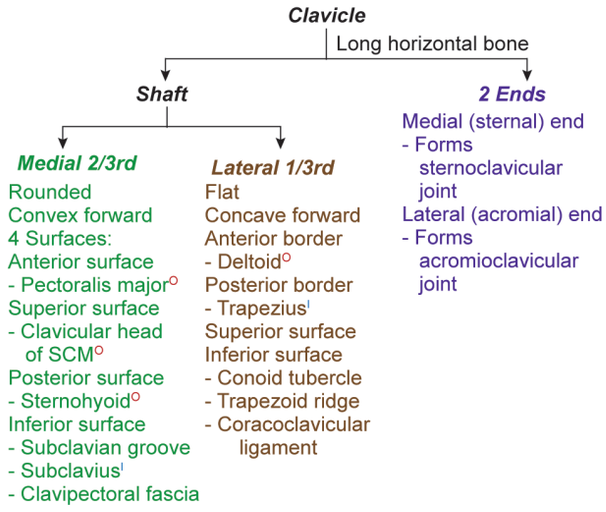
Flowchart 2.1: Clavicle



Clinical intergration: Fracture of clavicle, under developed or abscence of clavicle (cleidocranial dystosis)

Anterior surface

- It is convex.
- *Attachments*: It gives origin to clavicular head of *pectoralis major* muscle (Fig. 2.3).

Posterior surface

- It is smooth, concave backward.
- *Attachments*: Near medial end, the posterior surface gives origin to *sternohyoid* muscle.
- *Relations*

  Formation of brachiocephalic vein: Behind the medial end and posterior surface of medial two-thirds of clavicle, the internal jugular vein joins the subclavian vein to form brachiocephalic vein.

  Brachial plexus and subclavian artery: Posterior surface of medial two-thirds is related to trunks of brachial plexus and third part of subclavian artery.

Superior surface

- It is rough in its medial part, whereas smooth in its lateral part.
- *Attachment*: It gives origin to clavicular head of *sternocleidomastoid* muscle (*Note*: Sternal head arises from the anterior surface of manubrium) (Fig. 2.4).

Inferior surface

- Inferior surface of clavicle has the following features:
  - Rough oval impression at medial end of the surface.
  - Longitudinal *subclavian groove* on lateral part of the surface.
  - *Nutrient foramen* at the lateral end of subclavian groove. Nutrient foramen transmits a branch of suprascapular artery. Nutrient foramen is directed away from sternal end.
- *Attachments*
  - *Costoclavicular ligament*: It extends from rough oval impression at the medial end of interior surface to the first costal cartilage and the first rib (Fig. 2.4).
  - *Subclavius* muscle is inserted into the subclavian groove.

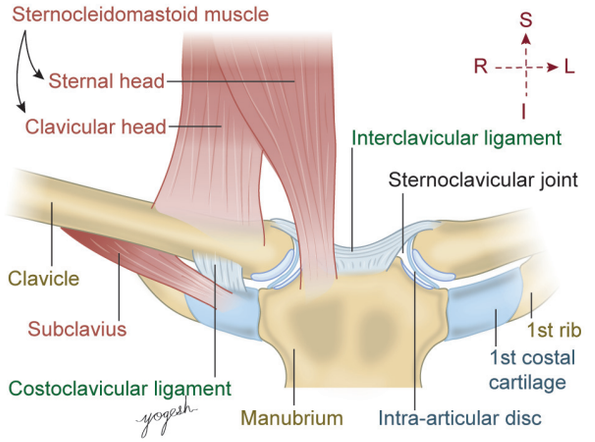


Fig. 2.4: Costoclavicular and interclavicular ligaments

  - *Clavipectoral fascia* is attached to the margins of subclavian groove.

Lateral one-third of clavicle

- Lateral one-third of clavicle is flat and has superior and inferior surfaces, and anterior and posterior borders.

Anterior border

- It is rough and concave forward. It may show a small deltoid tubercle.
- *Attachment*: It gives origin to *deltoid* muscle.

Posterior border

- It is convex backward and thick.
- *Attachment*: It gives insertion to *trapezius* muscle.

Superior surface

- It is rough anteriorly and posteriorly and its middle smooth part is subcutaneous.

Inferior surface

- It shows conoid tubercle and trapezoid ridge.
- *Attachments*

  Coracoclavicular ligaments: It has two parts (Fig. 2.5):

  1. Conoid part – attached to conoid tubercle
  2. Trapezoid part – attached to trapezoid ridge

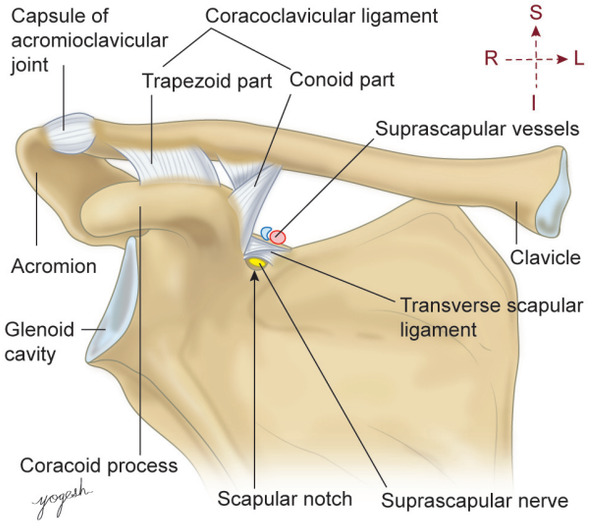


Fig. 2.5: Coracoclavicular and transverse scapular ligaments (right scapula and clavicle, anterior view)

- *Infraspinatus* muscle originates from infraspinous fossa and lower surface of spine.
- *Trapezius* muscle inserts on the upper lip of crest of the spine.
- *Deltoid* muscle originates from the lower lip of crest of the spine.

Acromion process

- Acromion process (acromion) is unexpended plate that projects laterally from the spine.
- Acromion has tip, lateral and medial borders, superior and inferior surfaces.
- Lateral border is continuous with the lower lip of the spine of scapula.
- Medial border of acromion has a facet for articulation with lateral end of clavicle.
- Medial border is continuous with the upper lip of the spine of scapula.
- Superior surface of acromion is rough and is subcutaneous.
- Inferior surface of acromion is smooth.

Attachments[Viva]

- *Trapezius* inserts on medial border of acromion.
- Intermediate fibers of *deltoid* originate from the lateral border of acromion.
- *Coracoacromial ligament* extends between tip of acromion and coracoid process. They all together form coracoacromial arch.
- *Capsule of acromioclavicular joint* is attached to the margin of articular facet.

Some Interesting Facts

- *Acromial angle*: It lies at the junction of lateral border of acromion and lower lip of the crest of spine. Acromial angle forms a palpable subcutaneous bony prominence.

Coracoid process

- Coracoid process arises from the upper part of head of scapula.
- Coracoid process has two parts:
  - Ascending part – broad and stout. It has anterior smooth and posterior rough surfaces.
  - Horizontal part – projects forward. It has lateral and medial borders, upper and lower surfaces, and a tip.

Attachments[Viva, NEXT]

1, 2. *Short head of biceps brachii* and *coracobrachialis* originate from the tip of coracoid process.

3. *Pectoralis minor* inserts on the medial border of horizontal part of coracoid process.

4. *Coracoclavicular ligament*: It has two parts:
   Conoid part is attached at the junction ascending and horizontal parts.
   Trapezoid part is attached to ridge on the superior surface of horizontal part of coracoid process.

5. *Coracoacromial ligament* is attached to the lateral border of horizontal part.

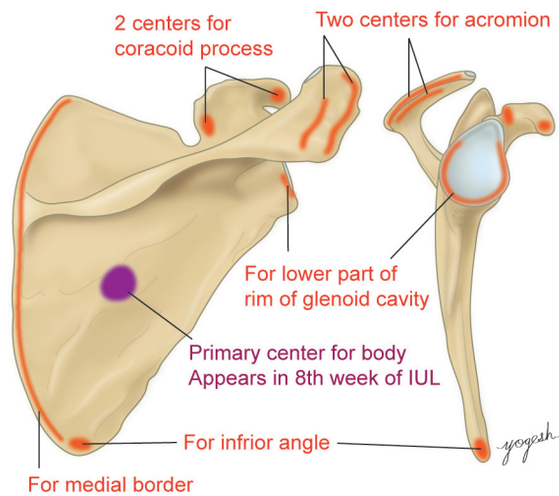
6. *Coracohumeral ligament* is attached to the root of coracoid process.

Some Interesting Facts

- *Atavistic epiphysis*: Coracoid process in reptiles is a separate bone but in human, it is a part of scapula. Thus, coracoid process represents atavistic epiphysis (phylogenetically independent bone).[MCQ, Viva]
- *Palpation of tip of coracoid process*: It can be felt through the skin, about 2.5 cm below the clavicle (at the junction of later one-fifth and medial four-fifths at the lateral border of infraclavicular fossa).
- Infraclavicular part of brachial plexus lies medial and inferior to the coracoid process.

Ossification

- Scapula ossifies from eight centers as follows (Fig. 2.13):
- One primary center for body – appears in 8th week of intrauterine life.
- Seven secondary centers:
  - Two for coracoid process
  - Two for acromion
  - One for medial border
  - One for inferior angle
  - One for glenoid cavity (lower margin)
- First secondary center appears for coracoid process in first year of life. All other secondary centers appear at puberty.



Secondary centers	Appearance	Fusion
For tip of coracoid process	1st year	15th year
All other centers	Puberty	20th year

Fig. 2.13: Ossification of scapula (right scapula, posterior view on the left and right lateral view on the right, Primary center – violet color, secondary centers – orange color).

- *Posterior oblique line* is the upper oblique part of the posterior border that runs obliquely downward and laterally.

Medial (interosseous) border

- Medial border is the sharpest border of radius.
- It begins from posteroinferior part of radial tuberosity.
- In its lower part, the medial border bifurcates to enclose a *triangular area* just above the ulnar notch of radius. [*Previous concept*: This small triangular area may be considered as medial surface of radius.]
- *Attachments*
  - *Interosseous membrane* is attached to the lower three-fourths of interosseous border and to the posterior border of the above-mentioned triangular area.
  - *Pronator quadratus* inserts on the lower-fourth of the anterior surface and triangular area on the medial side of the lower end of radius.

Surfaces

- Radius has three surfaces: Anterior, posterior, and lateral.

Anterior surface

- It lies between anterior and interosseous borders.
- It is narrow above and broader below.
- It is concave anteriorly.
- *Nutrient foramen* is present in the upper part of anterior surface. It is directed upward, as the lower end of radius is growing end.[Viva]
- *Nutrient artery* of the radius is the branch of anterior interosseous artery.[MCQ]
- *Attachments*
  - *Flexor pollicis longus* originates from upper two-thirds of anterior surface of radial shaft.
  - *Pronator quadratus* inserts on the lower-fourth of anterior surface and a small triangular area on the medial side of radius.

Posterior surface

- It lies between posterior and interosseous borders.
- *Attachments*
  - *Abductor pollicis longus* and *extensor pollicis brevis* originate from the posterior surface of radius.

Lateral surface

- It lies between anterior and posterior borders.
- It is convex laterally. A rough oblique ridge is present in the middle of the posterior surface and marks the maximum convexity of the bone.
- Lateral surface is wider above and is continuous with the neck.
- *Attachments*
  - *Pronator teres* inserts in the middle of the lateral surface.
  - *Supinator* inserts on the upper part of the lateral surface.

Lower End

- Lower end of radius is broad and expanded.
- It has 5 surfaces: Anterior, posterior, medial, lateral, and inferior.

Anterior surface of lower end

- It has a thick ridge that separates the anterior surface of shaft of radius from inferior surface of lower end of radius.
- *Attachments*
  - *Palmar radiocarpal ligament* is attached to the ridge-like anterior surface of lower end.

Posterior surface of lower end

It is broad and has grooves and tubercle.

Dorsal tubercle of Lister: It is small pointed tubercle on the posterior surface of radius.[Viva]

Grooves: Posterior surface shows four shallow grooves.

- Relations of grooves[Viva, NEXT]
  1. Lateral most groove – through the groove on the posterior surface of styloid process, the tendons of abductor pollicis longus and extensor pollicis brevis are passing.[NEXT]
  2. Second groove (between Lister's tubercle and styloid process) gives passage the extensor carpi radialis longus and extensor carpi radialis brevis tendon.[NEXT]
  3. Oblique groove (medial to Lister's tubercle) gives passage to extensor pollicis longus tendon.[Viva, NEXT]
  4. Fourth groove (on the medial side of oblique groove) gives passage to extensor digitorum, extensor indicis, posterior interosseous nerve, and anterior interosseous artery.

Medial surface of lower end

- It has *ulnar notch* for head of ulna to form inferior *radioulnar joint*.
- Smooth ridge that separates ulnar notch from inferior surface gives attachment to base of *triangular articular disc* of inferior radioulnar joint.

Lateral surface of lower end

- Lateral surface of the lower end forms *styloid process*.
- It projects downward beyond the rest of the bone.
- Lateral surface of styloid process has groove that gives passage to tendons of abductor pollicis longus and extensor pollicis brevis.[Viva] Radial artery lies medial to the styloid process of radius.[NEXT]
- *Attachments*
  - *Brachioradialis* inserts at the base of styloid process.[NEXT]
  - *Radial collateral ligament* is attached to the tip of styloid process.

Inferior surface of lower end (Fig. 4.7)

- It is concave and triangular.
- It is covered by articular cartilage and participate in wrist joint.[NEXT]

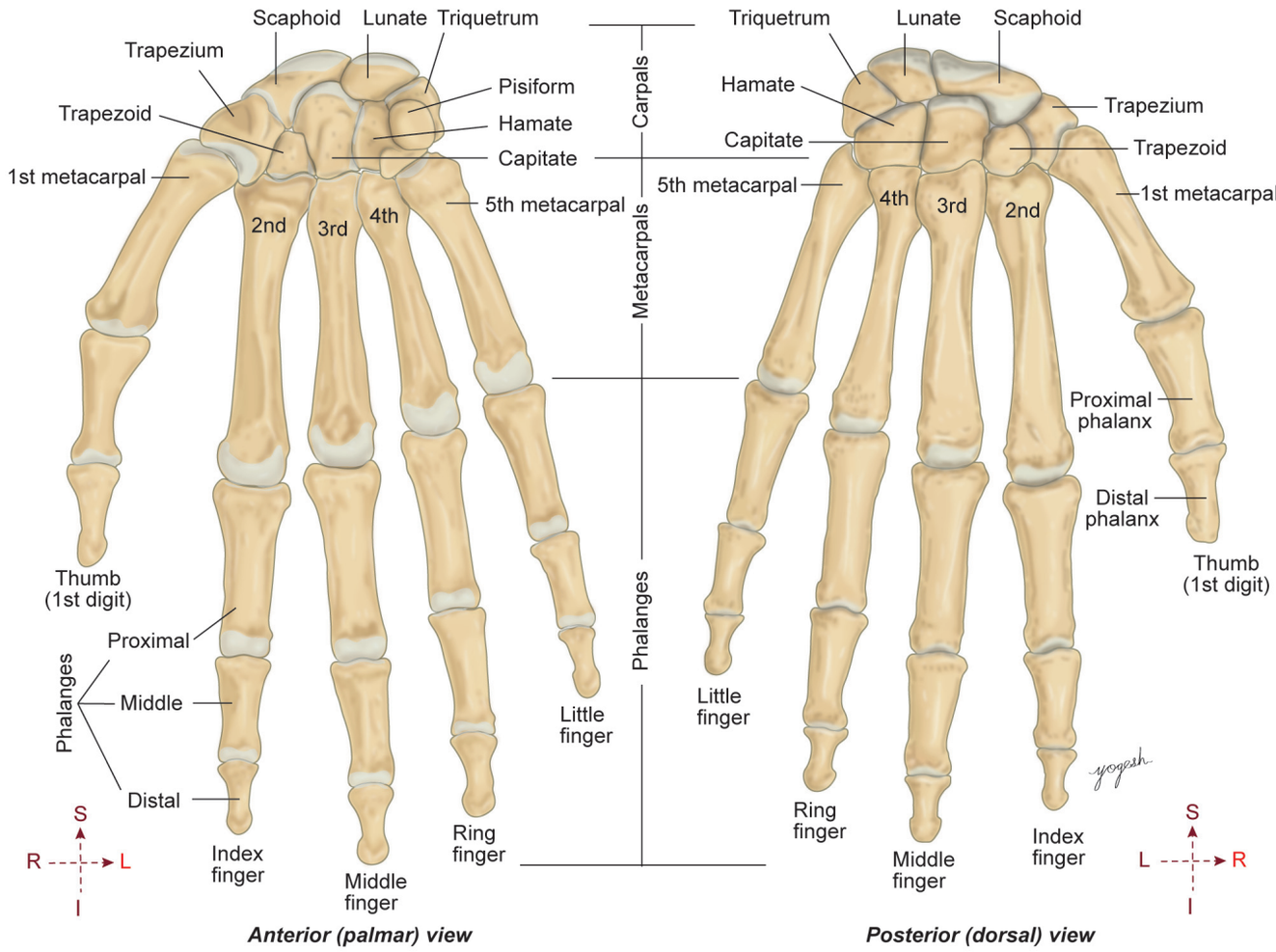


Fig. 5.3: Bones of the hand (right, anterior and posterior views)

Flowchart 5.1: Carpals: Proximal row

Carpals: Proximal row

Scaphoid	*Lunate*	*Triquetrum*	*Pisiform*
Boat-shaped	Semilunar-shaped (moon-shaped)	Wedge-shaped	Smallest carpal
Tubercle		Anteriorly circular facet for pisiform	Pea-shaped
Flexor retinaculum			Flexor carpi ulnaris[I]
Abductor pollicis brevis[O]			Pisiohamate ligament
			Flexor retinaculum
			Abductor digiti minimi[O]
			Extensor retinaculum[O]
Ossification			
5th year	4th year	3rd year	12th year

Flowchart 5.2: Carpals: Distal row

Carpals: Distal row

Trapezium	*Trapezoid*	*Capitate*	*Hamate*
Quadrilateral	Shoe-shaped	Largest carpal bone	Wedge-shaped
Groove for passage of flexor carpi radialis	Adductor pollicis (oblique head)[O]	Has large rounded head	Has hook/hamulus
Crest: Abductor pollicis brevis[O]		Oblique head of adductor pollicis[O]	Flexor retinaculum
Flexor pollicis brevis[O]			Opponens digiti minimi[O]
Opponens pollicis[O]			Flexor digiti minimi[O]
Ossification			
5th year	5th year	2nd month of IUL	3rd month of IUL

- Bones of proximal row (except pisiform) articulate:
  - Proximally with inferior surface of radius and articular disc to form *wrist joint*.
  - Distally with distal row of carpal bones.
- The bones of distal row of carpals articulate distally with metacarpals.

Scaphoid Bone (Figs 5.4, 5.5)

- It is the lateral most and the largest bone of the proximal row of carpals.
- In Greek, *scaphas* means 'boat', and *eidos* means 'kind'.
- Scaphoid is *boat-shaped bone*.[Viva]
- Its long axis is directed downward, forward, and laterally.

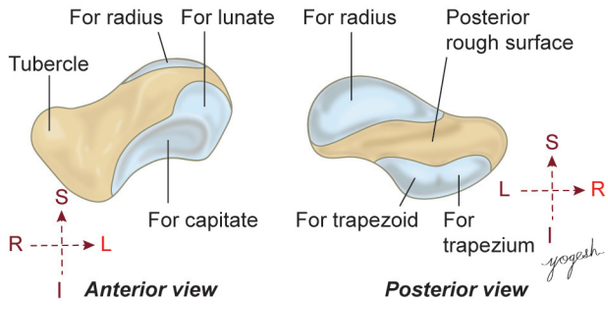


Fig. 5.4: Scaphoid (right, anterior and posterior views)