SNS COLLEGE OF PHYSIOTHERAPY

Affiliated to the Tamil Nadu Dr. M.G.R. Medical University, Chennai (Subject to Approval)

Subject : Anatomy

Topic : Upper Limb

Batch : B.P.T I year (2020-2021)

Syllabus:-

1. **OSTEOLOGY**

Identify parts, borders, surfaces, attachments of bones– **clavicle, scapula, humerus, radius, ulna, carpal bones, Meta carpal, phalanges**.

2. **ARTHROLOGY**

Type, articular surface, muscle, ligaments, movements blood supply, nerve supply of **joints-Sterno clavicular, acromio clavicular, shoulder, elbow, radio ulnar, IP, MCP, CMC**

3. **MYOLOGY**

Identify muscles – **origin, insertion, nerve supply**, action of muscles of Scapula, upper arm, lower arm

4. **NEUROLOGY**

Identify nerves of upper limb and its origin, course, division, innervations, Relation, its applied anatomy of **radial nerve, median nerve, ulnar nerve, Axillary nerve, musculocutaneous nerve. Brachial plexus** – formation and root values. Dermatome of UL.

5. **ANGIOLOGY**

Distribution of blood vessels, lymph nodes, main arteries and veins of UL - Axillary, brachial, radial, ulnar arteries.

6. **AXILLA**

Identify boundaries, contents of axilla, branches of axillary artery and its relation.

7. **Scapulo thoracic rhythm**

8. **Cubital fossa** – Boundaries , contents, relation

Which acts as a grasping/manual tool in our body?

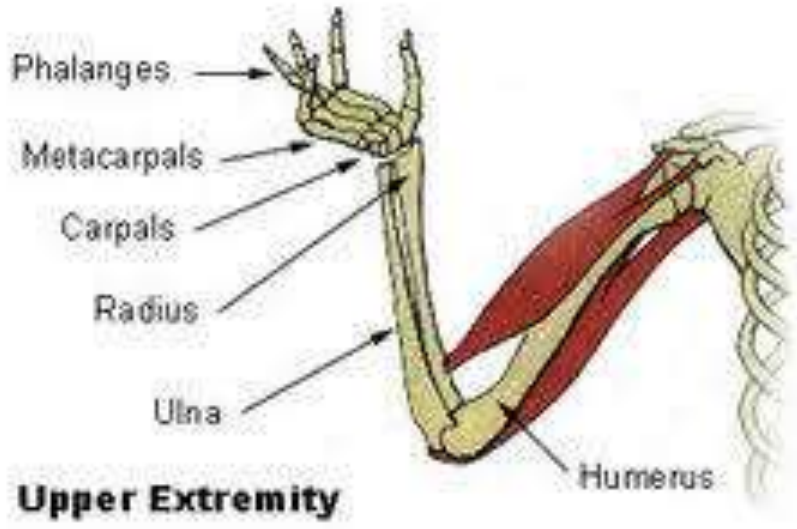
Which is the highly skilled part in our body?

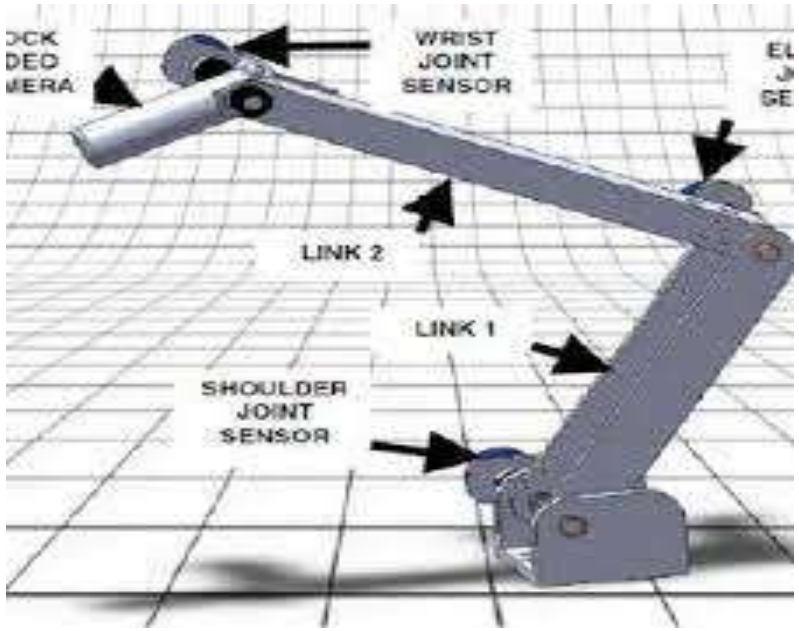
Which gives stability

Limbs

- **Animal** had two pairs of limb i.e., Fore limb and Hind limb, which does weight bearing and helps in locomotion.
- Hence they are quadrupeds (quadri- four ; ped[al]- foot) e.g., cow, dog etc
- **Human-** Erect posture, (bi- two; ped[al]- foot)
- Lower limb became the weight bearers and upper limb was set free, allowed to perform prehensile/ manupulative activities in environment like reaching, grasping, holding, picking etc.,

- Upper limb acts as a joint lever





- a rigid bar resting on a pivot, used to move a heavy or firmly fixed load with one end when pressure is applied to the other.

- Shoulder acts as a base for the upper limb and allows the limb to reach.
- Highly mobile joint hence allowing upper limb to reach wide varieties of angle

Elbow

- Alters the lever/ length of the upper limb
- Which allows in correct placement of hand

Hand

- Perform prehensile/ manupulative activities in environment like grasping, holding, picking etc.,
- Hand is the most skillful part, having larger area of representation in the cerebral cortex (Brain)

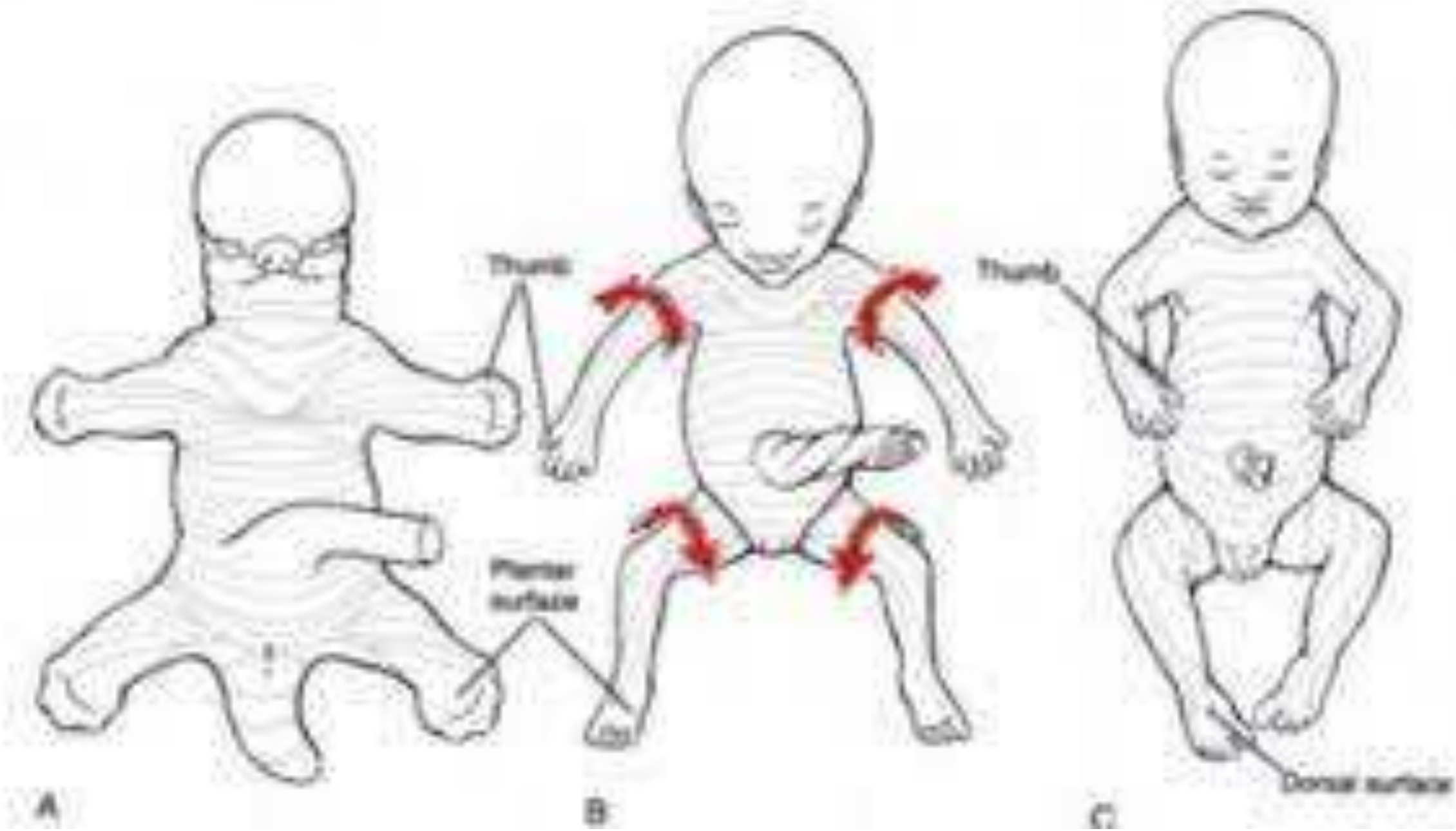
Types of grips:

- Power grip (used for gross movements, primitive)
- Precision grip (used for skillful movements, advanced)

- Precison hands activities are exclusive for human, as a result humans could make advancements in arts, crafts and technology
- Hence man is called as **“*master mechanic of the animal world*”**

Evolution in Upper Limb

- Rotatory movements in forearm (supination & pronation)
- Upperlimb placed away from the body, with the inclusion of a connecting bone called clavicle.
- Rotation of thumb to 90^{o} of opposition
- Suitable changes for free mobility of hand and fingers.


Thumb
Plantar surface
Thumb
Dorsal surface
A
B
C

- Upper limb is connected to the trunk by **pectoral girdle (PG)**

(Note: Limb girdle: bones that connect the limbs to axial skeleton)

- Composed of 2 bones – Clavicle & Scapula

- PG connected to the trunk only anteriorly, hence incomplete.

- Function: site of attachment for numerous muscles (acting on arm & forearm)

PARTS OF UPPER LIMB

4 major parts:

- Shoulder
- Arm or Brachium
- Forearm or Antebrachium
- Hand or Manus

Shoulder region

- Includes:

(a) Axilla or Armpit

(b) Scapular region

(c) Pectoral or Breast region

- Bones of shoulder girdle:

(a)Clavicle (Collar bone)

(b) Scapula (Shoulder blade)

Arm

- Extending between shoulder and elbow
- Longest segment of upper limb
- Bone od arm:
- Humerus : articulates with scapula forming shoulder joint
- upper ends of radius & ulna forming elbow joint

Forearm

- Extending between elbow and wrist joints
- Bones of forearm: **Radius** (laterally)

&

Ulna (medially)

Articualtion : with lower end of humerus forming elbow joint

with proximal surface of distal row of carpal bones forming wrist joint

Hand (Manus)

Parts:

a) Wrist / Carpus
b) Hand proper / Metacarpus
c) Digits / thumb and fingers

Wrist / Carpus

- 8 Carpal bones arranged in two rows (proximal & distal) 4 bones per row
- Carpal bone articulate with

a) With each other at intercarpal joints
b) Proximally with radius forming radio-carpal wrist joint
c) Distally with metacarpal bones at carpometacarpal joints

Hand proper / Metacarpus

- 5 metacarpal bones (1 to 5 from lateral to medial in anatomical position)
- Articulate :

❖Proximally with the distal row of carpal bones forming carpometacarpal joints

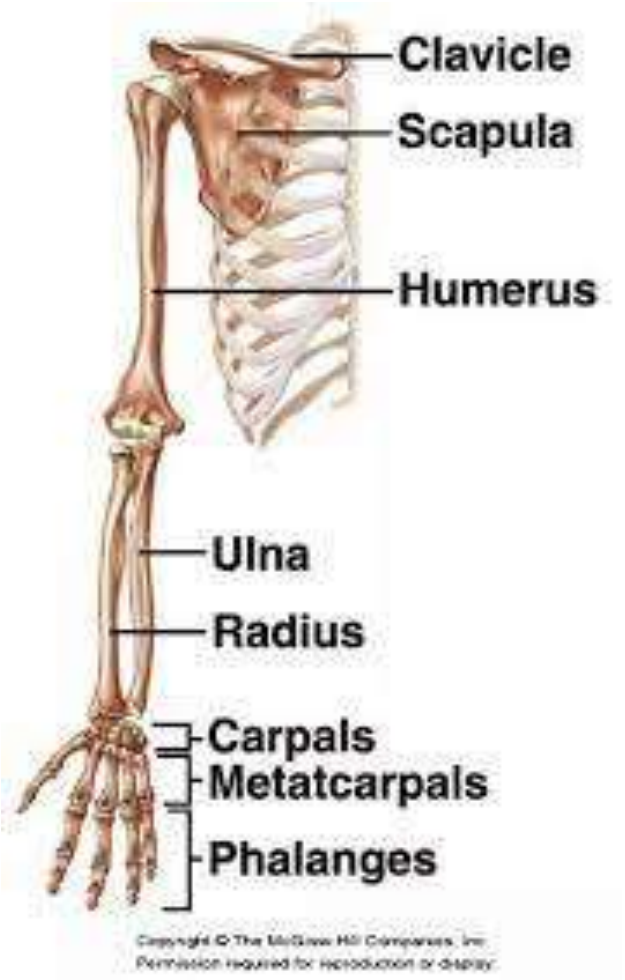
❖With eachother forming intermetacarpal joints

❖Distally with proximal phalanges, forming metacarpophalangeal joints

Digits / thumb and fingers

- 5 and numbered 1 – 5 from lateral to medial side
- 1st digit thumb and remaining all are fingers
- Each digit supported by three short long bones –phalanges– excepts the thumb which having only two

Bones of the upper limb (Osteology)

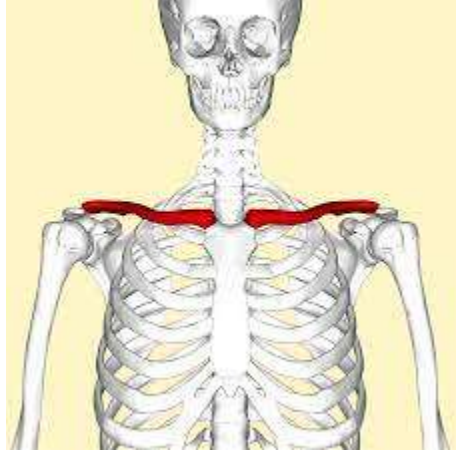


- UL - 64 bones, out of 206 total bones

Why to study bone-

- Understanding general topography
- Attachment of various muscles and ligaments
- Position of articulations/ joints
- Movements executed by UL
- Genesis of fracture.

Clavicle



- Latin word., clavicle: key ; synonym- collar bone
- Long bone having slight S shape
- Location:- anterior aspect, at junction of root of neck and trunk
- Articulation:-

➢Medially- Sternum

➢Laterally- Acromion process of scapula

- Entire bone cane be palpated, since placed subcutaneously.

Functions

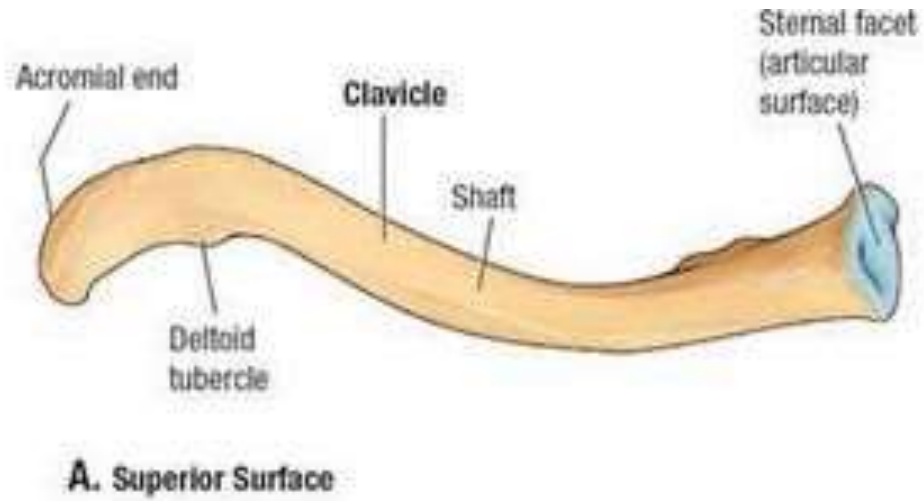
- Strut which keeps UL away from trunk, allowing the limb to move freely.
- Transmit force from upper limb to axial skeleton
- Area for the attachment of muscles

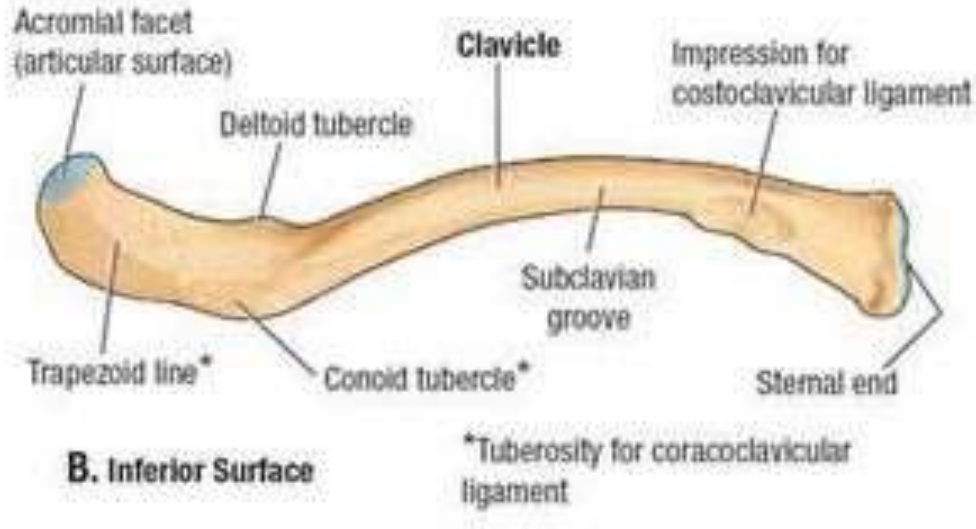
Peculiarities

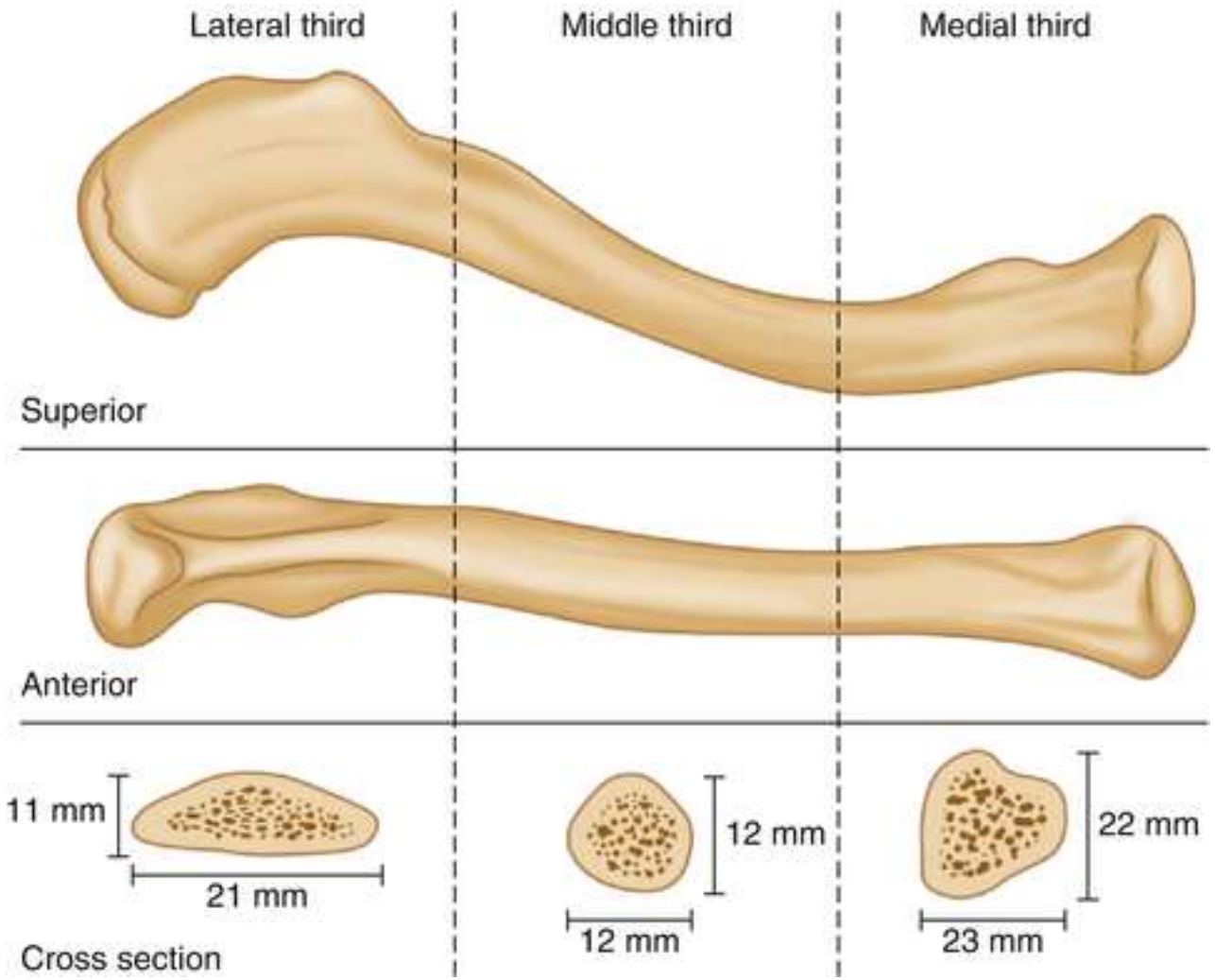
- Only long bone that lies horizontally
- No medullary cavity
- Subcutaneous throughout its extent
- First bone to start ossifying (b/w 5^{th} to 6^{th} weel of intrauterine life) and last bone to complete its ossification (@ 25 years)
- Having two primary ossification center
- Ossifies in membrane except for its medial end which ossifies in cartilage

Parts of Clavicle- Shaft and two ends

1.Shaft- Curved, divided into lateral (one third) & medial (two third)






Lateral third
Middle third
Medial third
Superior
Anterior
11 mm
21 mm
12 mm
12 mm
22 mm
23 mm
Cross section

Lateral one third: flattened from above downwards

- Borders – **Anterior** :concave forwards, deltoid tubercle (origin for deltoid muscle) & **Posterior** (convex backwards, insertion to trapezius muscle)
- Surfaces- **superior** (subcutaneous) & **inferior** (conoid tubercle, trapezoid ridge)
- Trapeziod ridge:-
- Provides attachment to conoid and trapezoid parts of coracoclavicular ligament respectively.

Medial two thirds: Cylindrical

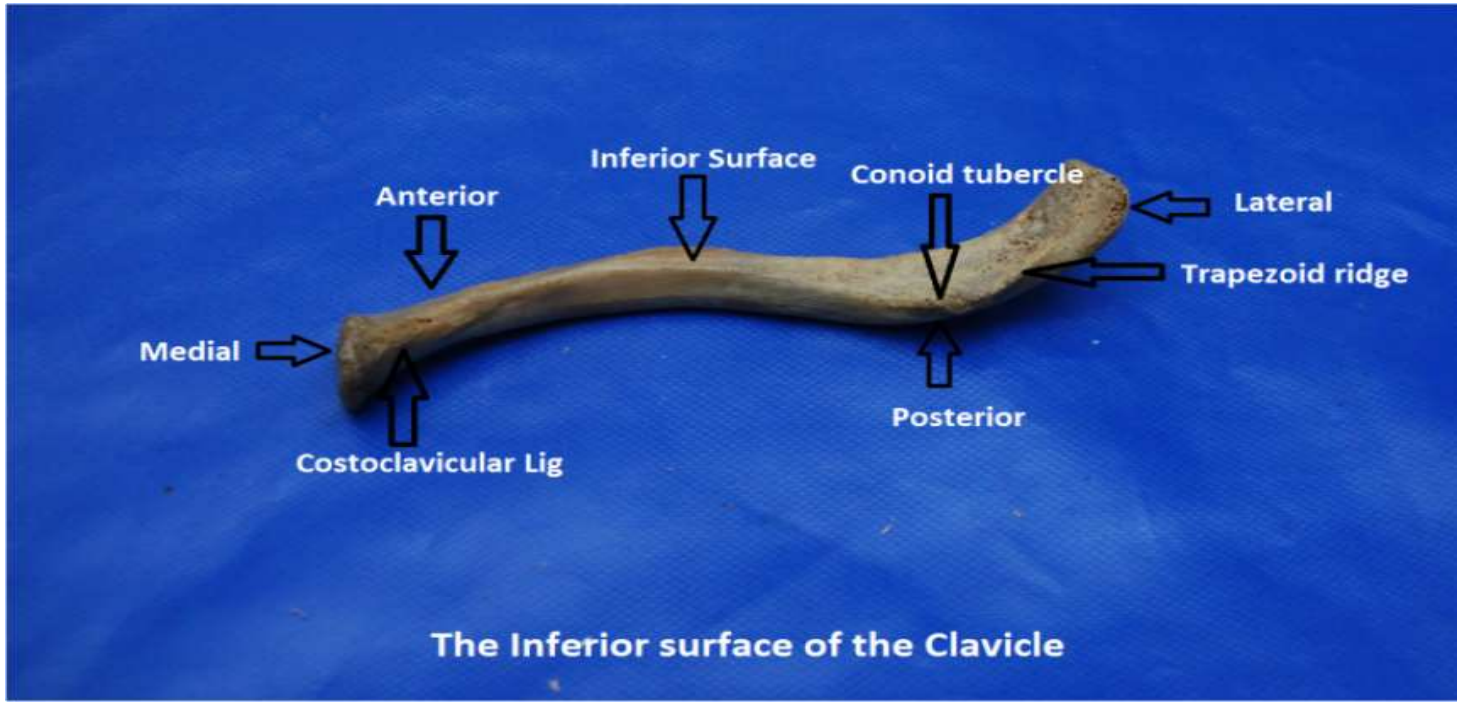
Surfaces:

Anterior→ convex forward, origi
to clavicular head of pectoralis major

Posterior→ , concave backward,Smooth

Superior→ rough medially

Inferior→ rough oval impression at medial end, longitudinal subclavian groove (nutrient foramen lies at the end of groove



Ends of Bone- Lateral and Medial ends

- **Lateral or Acromial end-** oval facet articulating with acromion process of scapula forming acromioclavicular joint.
- Attachment:

Fibrous capsule of acromioclavicular joint

Medial or Sternal end-

Quadrangular (saddle shaped articulating surface) articulating with clavicular notch of manubrium sterni forming sternoclavicular joint

Attachment:

- ❖Fibrous capsule of acromioclavicular joint
- ❖Articulating disc
- ❖Interclavicular ligament

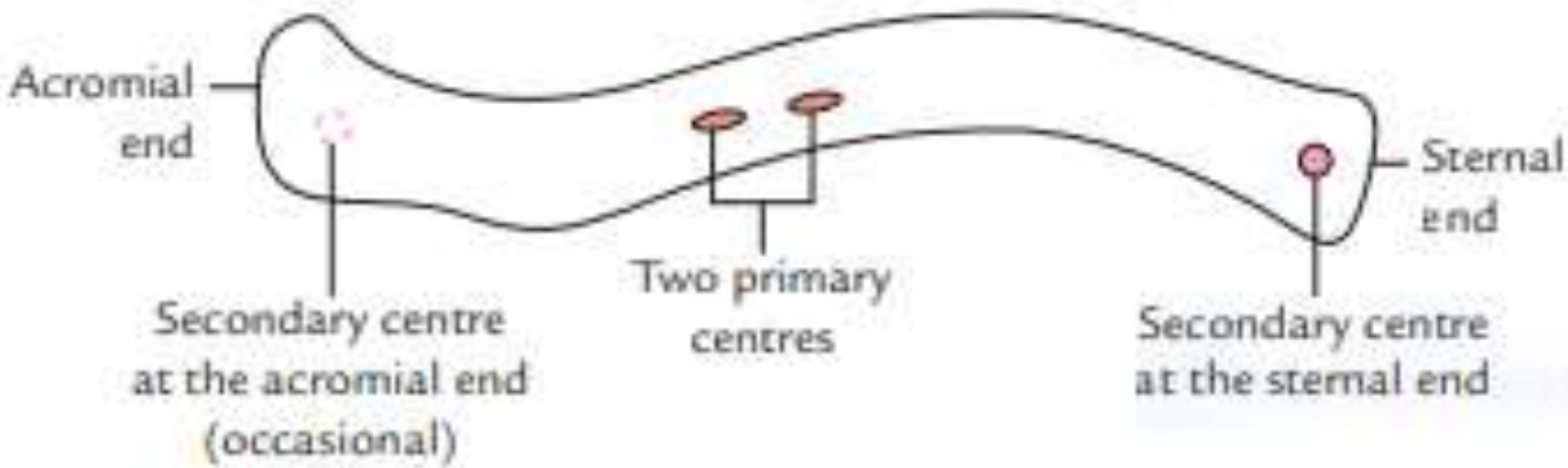
Side Determination

- Lateral end flat; Medial end quadriangular
- Medial two third convex anteriorly; Lateral one third concave anteriorly
- Inferior surface, longitudinal groove in middle

Ossification

- Ossification in membranocartilaginous
- Whole ossifies in membrane, medial end ossifies in cartilage
- 4 ossification centers: two primary centers for shaft, one for each end

Site of appearance	Time of appearance	Time of fusion
2 primary centers (medial & lateral) in the shaft	5-6 weeks of intrauterine life (IUL)	45th day of IUL
Secondary center at sternal end	19-20 years (2 years earlier in female)	25TH year
Secondary center at acromial end	20th year	Fuses immediately

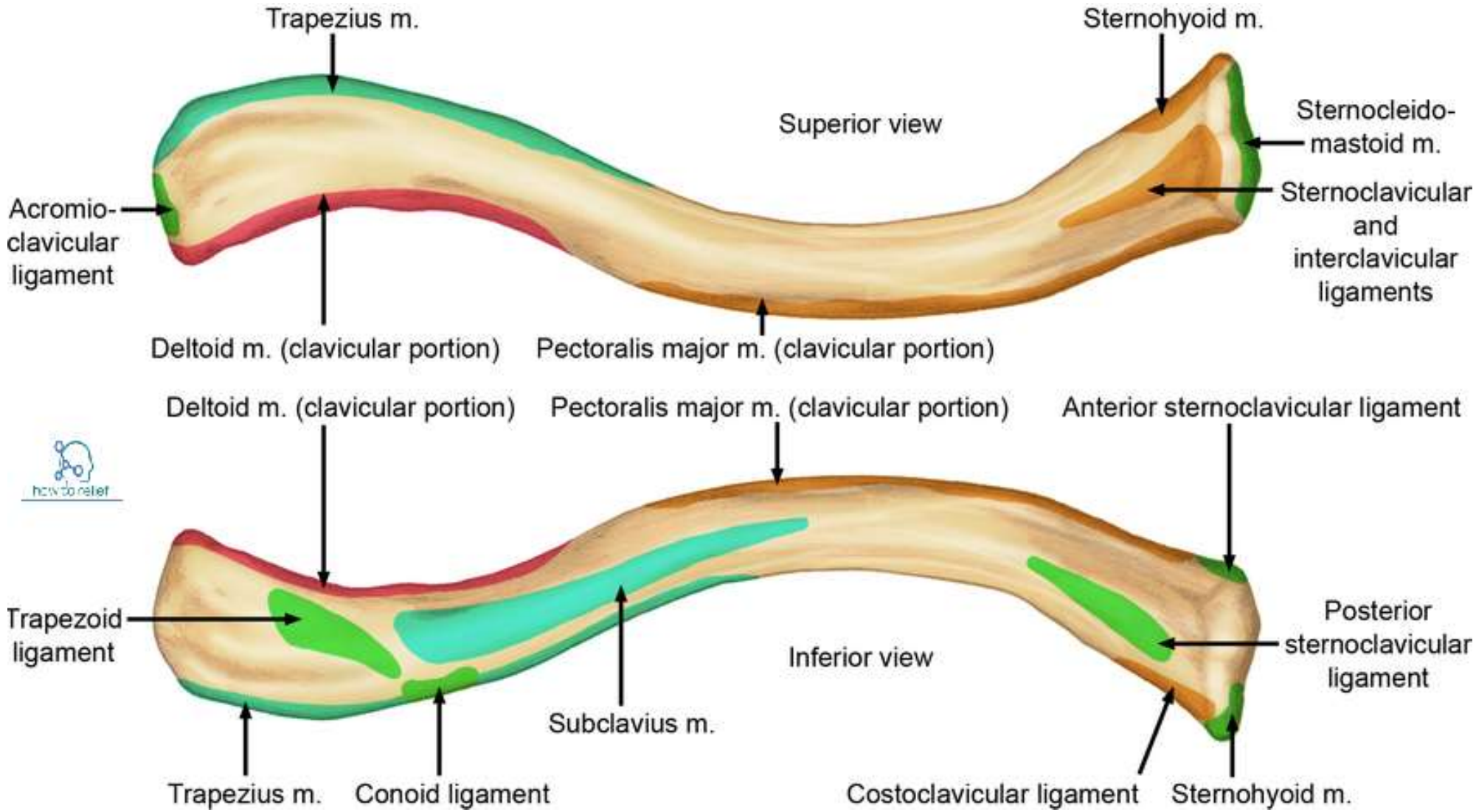

Acromial end
Sternal end
Two primary centres
Secondary centre at the acromial end (occasional)
Secondary centre at the sternal end

Growing end of clavicle

- Sternal end of clavicle
- Epiphysis appears at the age of 19–20 years and unites with the shaft at 25 years.
- Last epiphyses to fuse with shaft in the body.
- The radiological appearance of this epiphysis in females confirms their bone age for legal consent to marriage

Muscles and ligaments

Muscles	Ligaments
Pectoralis major	Coracoclavicular
Sternocleodomastoid (claviculra head)	Costoclavicular
Deltoid	Interclavicular
Trapezius	
Subclavius	


Trapezius m.
Sternohyoid m.
Superior view
Sternocleido-
mastoid m.
Acromio-
clavicular
ligament
Sternoclavicular
and
interclavicular
ligaments
Deltoid m. (clavicular portion)
Pectoralis major m. (clavicular portion)
Deltoid m. (clavicular portion)
Pectoralis major m. (clavicular portion)
Anterior sternoclavicular ligament
Trapezoid
ligament
Posterior
sternoclavicular
ligament
Inferior view
Subclavius m.
Trapezius m.
Conoid ligament
Costoclavicular ligament
Sternohyoid m.

Clinical correlation

Fracture of clavicle

- Commonly fractured bone in the body.
- **Site:** junction of its lateral one-third and medial two-third
- The fracture at the junction of lateral one third and medial two-third occurs because:

(a) This is the weakest site.

(b) Two curvatures of clavicle meet at this site.

(c) The transmission of forces (due to impact) from the clavicle to scapula occur at this site through coracoclavicular ligament

Mechanism:

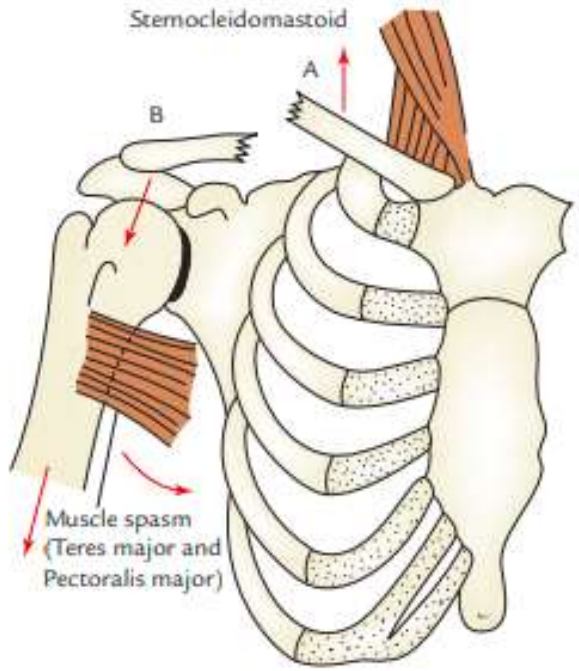
- Blows to the shoulder or indirect forces,
- Strong impact on the hand or shoulder,
- When person falls on the outstretched hand or the shoulder.

Find it out!!!

FOOSH ???

Bony displacement after fracture

	LATERAL FRAGMENT	MEDIAL FRAGMENT
Direction of displacement	Downward & medial	Upward
Cause of displacement	Downward-Weight of upper limb Medial- Pull of shoulder adductors	Pull of sternocleidomastoid


Sternocleidomastoid
A
B
Muscle spasm
(Teres major and
Pectoralis major)

How do they present?

- Characteristic clinical picture that of a man/woman supporting his sagging upper limb with the opposite hand.

Radiological view

Congenital anomalies:

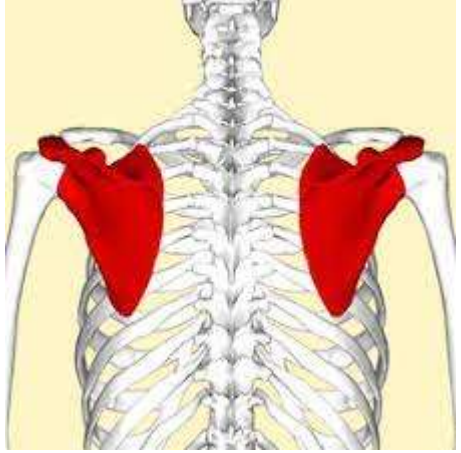
- **Clavicular dysostosis:**

  It is a clinical condition in which medial and lateral parts of clavicle remain separate due to nonunion of two primary centers of ossification.

- **Cleidocranial dysostosis:**

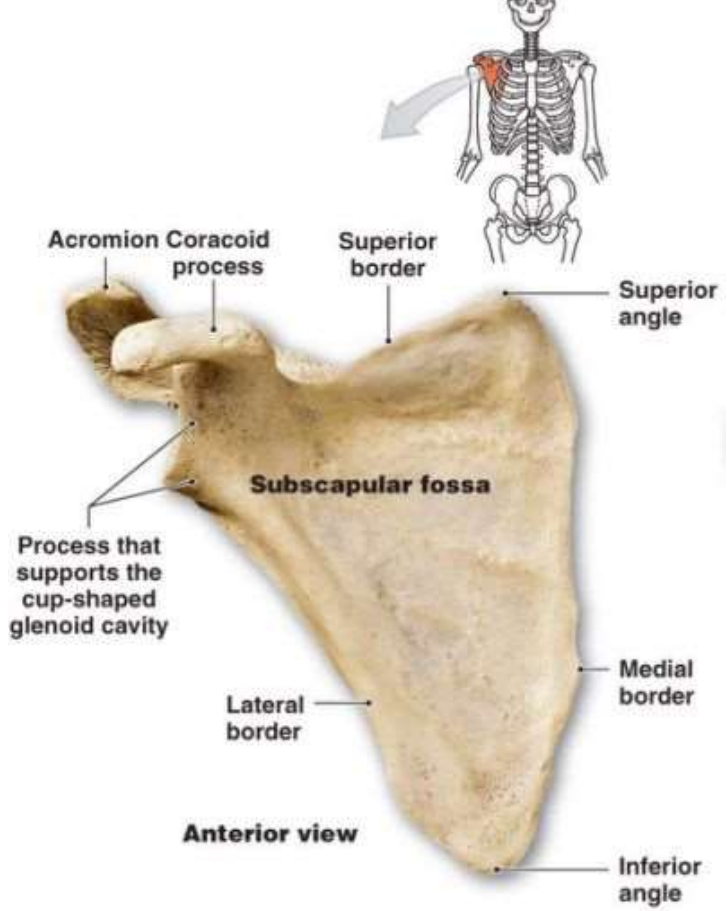
  It is a clinical condition characterized by partial or complete absence of clavicle associated with defective ossification of the skull bones

Scapula



- Also known as Shoulder blade
- Large, flattened and triangular bone in upper part of posterolateral aspect of thorax opposite to 2^{nd} and 7^{th} ribs.

Parts



Body

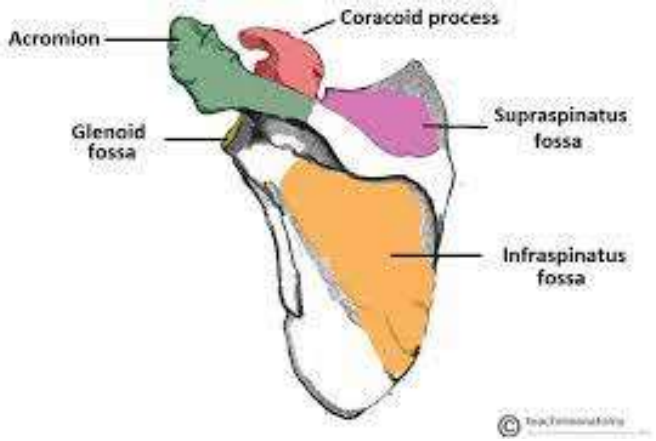
- 2 surfaces: costal & dorsal
- 3 borders: superior, lateral & medial
- 3 angles: inferior, superior & lateral

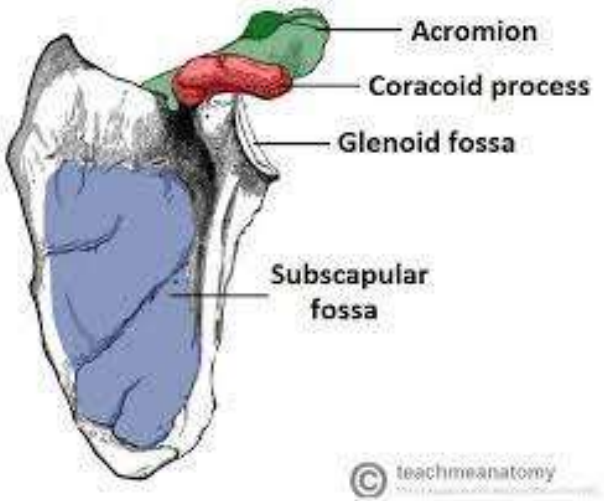
✓In dorsal surface shelf like projection in upper part called spinous process

✓Lateral angle truncated into articular surface called Glenoid cavity

Processes

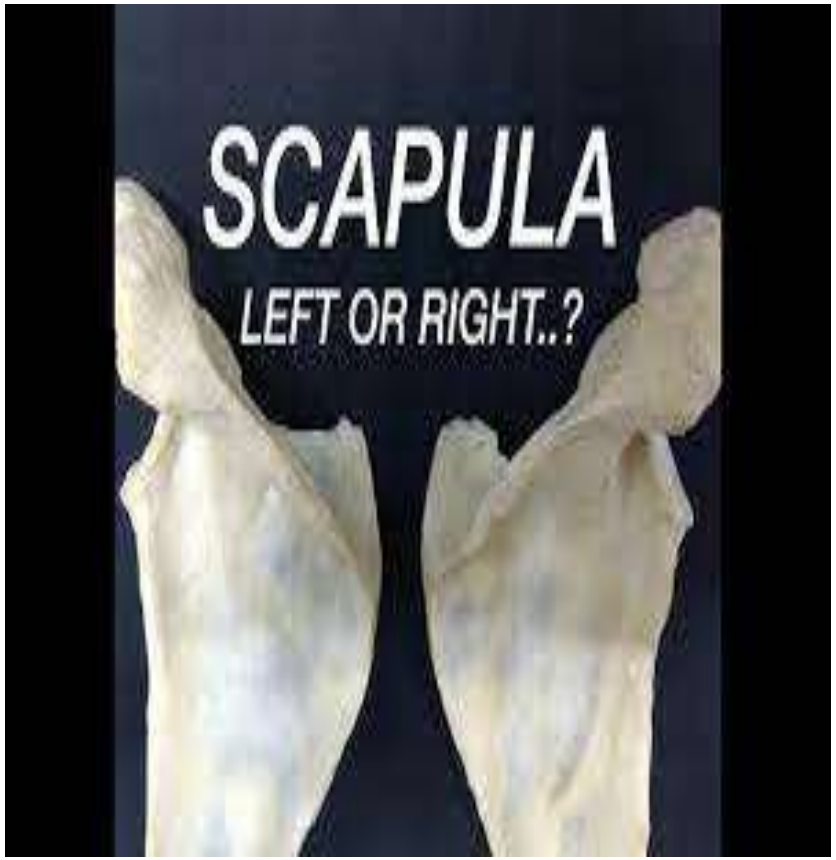
- **Spinous**: shelf like projection on dorsal aspect of body
- **Acromion**: projects forward almost at right angle from the lateral end of spine
- **Coracoid**: similar to bird's beak, arises from upper border of head abd bends sharply to project superoanteriorly

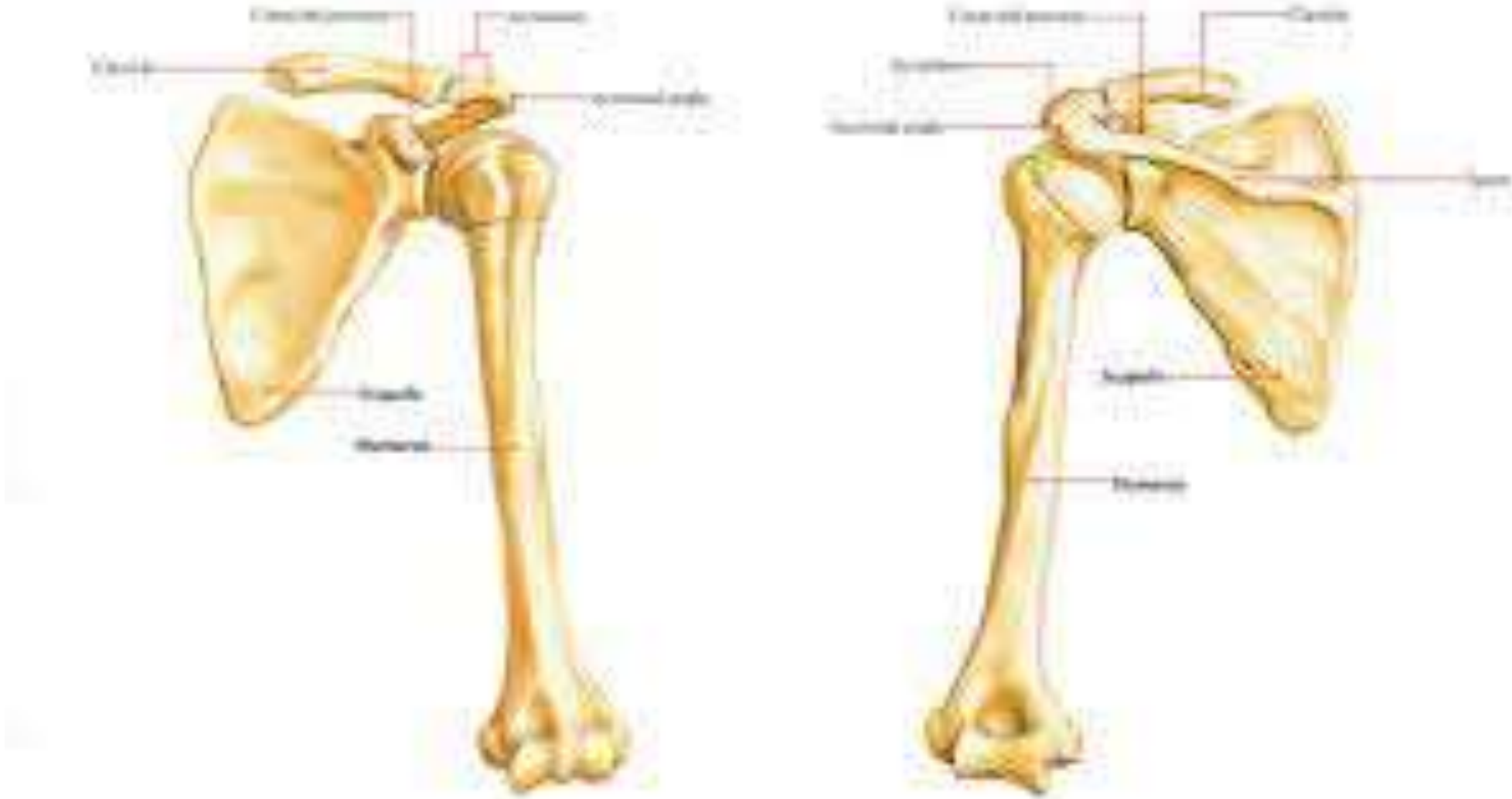




Side determination

- Glenoid cavity faces laterally, froward & upward (at an angle of 45 degree from coronal plane)
- Coracoid process directed forward
- Spinous process directed posteriorly (divides dorsal aspect into supraspinous & infraspinous fossae)





Body

- Triangular, thin and transparent (relatively)
- Surfaces:

a) Costal surface/ subscapular fossa

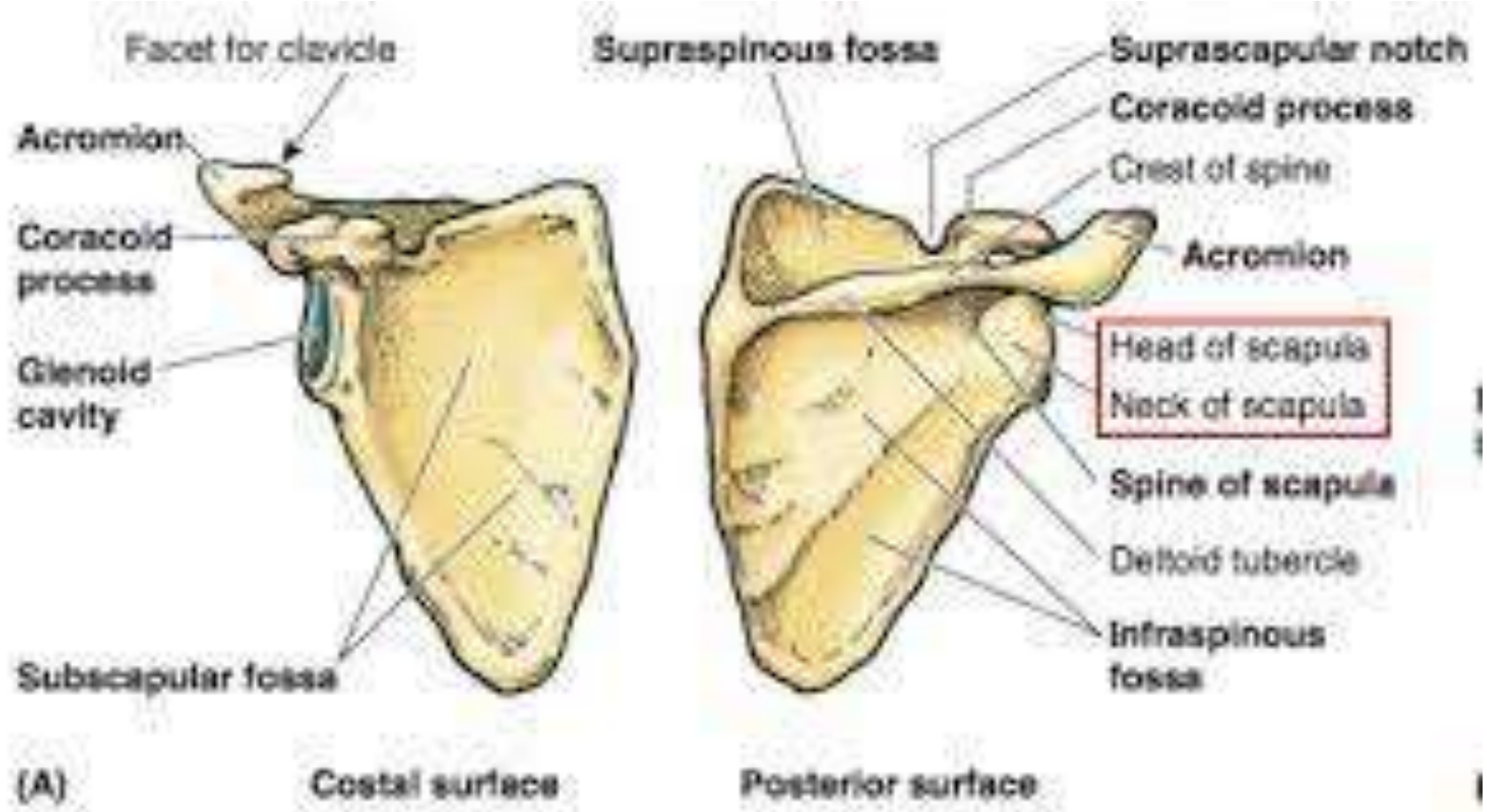
Concave, directed medially and forward

Marked by 3 longitudinal ridges (attachment of subscapularis intermuscular tendons)

Attachments:-

Subscapularis muscle originates

Serratus anterior inserts


Facet for clavicle
Acromion
Coracoid process
Glenoid cavity
Subscapular fossa
Costal surface
Suprespinous fossa
Suprascapular notch
Coracoid process
Crest of spine
Acromion
Head of scapula
Neck of scapula
Spine of scapula
Deltoid tubercle
Infraspinous fossa
Posterior surface

(A)

(b) **Dorsal surface:**

- Convex
- Spine is present, that divides into supraspinous (small one third) and infraspinous fossae (large tow third)
- Above two fossae are connected by spinoglenoid notch, situated lateral to root of spine

Attachements: **Origin** of following

- Supraspinatus muscle
- Infraspinatus muscle
- Teres minor
- Teres major
- Latissimus dorsi

Borders

Superior: thin and short, extending b/w superior and lateral angles

- Suprascapular notch present in this border near root of coracoid process
- Suprascapular notch turned to Suprascapular formen by attachment of superior transverse ligament

Structures passing

Suprascapular artery above ligament

Suprascapular nerve below ligament

Mnemonic: **Air** force flies above **Navy**

A-Artery above ligament **; N-Nerve** below ligament

Attachment:

Origin of inferior belly of omohyoid

Lateral border:-Thickest border extending from inferior angle to glenoid cavity

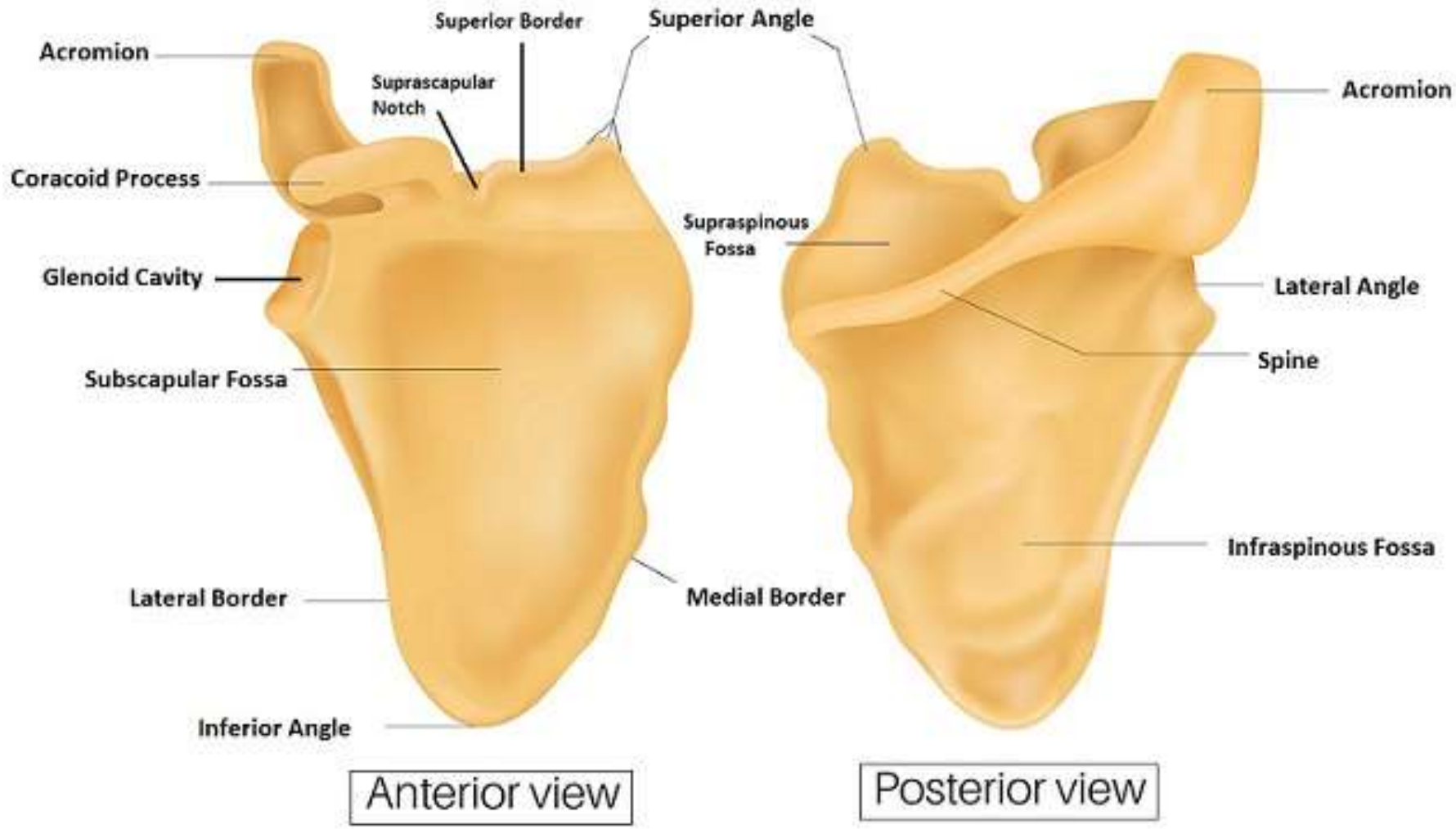
- Inferaglenoid tubercle present in the upper end just below glenoid cavity

Attachment: origin

Long head of triceps

(Note:- This border is thick because this acts as a fulcrum during rotation of the scapula)

Right Scapula Bone



Credit: Achiichili/Shutterstock.com

Medial border

- Extending from superior to inferior angle
- Thin and angled at root of spine area

Attachment:

Insertion of

- Serratus anterior
- Levator scapulae
- Rhomboideus minor
- Rhomboideus major

Angles

Inferior angle: lies over 7th or 7th intercostal space

Superior angle: at junction of superior & medial border, lies over second rib

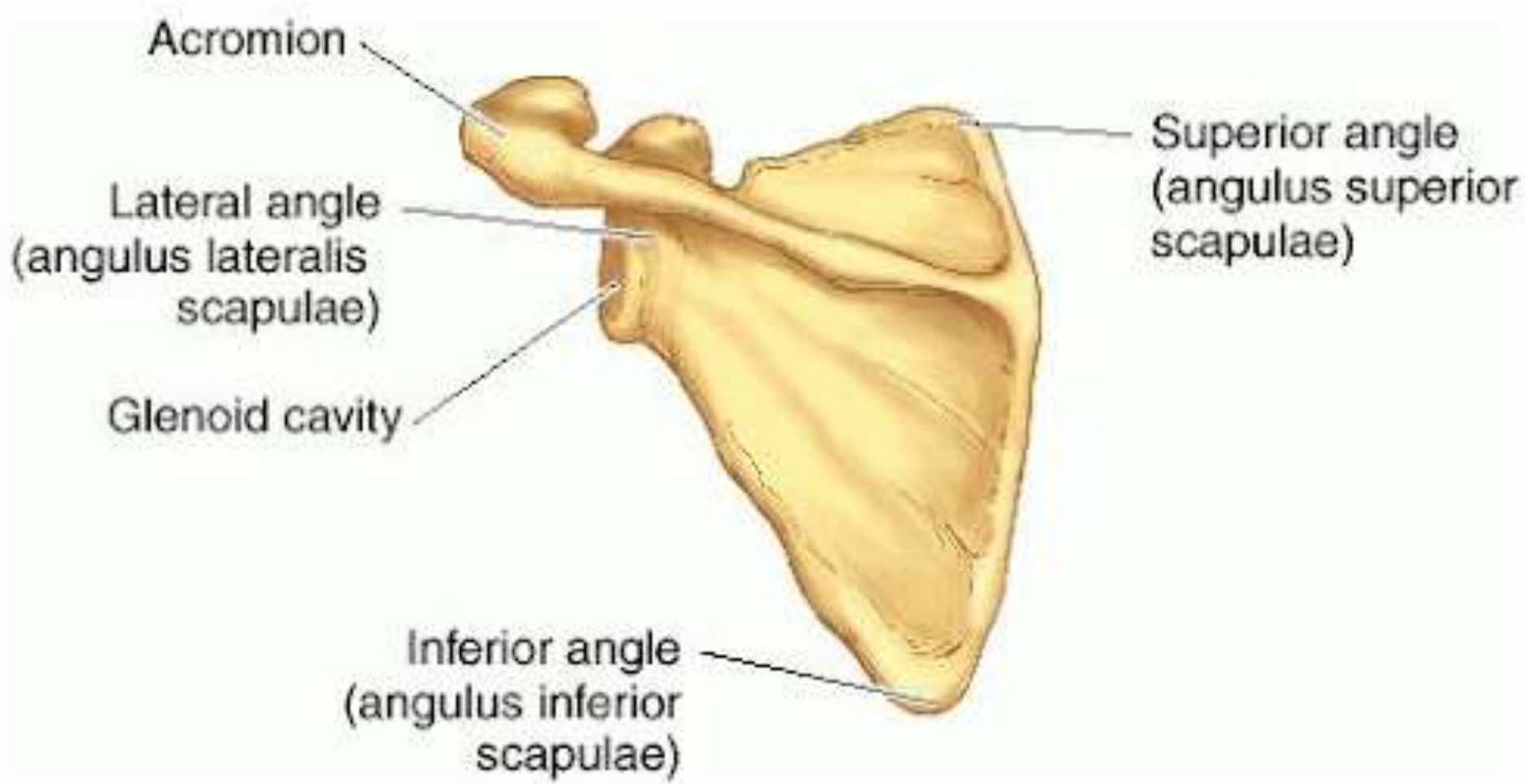
Lateral angle (head of scapula):

✓Truncated and bears glenoid cavity (articulating with head of humerus forming glenohumeral joint)

Attachment:

✓Capsule of shoulder joint

✓Origin of long head of triceps

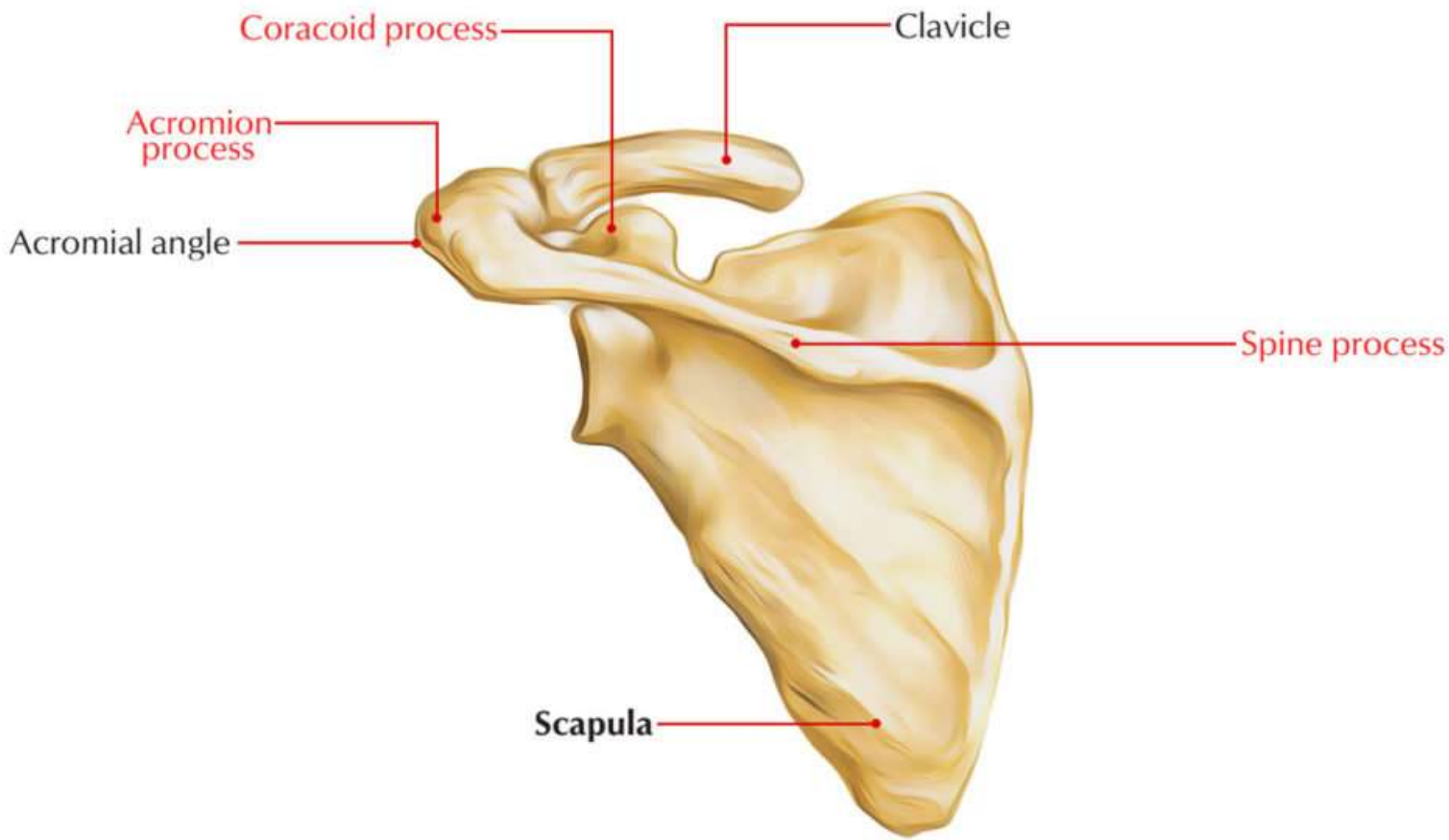

Acromion
Lateral angle
(angulus lateralis
scapulae)
Glenoid cavity
Inferior angle
(angulus inferior
scapulae)
Superior angle
(angulus superior
scapulae)

Processes

Spinous process (spine of scapula)

- Present in dorsal surface, at the junction of upper one third and lower two third.
- Dividing dorsal surface of scapula into supraspinous and infraspinous fossaa

- Spine has
- 2 surfaces→ (a) superior & (b) inferior
- 3 borders→ (a) anterior (b) posterior & (c) lateral


Coracoid process
Clavicle
Acromion process
Acromial angle
Spine process
Scapula

- Surfaces :

a) Superior: lower boundary of supraspinous fossa, supraspinatus ms originates

b) Inferior: upper boundary of infraspinous fossa, infraspinatus ms originates

- Borders :

a) Anterior border of spine attached to dorsal surface of scapula

b) Lateral border of spine

c) Posterior border, also called **crest of spine**

Attachment: insertion of trapezius; origin of posterior fiber of deltoid

Acromion process

- Projecting forwarded at right angle from lateral end of spine and overhangs the glenoid cavity
- Superior surface is subcutaneous and palpable
- Inferior surface smooth, related to subacromial bursa
- Parts: a tip & 2 borders

Borders: medial and lateral borders continuous with upper and lower lip of crest of spine

Attachments

✓Medial border- insertion of trapezius ms

✓Lateral border- origin to intermediate fibers of deltoid

✓Tip of acromion- coracoacromial ligament

Coracoid process

- Arises from upper part of head of scapula & bent sharply projecting forward and slightly laterally
- 3 muscles are attached- short head of biceps brachii, coracobrachialis both arise from tip & pectoralis minor inserted on medial border of upper surface
- 3 ligaments- coracoacromial (lateral border), coracoclavicular (conoid part attached to knuckle & trapezoid part attached to ridge in the superior portion) & coracohumeral (attached to roort adjacent to glenoid cavity)

Ossification

Cartilaginous

- 1 primary center & 7 secondary centers
- Primary center in body
- Secondary centers appears as follow:

❖2 centers in coracoid process

❖2 centers in acromion process

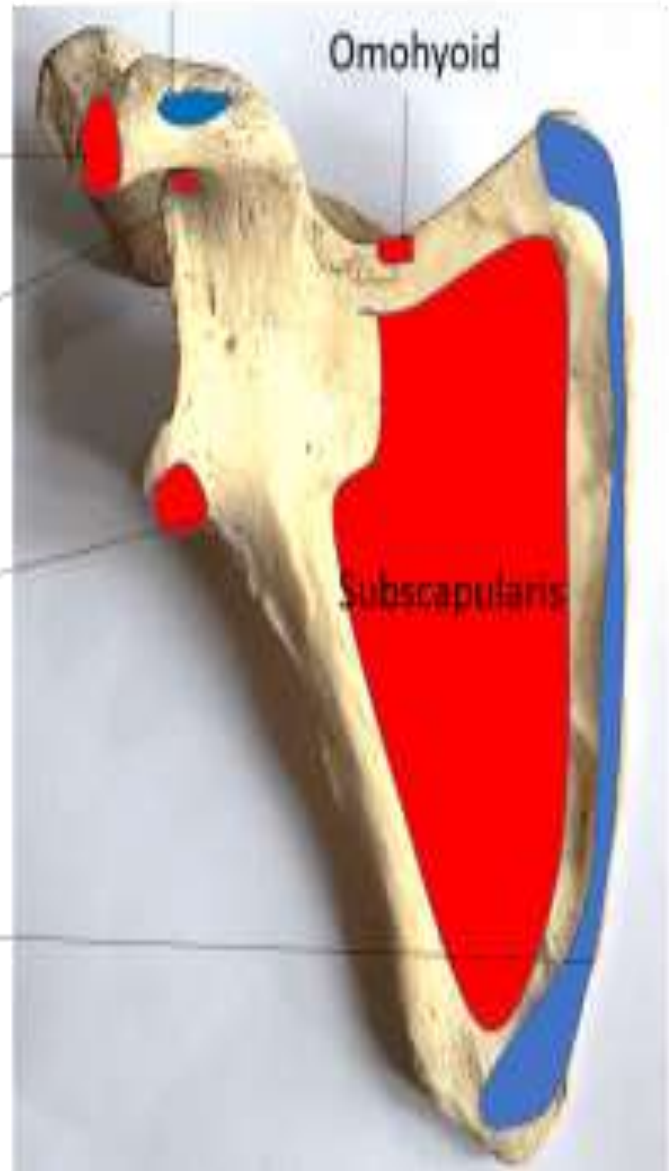
❖One center each in (a) medial border (b)inferior angle (c) lower part of rim of glenoid cavity

Site of appearance	Time of appearance	Time of fusion
Primary center	8th week of IUL &	15 years
first secondary center	first year of postnatal life	1 years
All other Secondary center	Puberty	20 years

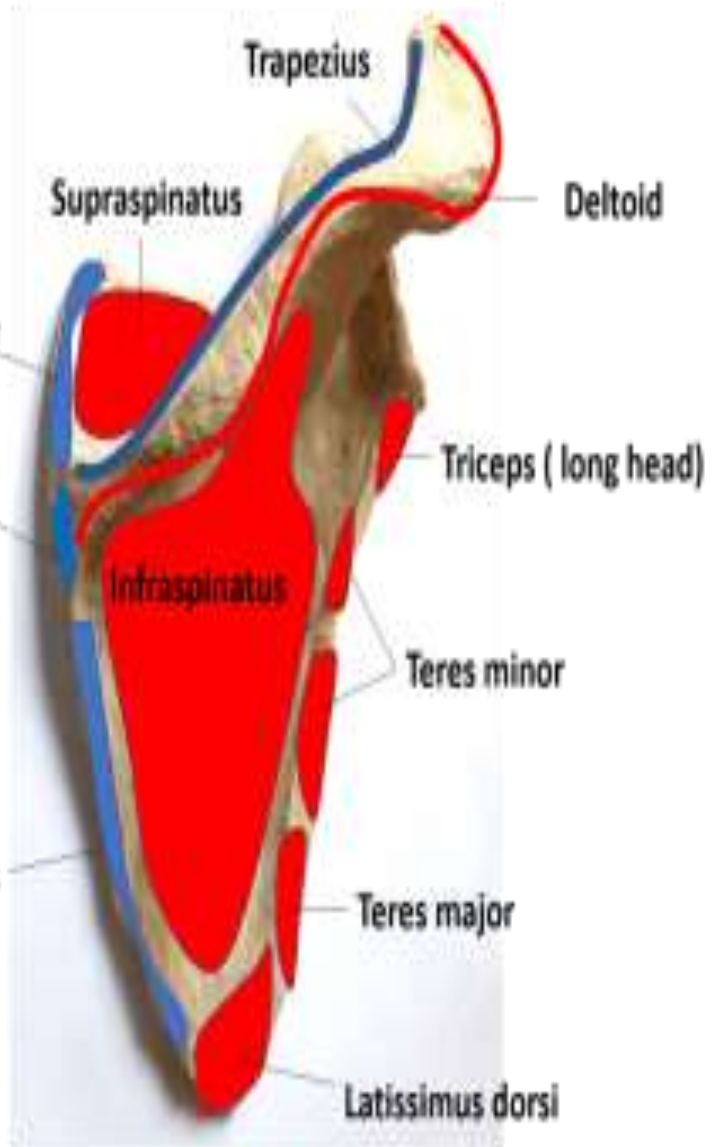
Muscles and ligaments

Muscle origin	Muscle insertion	ligament
subscapularis	trapezius	Glenoid labrum
supraspinatus	Serratus anterior	Capsule of acromioclavicular joint
infraspinatus	Pectoralis minor	Coracoacromial ligament
deltoid	Levator scapulae	Coracohumeral ligament
Biceps brachii, long head	Rhomboideus minor	Coracoclavicular ligament
coracobrachialis	Rhomboideus major	Suprascapular ligament
Triceps brachii, long head		Spinoglenooid ligament
Teres mior and major		
Inferior belly of omohyoid		

Ventral surface



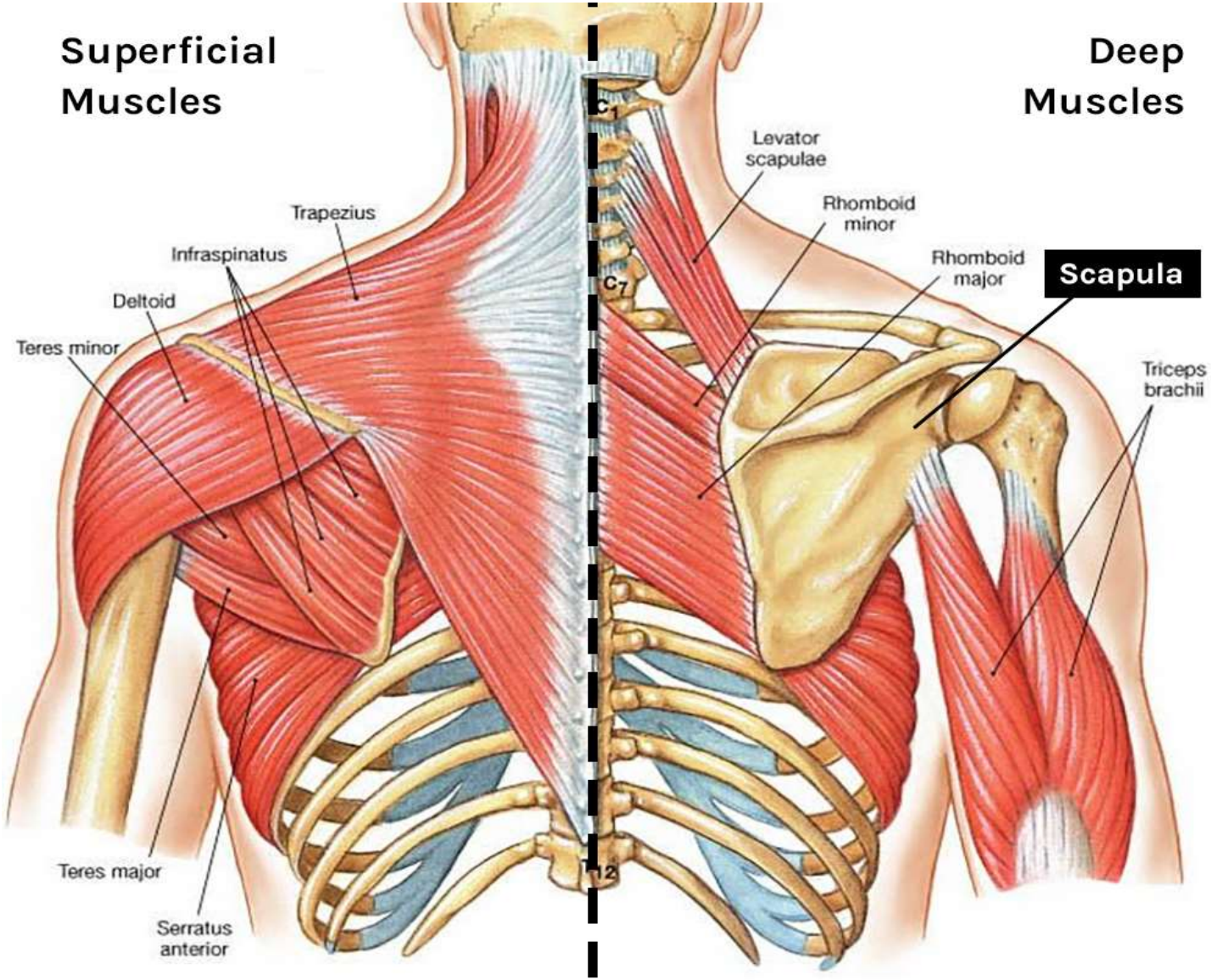
Dorsal surface



Clinical correlation

Paralysis of the serratus anterior :

- “Winging of the scapula”
- Medial border (vertebral) of the bone becomes prominent.
- **Test:** The vertebral border and inferior angle of scapula protrude posteriorly, when the patient is asked to press his hands against the wall
- **Presentation :** the arm cannot be abducted beyond 90 degrees.



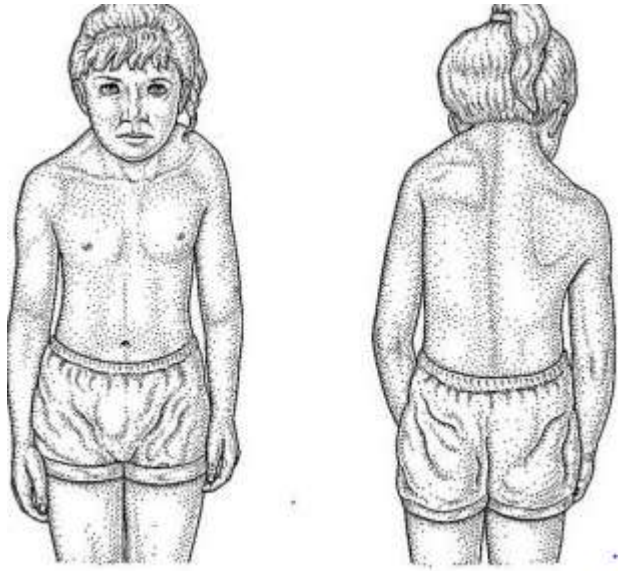
Back View (with Muscles)

Scaphoid scapula is a developmental anomaly, in which the medial border is concave.

(Scaphoid mean to say, a bony area that is curved inward)

Sprengel’s deformity of the scapula

- Congenital high scapula
- The scapula develops in the neck region during IUL and then migrates downwards to its adult position
- Hypoplastic (undergrown) and situated in the neck region.



- It may be connected to the cervical part of vertebral column by a fibrous, cartilaginous, or bony bar called omovertebral body.

- If corrected by surgical procedure to bring down the scapula may cause injury to the brachial plexus