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Inderbir Singh's Textbook of HUMAN OSTEOLOGY

With ATLAS OF MUSCLE ATTACHMENTS

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

Revised & Edited by
Sushil Kumar

5th Edition

JAYPEE

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Bones of the Upper Limb

3
CHAPTER

CLAVICLE (COLLAR BONE)

The clavicle (*modified long bone*) presents shaft, and two ends. The medial end is quadrilateral; distinguished from the flattened lateral end. The shaft shows a gentle S-shaped curve (convex forward in medial two-thirds; concave forward in lateral one-third). The inferior aspect of the shaft presents a shallow groove **(Figs. 3.1 and 3.2)**.

Side Determination

- *Medial:* Quadrilateral sternal end.
- *Anterior*: Convexity of medial two-thirds of the shaft.
- *Inferior*: Groove for subclavius, conoid tubercle, and trapezoid line.

Anatomical Position

Placed horizontally in the body.

AN 8.3 PECULIARITIES OF CLAVICLE

- First bone to start ossifying in the body
- Only long bone that ossifies in membrane (greater part)
- Only long bone which has two primary centers of ossification
- Only long bone placed horizontally
- Only long bone that lacks medullary cavity
- Subcutaneous throughout its extent
- Occasionally pierced by middle supraclavicular nerve.

Functions

- Supports shoulder laterally and backward so that the arm can swing clearly away from the trunk.
- Transmits the weight/force from the upper limb to the sternum
- Clavicular movements at sternoclavicular joint permits overhead abduction.



Fig. 3.1: Right clavicle from above.

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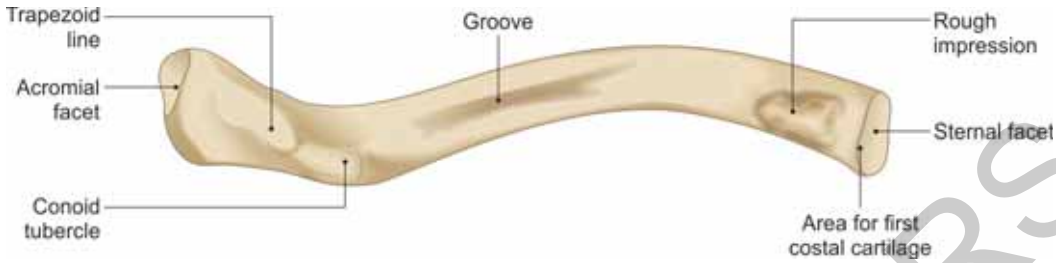


Fig. 3.2: Right clavicle from below.

General Features

Shaft: The shaft is divided into the lateral one-third (flattened) and the cylindrical medial two-thirds. *Lateral one-third* of the shaft has superior and inferior surfaces; separated by anterior and posterior borders. The anterior border is concave and shows a small *deltoid tubercle*. The inferior surface shows a prominent thickening near the posterior border—the *conoid tubercle*. Lateral to the tubercle, a rough ridge runs obliquely up to the lateral end of the bone called the *trapezoid line*.

Medial two-thirds of the shaft presents four surfaces (anterior, posterior, superior, and inferior) which merge with each other.

Ends: Lateral (acromial) end has a smooth facet which articulates with the acromion of the scapula to form the acromioclavicular joint.

Medial (sternal end) articulates with the manubrium sterni and the first costal cartilage. The articular area is smooth; extends for a short distance on to the inferior surface of the bone. The sternal end forms a prominent bulge which extends above the upper border of the manubrium sterni **(Fig. 3.3)**.

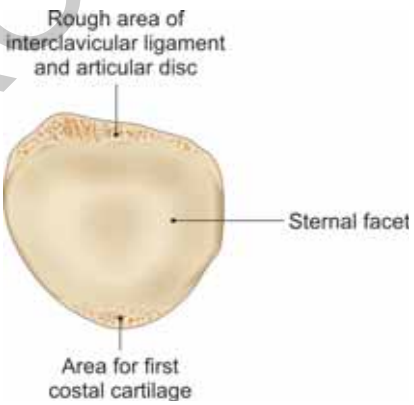


Fig. 3.3: Medial end of clavicle: Medial aspect.

***Movements*:** Clavicle moves round an axis of the costoclavicular ligament. Thus, the two ends of the bone move in opposite directions.

Attachments on the Clavicle (Figs. 3.4 and 3.5)

Muscles

Muscle	Attachment
Pectoralis major *(clavicular head)*	Anterior surface of the medial half of shaft (*origin*)
Deltoid	Anterior border of lateral one-third of shaft (*origin*)
Sternocleidomastoid *(clavicular head)*	Medial part of the upper surface (*origin*)
Sternohyoid	Lower part of posterior surface near sternal end (*origin*)
Trapezius	Posterior border of lateral one-third of shaft (*insertion*)
Subclavius	Groove on the inferior surface of shaft (*insertion*)

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- ***Weight transmission from upper limb:*** Clavicle is a connection between appendicular and axial skeleton. Coracoclavicular ligament transmits weight from the upper limb onto the clavicle which passes it onto the sternum.
- ***Craniocleidodysostosis:*** There is faulty ossification of the membranous bones. This rare abnormality is associated with congenital absence of one or both clavicles. The patient can bring both shoulders close to each other in front of chest **(Fig. 3.7)**.



Fig. 3.7: Cleidocranial-dysostosis.

Measurement of Upper Limb

Following bony landmarks are used:
- Tip of acromion process to medial epicondyle of humerus.
- From medial epicondyle of humerus to styloid process of ulna.

QUESTIONNAIRE

- Classify the bone. How does it differ from other long bones?
- Side determination and anatomical position.
- Enumerate the peculiarities of the clavicle.
- What are the joints associated with clavicle and their types?
- Mark the attachments of:

Ligaments	Muscles
Costoclavicular	On medial one-third of shaft
Coracoclavicular (conoid and trapezoid parts)	On lateral one-third of shaft
Interclavicular	On subclavius groove
Clavipectoral fascia	

- Comment on its ossification. Which is the growing end?
- Which is the most vulnerable part of the clavicle? Why?
- What is the function of the coracoclavicular ligament?

SCAPULA (SHOULDER BLADE)

The scapula is a large triangular (*flat*) bone. It is placed on the posterolateral side of the chest wall. It extends from the second to the seventh ribs.

Side Determination

- *Lateral*: Glenoid cavity
- *Inferior*: Inferior angle
- *Dorsal*: Spinous process.

Anatomical Position

- Glenoid cavity is directed anterolaterally
- Costal surface is directed medially and forward.

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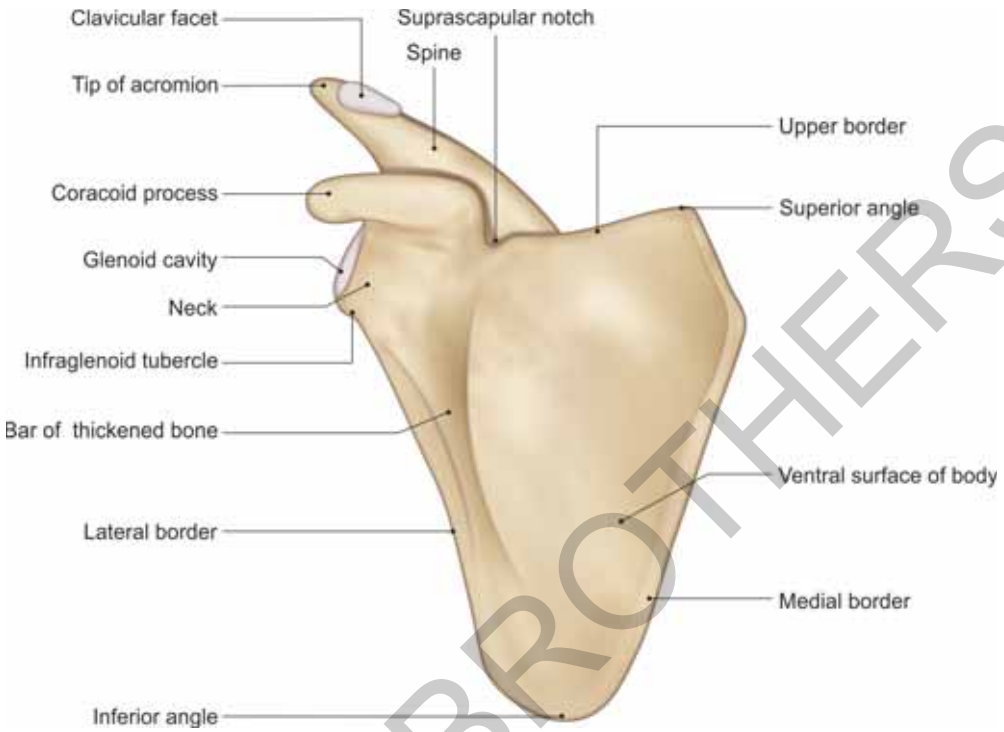


Fig. 3.8: Right scapula: From the front.

The greater part of the scapula (flat triangular plate) is the *body*. The upper part of the body is broad (*base of triangle*) and the inferior end (*apex*) is pointed. The body presents anterior (costal) and posterior (dorsal) surfaces. The anterior surface is smooth. The upper part of the posterior surface has a large projection called the spine or spinous process. At its lateral angle, scapula presents large shallow depression called the *glenoid cavity* which articulates with the head of the humerus **(Figs. 3.8 to 3.10)**. The body presents:

- *Three angles*: (a) Superior, (b) inferior, and (c) lateral.
- *Three borders*: (a) Medial, (b) lateral, and (c) superior.

Three processes arise from the body:

- Spinous process
- Acromion process
- Coracoid process.

Lateral border runs from the glenoid cavity to the inferior angle.
Medial border extends from the superior angle to the inferior angle.
Superior border passes laterally from the superior angle; separated from the glenoid cavity (*lateral angle*) by the root of coracoid process. The *suprascapular notch* is seen at the lateral end of the superior border.

The concave *costal surface* lies against the posterolateral part of the chest wall. The spine divides *dorsal surface* into *supraspinous* and *infraspinous fossae*. Both fossae communicate through the *spinoglenoid notch*.

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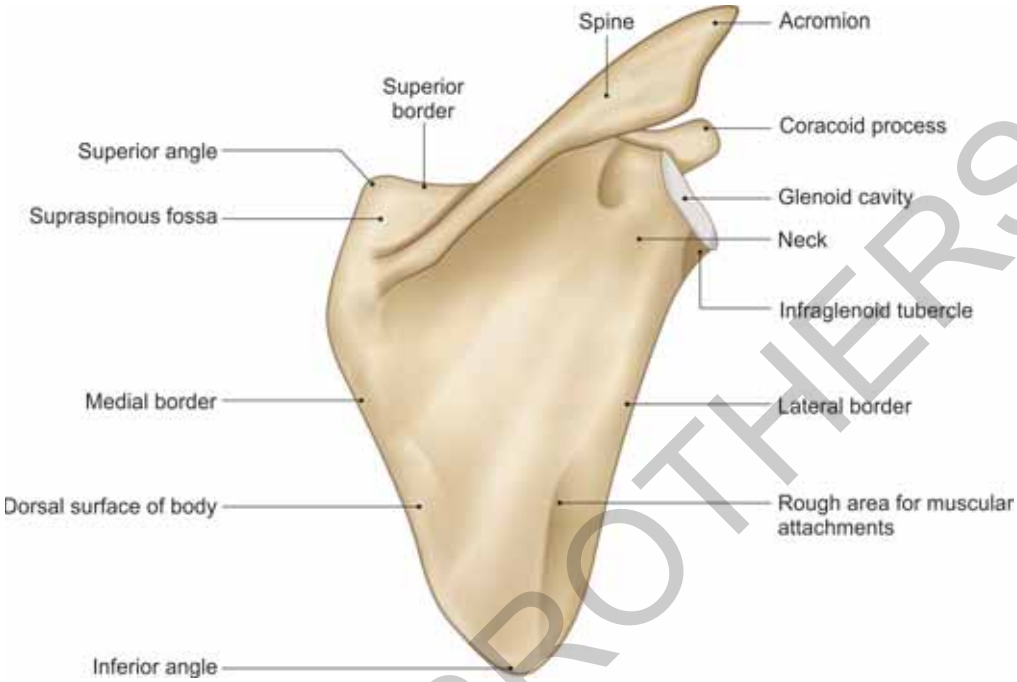


Fig. 3.9: Right scapula: From behind.

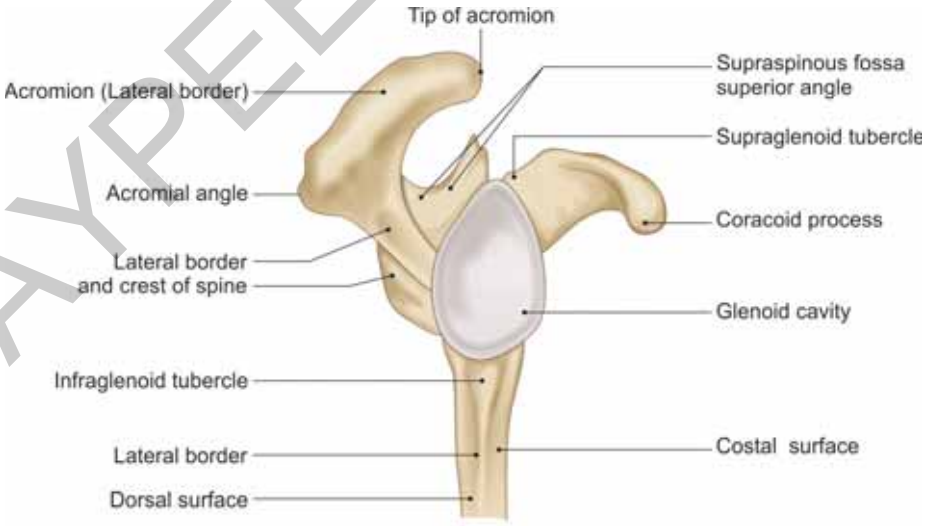


Fig. 3.10: Upper part of right scapula: From the lateral side.

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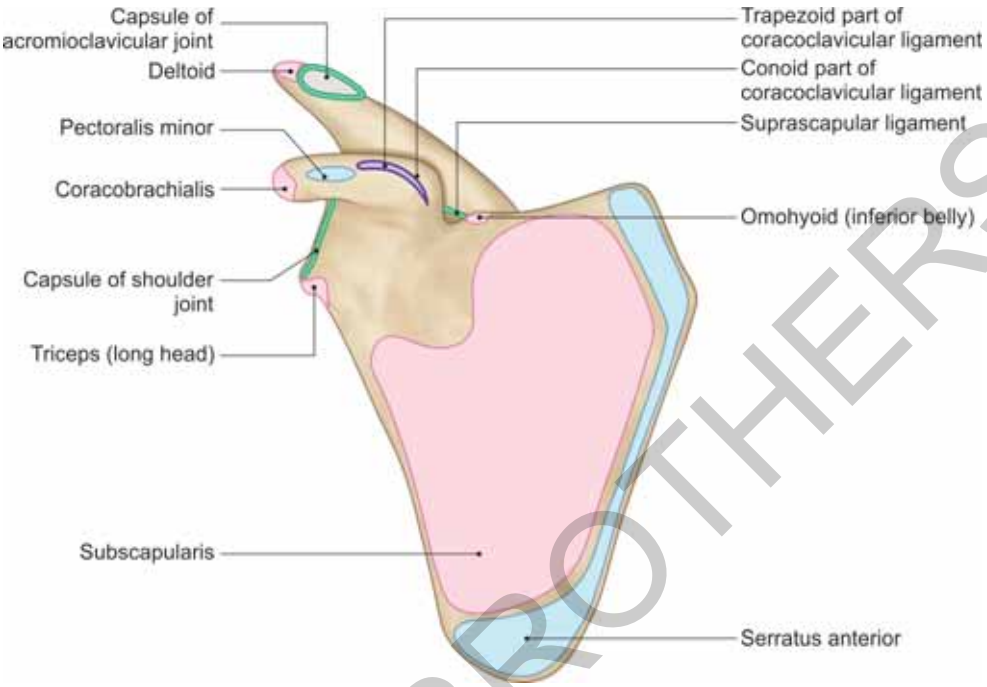


Fig. 3.11: Right scapula: Attachments seen from the front.

The bone adjoining the lateral border is thickened to form a longitudinal bar of bone. The dorsal aspect of the scapula adjoining lateral border is rough for muscular attachments.

The pear-shaped *glenoid cavity* (*head of scapula*) forms the shoulder joint with the head of the humerus. Just below the cavity the lateral border shows a rough raised area called the *infraglenoid tubercle*. Immediately above the glenoid cavity *supraglenoid tubercle* is noted. Immediately beyond glenoid cavity there is a constriction which constitutes the *neck*.

Spinous process is triangular shaped. Its anterior border is attached to the dorsal surface of the body. Its posterior border is free and forms the *crest of spine*. The medial end of the spine forms the *root of spine*. The lateral border of the spine is free and forms the medial boundary of the *spinoglenoid notch*.

Acromion process continues with the lateral end of the spine; forms a projection that is directed forward. It has lateral and medial borders that meet anteriorly at the tip of the acromion. The lateral border meets the crest of the spine at a sharp angle—the *acromial angle*. The medial border shows a small oval facet for articulation with the lateral end of the clavicle. Acromion presents upper and lower surfaces.

Coracoid process is shaped like a bent finger. The root of the process is attached to the body of the scapula just above the glenoid cavity. The lower part of the root is marked by the supraglenoid tubercle. The tip of the coracoid process is directed forward. (*note*: costal surface of the body of scapula faces anteromedially; glenoid cavity faces forward and laterally).

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Muscles

Muscle	*Attachment*
Deltoid	Lower border of the crest of spine; lateral margin, tip and upper surface of acromion (*origin*)
Trapezius	Upper border of the crest of spine and medial border of acromion (*insertion*)
Biceps brachii (short head)	Tip of coracoid process (*origin*)
Biceps brachii (long head)	Supraglenoid tubercle (*origin*)
Coracobrachialis	Medial part of the tip of coracoid process (*origin*)
Long head of triceps	Infraglenoid tubercle (*origin*)
Pectoralis minor	Superior aspect of coracoid process (*insertion*)
Inferior belly of omohyoid	Upper border near suprascapular notch (*origin*)
Subscapularis	Costal surface, except for a small part near neck (*origin*)
Serratus anterior	Costal surface along medial border: *First digitation* extends from superior angle to root of spine, *next 2–3 digitations* into a narrow line along the medial border, *lower 4–5 digitations* into triangular area over inferior angle (*insertion*)
Supraspinatus	Medial two-thirds of supraspinous fossa, including upper surface of spine (*origin*)
Infraspinatus	Greater part of infraspinous fossa, except near lateral border and neck (*origin*)
Teres minor	Upper two-thirds on the lateral border; dorsal surface (*origin*)
Teres major	Lower one-third along the dorsal aspect of lateral border up to inferior angle (*origin*)
Levator scapulae	Dorsal aspect of medial border, extending from superior angle to root of spine (*origin*)
Rhomboideus minor	Dorsal aspect of medial border, opposite root of spine (*origin*)
Rhomboideus major	Dorsal aspect of medial border, from root of spine to inferior angle (*origin*)
Latissimus dorsi	Dorsal surface of inferior angle (*origin*)

Ligaments

Ligament	*Attachment*
Capsule of shoulder joint and glenoid labrum	Margins of glenoid cavity; in upper part, capsular attachment extends above supraglenoid tubercle (origin of long head of biceps brachii is intracapsular)
Capsule of acromioclavicular joint	Margins of the facet for the clavicle
Coracoacromial ligament	Anteromedial end to lateral border of coracoid process; lateral end to medial aspect of the tip of acromion in front of clavicular facet
Coracoclavicular ligament	Coracoid process: *Trapezoid part* on superior aspect and *conoid part* near the root
Suprascapular ligament	Suprascapular notch; converts it into a foramen—transmits suprascapular nerve; suprascapular vessels pass above the ligament

Ossification

Scapula has eight centers of ossification.

❖ A center appears in the body during 8th week of fetal life; spine ossifies by extension from this center.

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QUESTIONNAIRE

- Identification of carpal bones.
- Scaphoid: Why avascular necrosis of scaphoid is common?
- Lunate: What are the muscles attached to it?
- Pisiform: Type of bone and ossification.
- Hamate: Which nerve is related to hook of hamate?
- Trapezium: What is attached to its groove?
- What are the attachments of the flexor retinaculum?
- Enumerate the structures passing superficial and deep to flexor retinaculum?
- Comment on the ossification of the carpal bones.
- Classify the joints in the hand:
  - Radiocarpal joint
  - First carpometacarpal joint
  - Carpometacarpal joints of fingers
  - Interphalangeal joints.

MOVEMENTS AT MAJOR UPPER LIMB JOINTS

Shoulder Joint (Fig. 3.68)

Type	*Axis*	*Movements*
Ball and socket	Multiaxial	Flexion and extension, Abduction and adduction, Medial and lateral rotations and Circumduction

Elbow Joint (Fig. 3.69)

Type	*Axis*	*Movements*
Hinge	Uniaxial	Flexion and extension

Superior and Inferior Radioulnar Joints (Fig. 3.70)

Type	*Axis*	*Movements*
Pivot	Uniaxial	Supination and pronation

Wrist Joint (Figs. 3.71A to D)

Type	*Axis*	*Movements*
Ellipsoid	Biaxial	Flexion and extension, Abduction and adduction, Circumduction

Metacarpophalangeal Joints (Figs. 3.72A to D)

Type	*Axis*	*Movements*
Condylar	Biaxial	Flexion and extension Abduction and adduction

Interphalangeal Joints (Figs. 3.73A and B)

Type	*Axis*	*Movements*
Hinge	Uniaxial	Flexion and extension

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- Brief account of important clinical considerations with addition of new images at the end of several topics to generate interest
- Provided questionnaire at end of topics to prepare students for theory and viva-voce examinations.

Brig (Dr) Sushil Kumar MBBS MS (Anatomy) is an alumnus of prestigious Maulana Azad Medical College, New Delhi, India who obtained his MBBS (1986) and MS (1991). After obtaining his Postgraduate degree he worked as Senior Resident in the Department of Anatomy of his alma mater for two years. After joining Army, he joined numero uno Armed Forces Medical College (AFMC), Pune, Maharashtra as Reader in 1995. He has worked in AFMC for twenty years in various capacities including Professor and Head, Department of Anatomy for five years. He is on the editorial boards of many medical journals. To his credit are about 25 research papers published in national and international journals of repute. He has also published twelve books on various subjects of Anatomy. He is the undergraduate and postgraduate examiner and paper setter of Anatomy of many Indian universities including prestigious National Board of Examinations, New Delhi. His core interest areas include Clinical Anatomy and Medical Education.

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