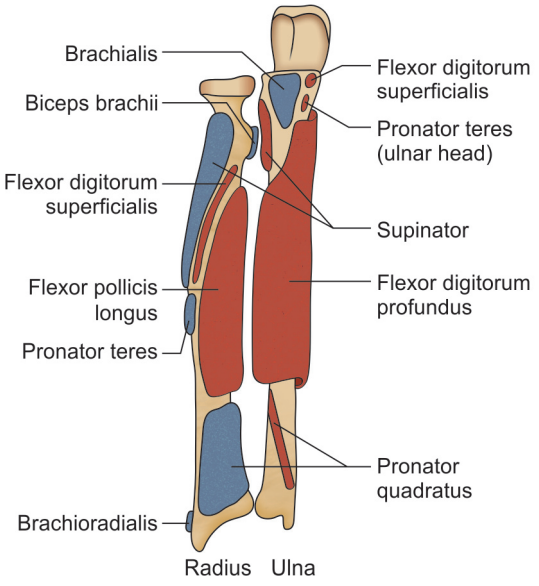

Fig. 6.9: The bones of right forearm: Anterior aspect

b. Medial surface

1. *Flexor digitorum profundus* originates from its upper ¾th.
2. Lower 1/4th of this surface is subcutaneous.

c. Posterior surface (Figs 6.10 and 6.11)

1. It lies between posterior and interosseous borders.
2. It is divided into smaller upper and larger lower part by an oblique line.

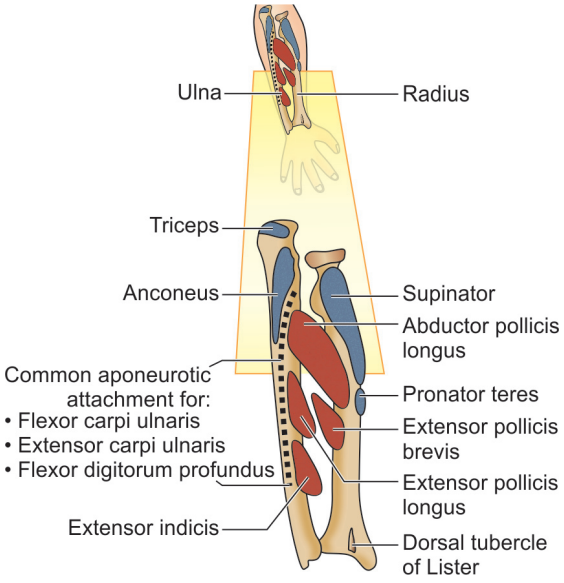

Fig. 6.10: The bones of right forearm: Posterior aspect

3. Area above the oblique line receives insertion of *anconeus*.
4. The posterior surface below the oblique line is divided into medial and lateral areas by a vertical line. The lateral one provides attachments to 3 muscles from proximal to distal:
   - *Abductor pollicis longus*
   - *Extensor pollicis longus*
   - *Extensor indicis*

Note: *Remember the middle 3rd of the posterior surfaces of both radius and ulna are meant for longus tendons of extensor compartment going to thumb. Extensor pollicis longus arises from middle 1/3rd of ulna only. Abductor pollicis longus originates from the upper ulna as well as middle 1/3rd of radius.*

III. Lower end

It includes the head and styloid process.

A. Head

1. It articulates with the ulnar notch of radius and forms the inferior *radio-ulnar joint*.

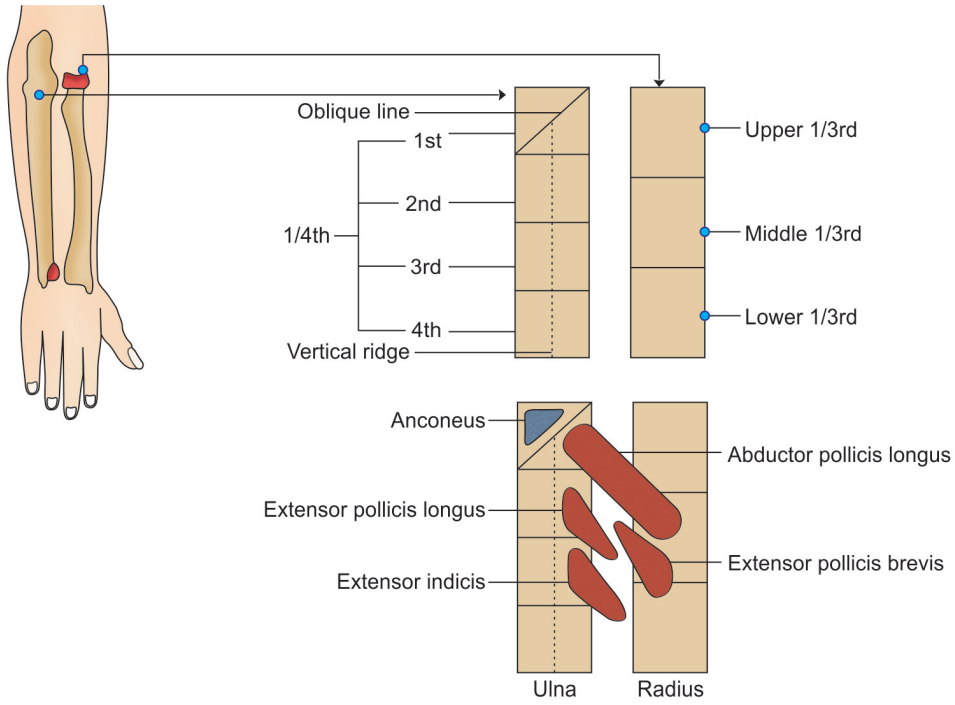

Fig. 6.11: Attachments to the posterior surfaces of radius and ulna

2. Articular disc separates the head from wrist joint.

B. Styloid process

1. It projects downwards from the postero-medial aspect of lower end of ulna.
2. *Medial (ulnar collateral) ligament of wrist* joint is attached to its apex.
3. The *apex of triangular articular disc* is attached to the depression between the head and styloid process.
4. *Tendon of extensor carpi ulnaris* grooves the area between the head and styloid process posteriorly (Fig. 6.12).

OSSIFICATION

A. Primary centre

One centre appears for the shaft during 8th week of intrauterine life.

B. Secondary centres

Two in all, one for upper end and one for lower end.

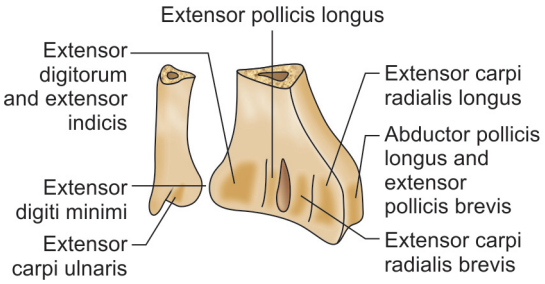

Fig. 6.12: Lower ends of the right radius and ulna: Dorsal aspect

a. Upper end

Appearance : 8 years
Fusion : 18 years

b. Lower end

Appearance : 6 years
Fusion : 20 years.

APPLIED ANATOMY

1. Ulna stabilizes the forearm. Its trochlear notch grips the lower end of humerus.

2. Ulna helps the radius to produce supination and pronation by providing a foundation for the radius to move.
3. If a person falls on the outstretched hand then *dislocation of elbow* may take place. Dislocation is more common if the elbow is slightly flexed.
4. Tip of olecranon process (point of elbow) lies in line with the two epicondyles of humerus in fully extended elbow. In a fully flexed elbow the three bony points form an equilateral triangle. In dislocation of elbow this relationship is altered. While it is maintained in the supracondylar fracture of humerus (Fig. 6.13).

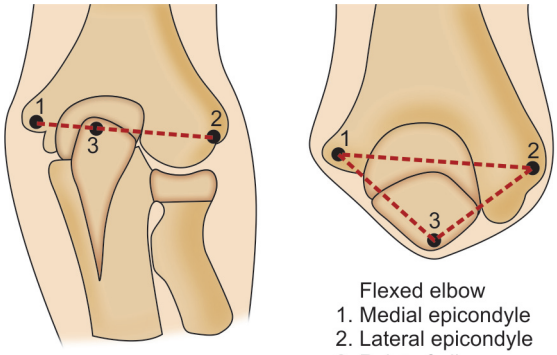

Fig. 6.13: Interrelationship of epicondyles of humerus (1 and 2) and point of elbow (3)

5. *Fracture of olecranon* occurs if one falls on the point of elbow.
6. Fracture of olecranon can be classified as (Fig. 6.14);
   a. ***Avulsion fracture:*** In this case fracture line is close to insertion of triceps and thus displaced by its pull.
   b. ***Transverse fracture***: It is located somewhere in the middle.
   c. ***Comminuted fracture***: Bone is broken into multiple pieces.
7. Ulna is fractured when the arm is put up to ward off a blow with a stick. This is an example of traumatic fracture due to direct violence. It is seen in night watchman and is called *night stick fracture.*
8. Fracture of shaft of ulna may be alone or in association with the fracture of radius. Usually single bone fractures are very rare.
9. Owing to the shapes of bones, backward dislocation at elbow is often associated with *fracture of coronoid process* of ulna.
10. *In cases of acute synovitis* (inflammation of synovial membrane) of elbow joint, the bulging of the capsule is noticed around olecranon due to collection of fluid inside the joint. Bulging is due to laxity of capsule around olecranon.

    The metaphyses at both ends of ulna are extracapsular (Fig. 6.6) and therefore rarely involved in cases of lesions of elbow and inferior radioulnar joints and vice versa.

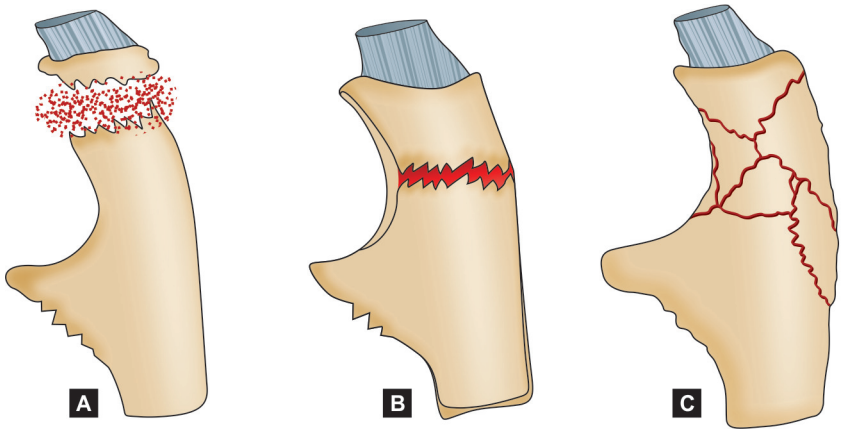

Fig. 6.14: Fractures of olecranon. (A) Avulsion fracture; (B) Transverse fracture; (C) Comminuted fracture