

UPPER LIMB - JOINTS



**What makes your upper limb to move as various compartment,
in different angles, through wide ranges.....**

SHOULDER GIRDLE

Purpose:- Connects the upper limb to the axial skeleton.

Contents:- Clavicle and the Scapula.

Union:-

- Anteriorly - **clavicle** reaches the **sternum** and articulates with it at the **sternoclavicular joint**.
- The clavicle and the scapula are united to each other at the **acromioclavicular joint**.
- **The scapula is not connected to the axial skeleton directly, but is attached to it through muscles. (Physiological joint)**



Sternoclavicular Joint

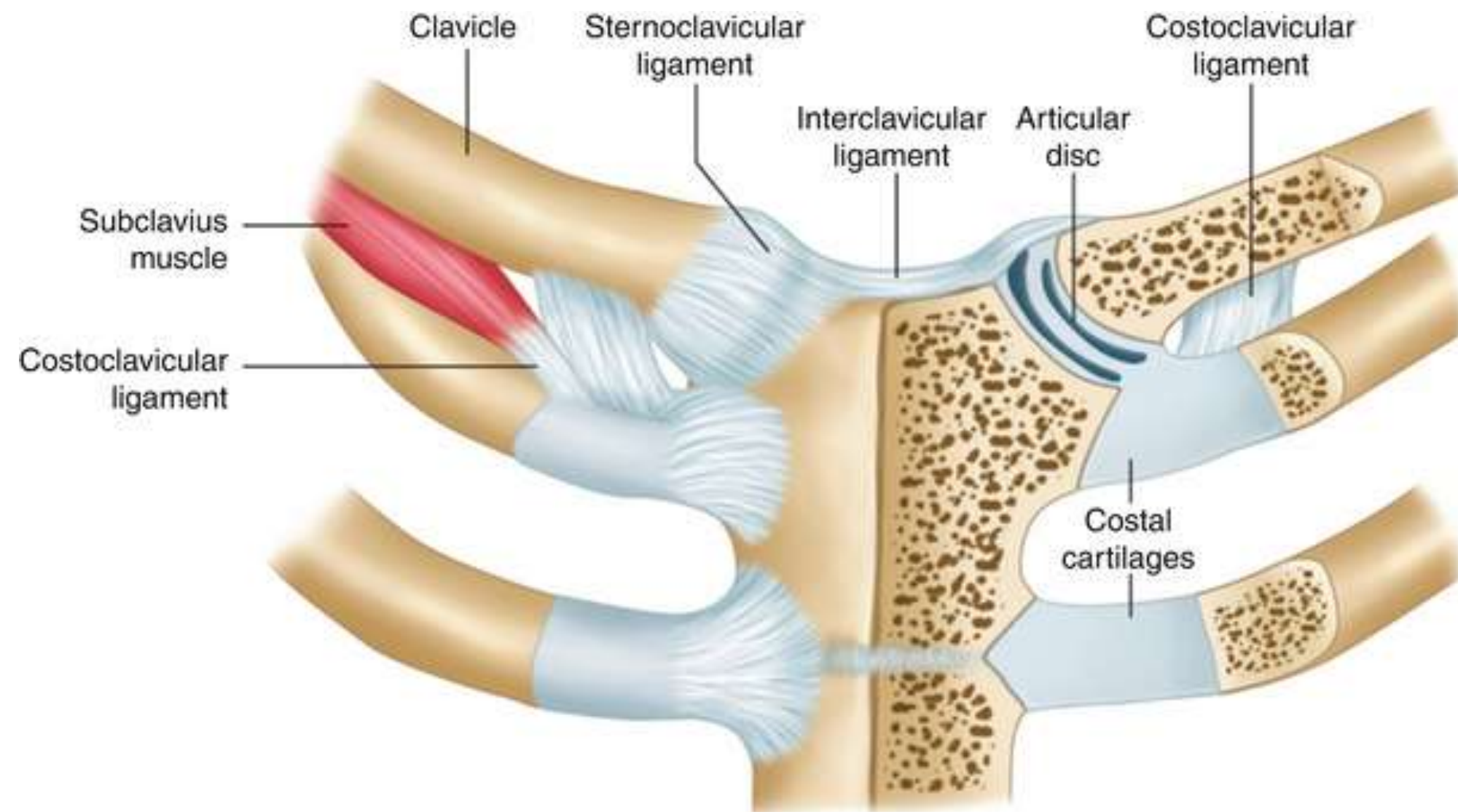
Type: Saddle (synovial joint)

Articular Surfaces:

(i) sternal end of clavicle

articulates with

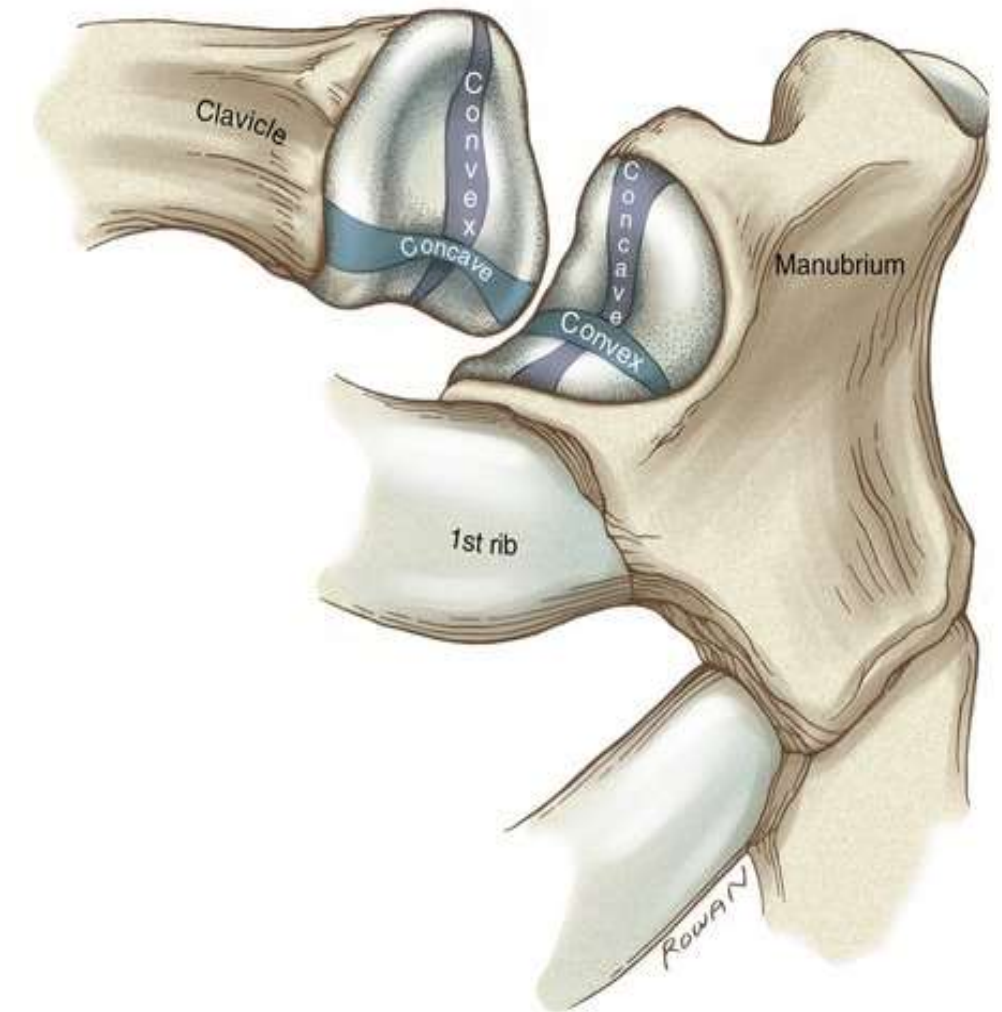
(ii) shallow socket of **manubrium sterni** (superolateral angle) ; adjacent part of the **1st costal cartilage**.



Articular surface

Clavicle - **Convex** from **above downwards**
slightly **concave** from **front to back**.
Sternum - Reciprocally curved.

Articular surfaces are covered with
fibrocartilage.



Orientation of articular surfaces

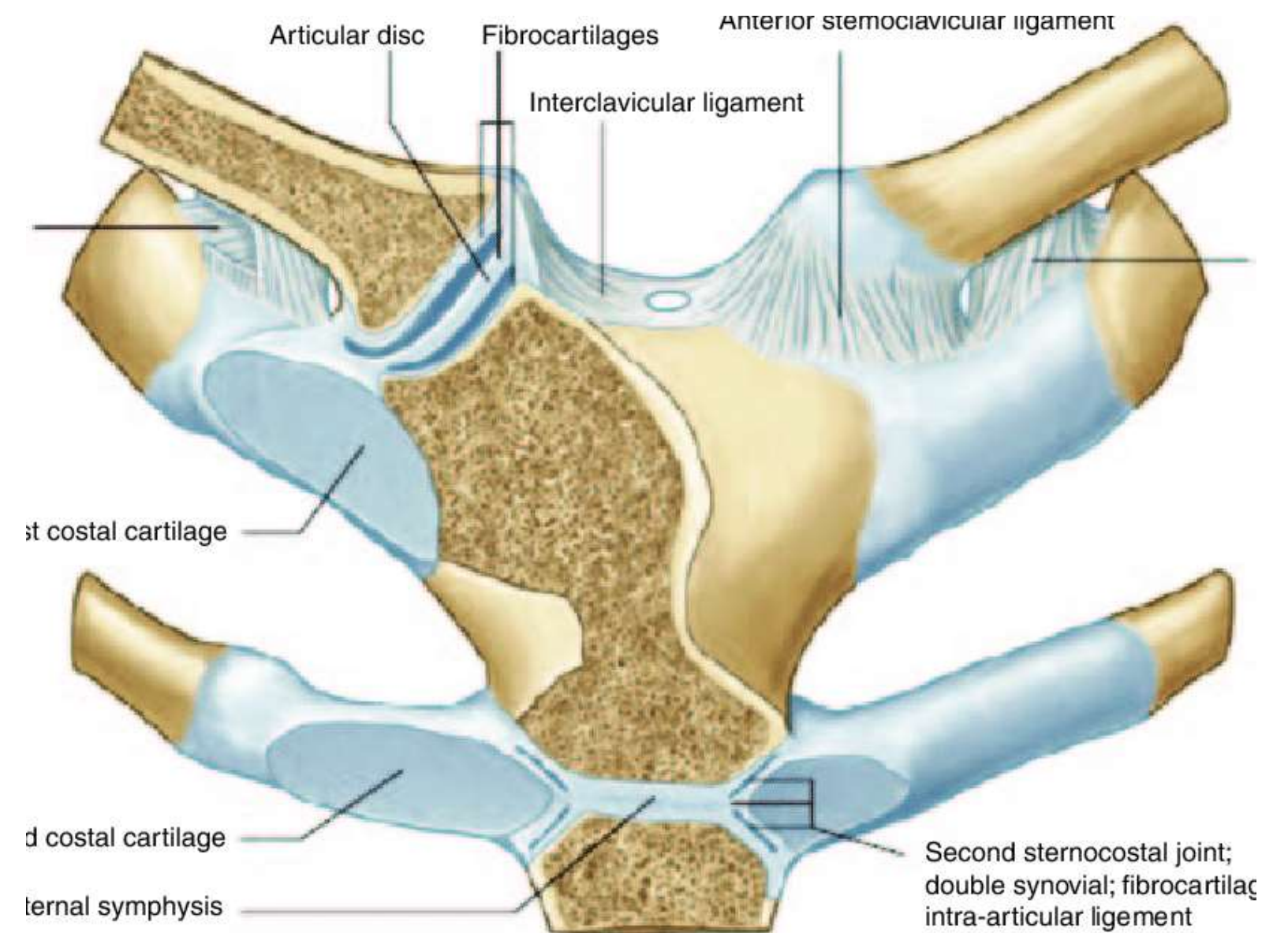
Medial end of clavicle rises higher than the manubrium, hence it poorly fits into its shallow socket.

Compensated by.....

Strong thick **articular disc** of fibrocartilage

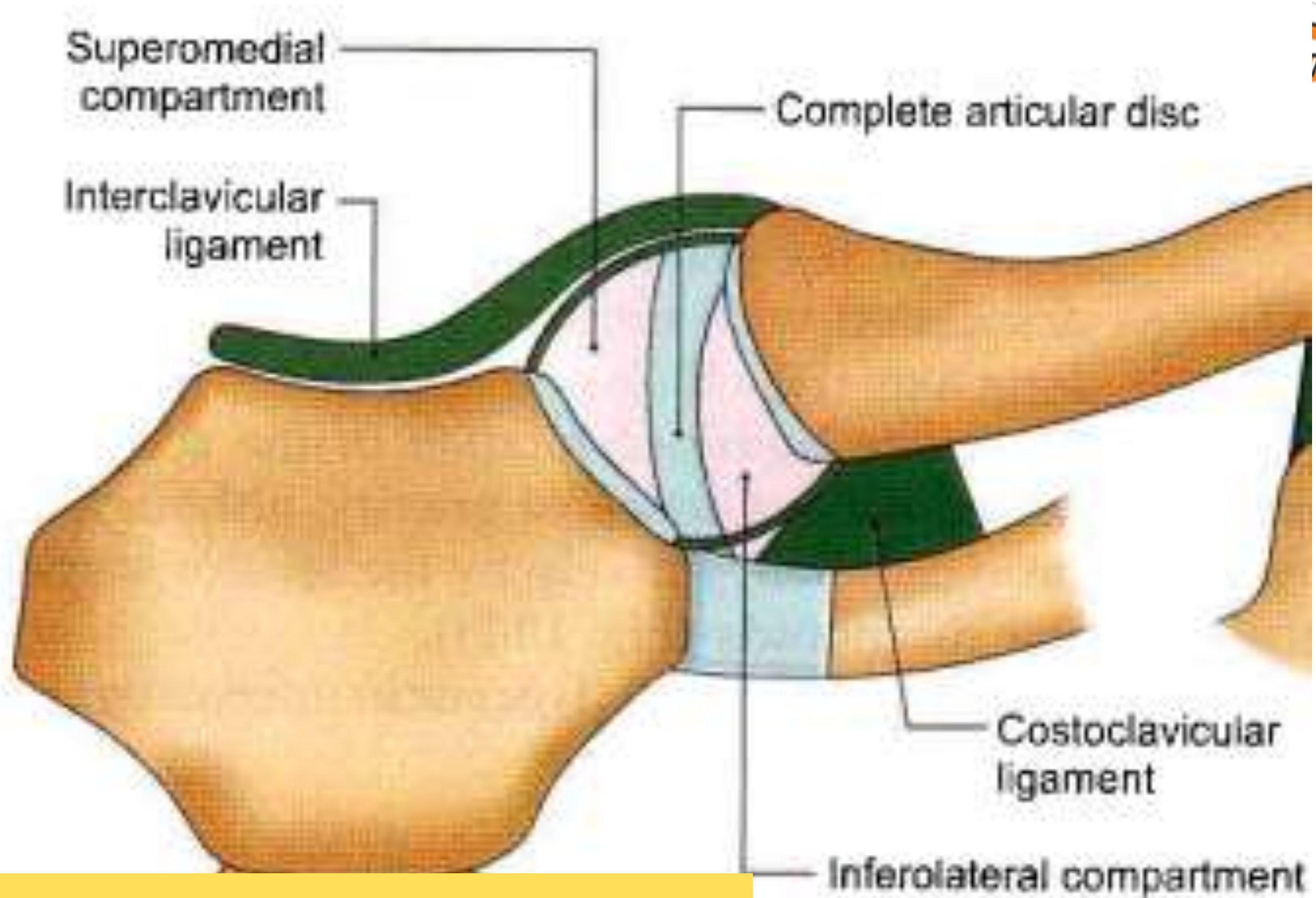
Attachment:-

- Superiorly to the clavicle and 1st costal cartilage
- Inferiorly prevents the displacement of the medial end of the clavicle.



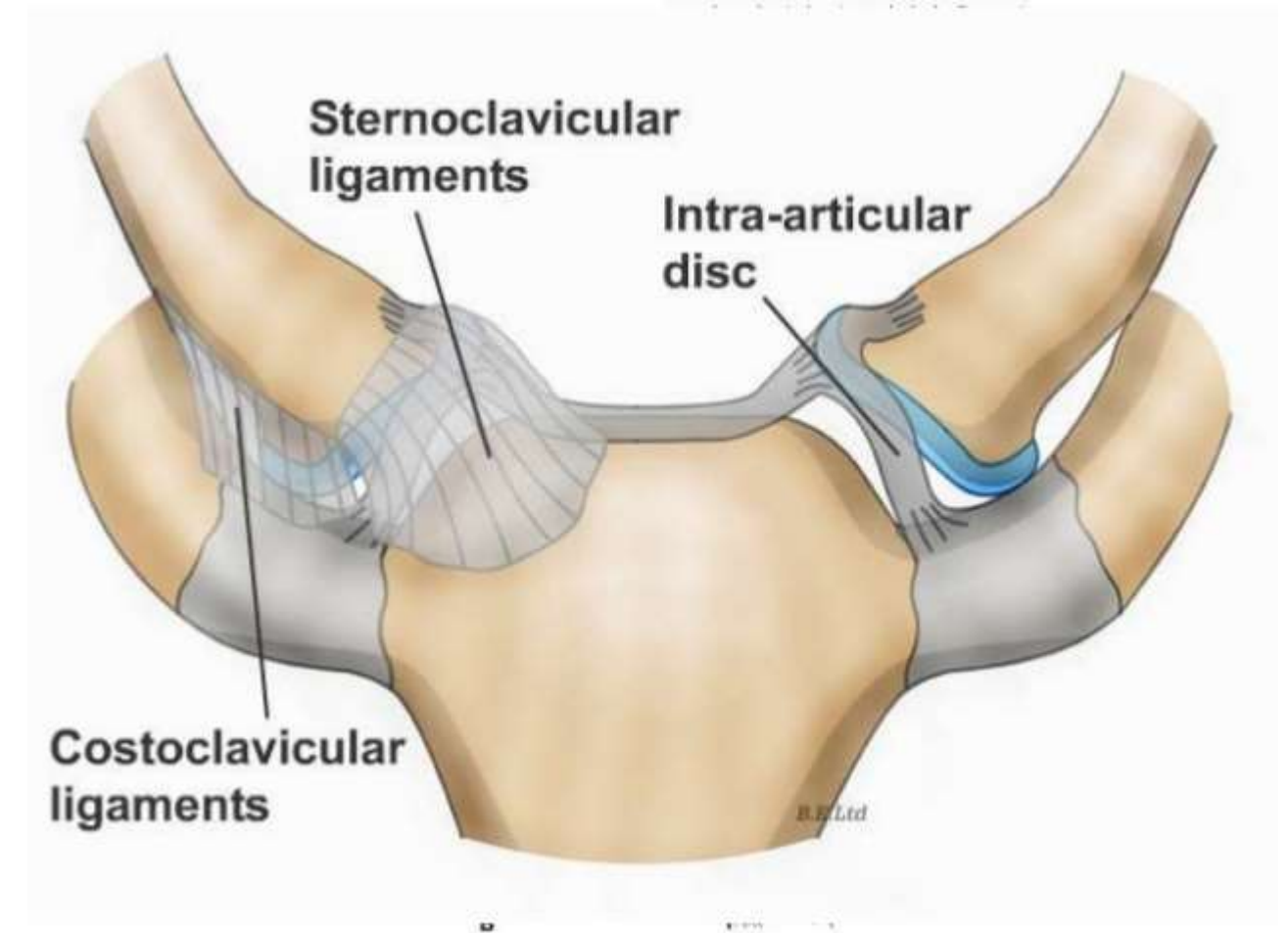
- Articular disc
into two compartments

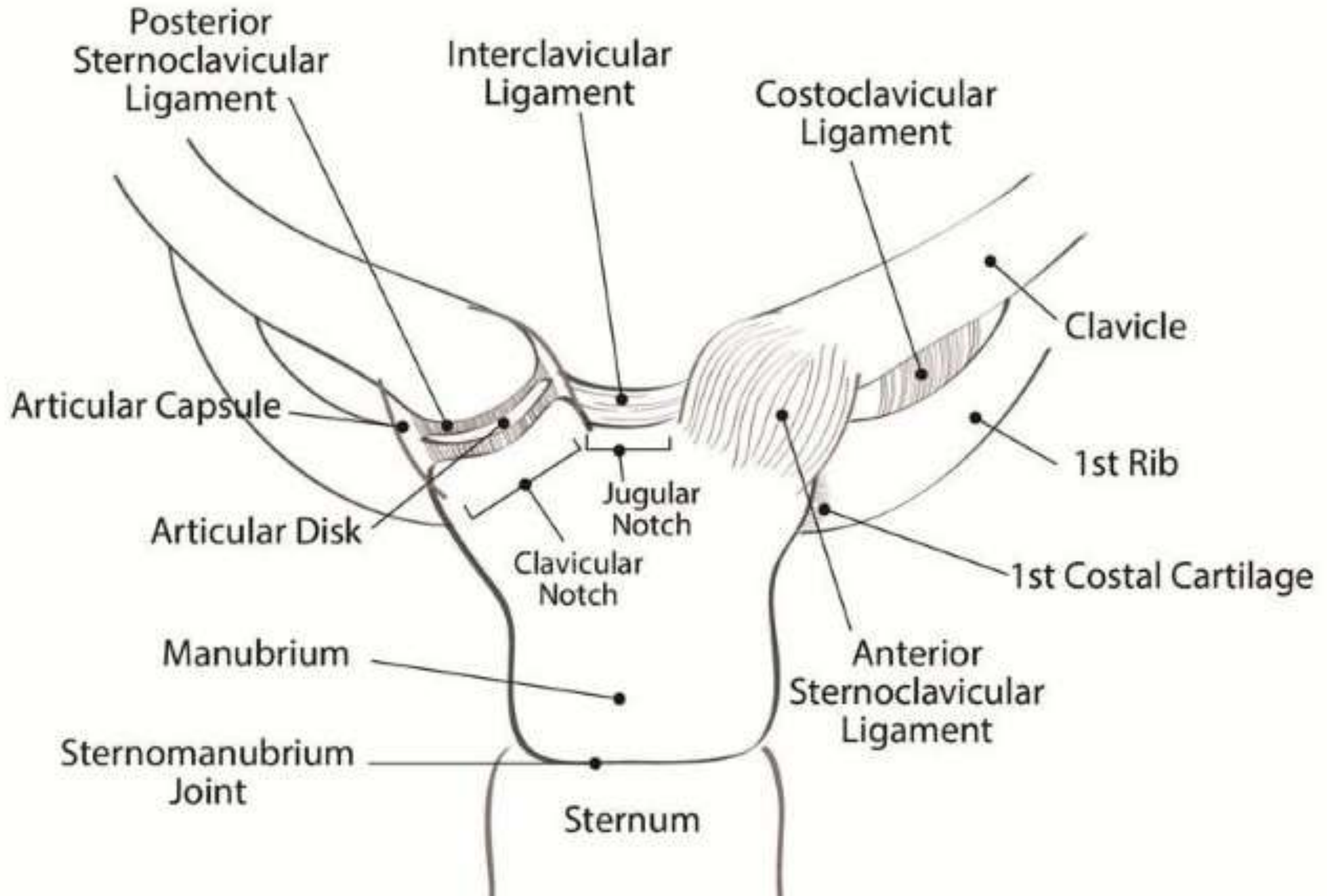
 1. superomedial
 2. inferolateral



Articular disc attachment

- Laterally to the clavicle on a rough area above and posterior to the articular area for the sternum.
- Inferiorly, the disc is attached to the sternum and to the first costal cartilage at their junction.
- Anteriorly and posteriorly the disc fuses with the capsule.







Blood supply:

- Internal thoracic artery
- Suprascapular artery

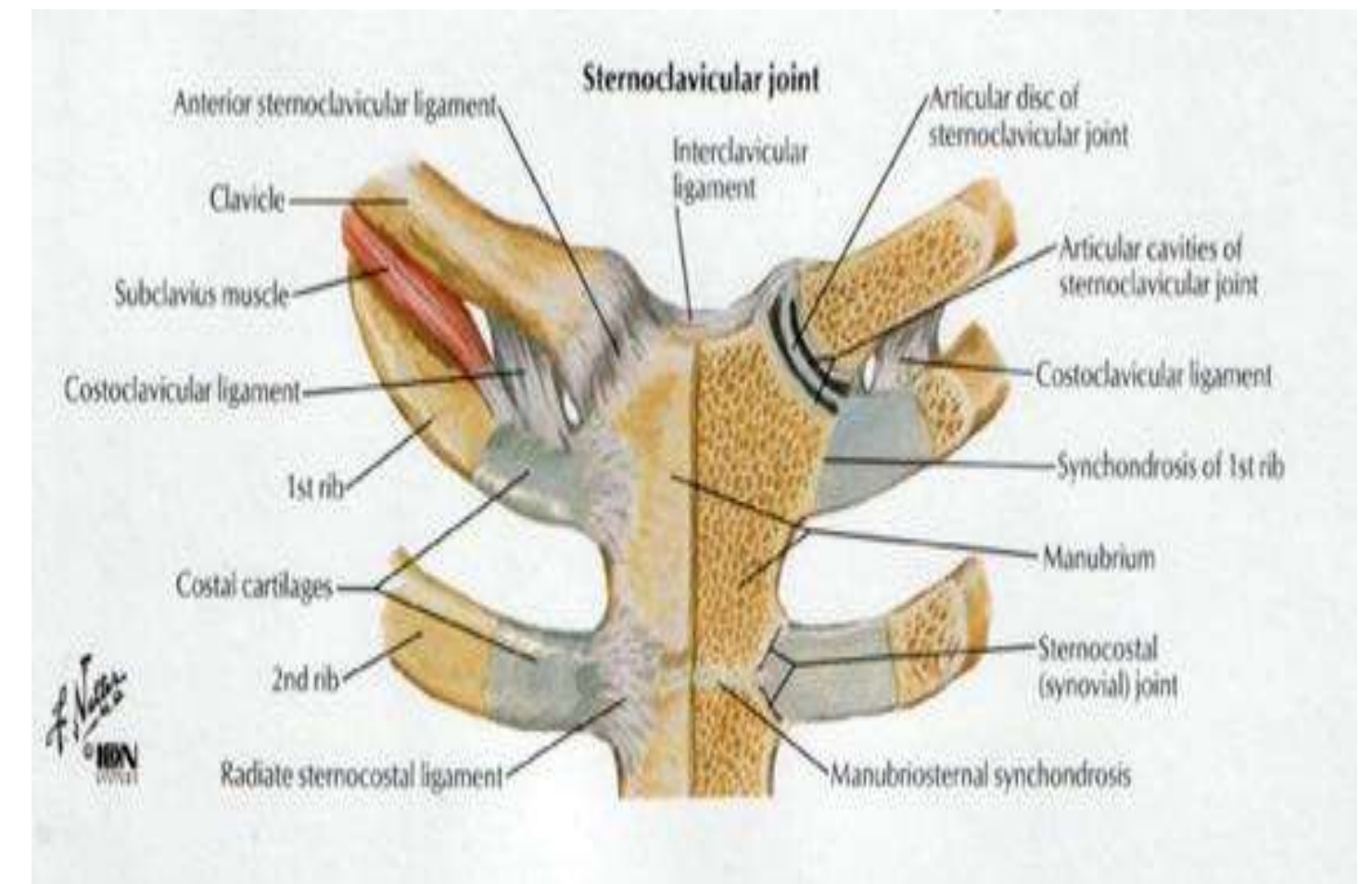
Nerve supply:

- Medial supraclavicular nerve.

Ligaments

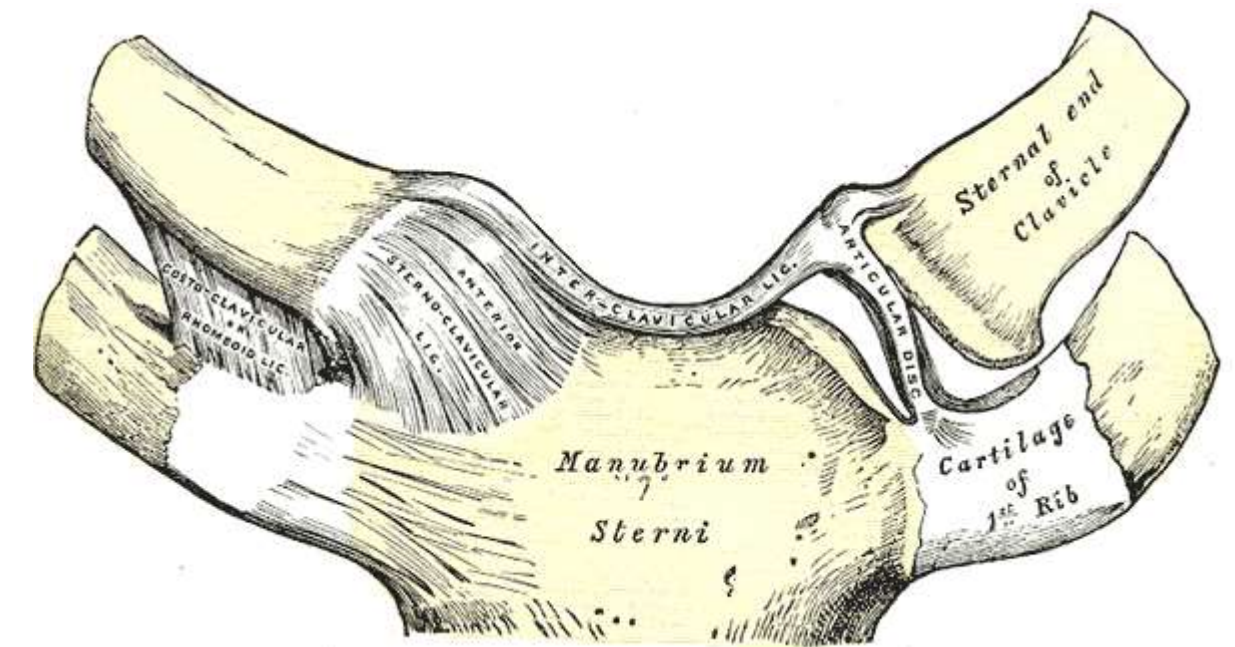
1. Anterior and posterior sternoclavicular ligaments:

- reinforce the joint capsule anteriorly and posteriorly.
- The posterior ligament is weaker than the anterior ligament.



2. *Interclavicular ligament:*

- **ligament passes between the sternal ends of the right and left clavicles**
- T-shaped
- strengthens the joint capsule superiorly.
- In between, it is attached to the superior border of the suprasternal notch.



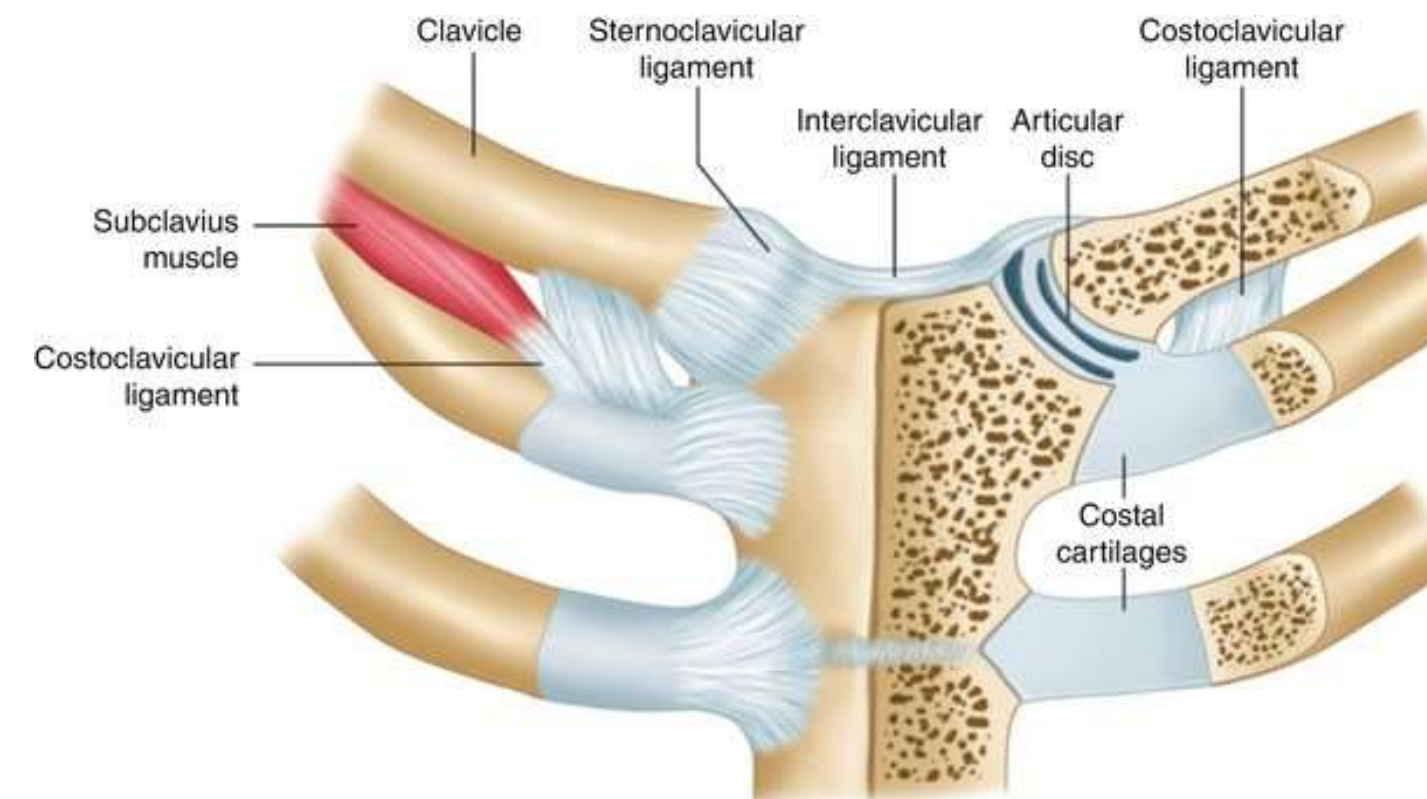
3. Costoclavicular ligament:

- Anchors the inferior surface of the sternal end of clavicle to the first rib and adjoining part of its cartilage

- **Attachment:-**

Superiorly, to the rough area on the inferior aspect of the medial end of the clavicle.

Inferiorly, the first costal cartilage and to the first rib.





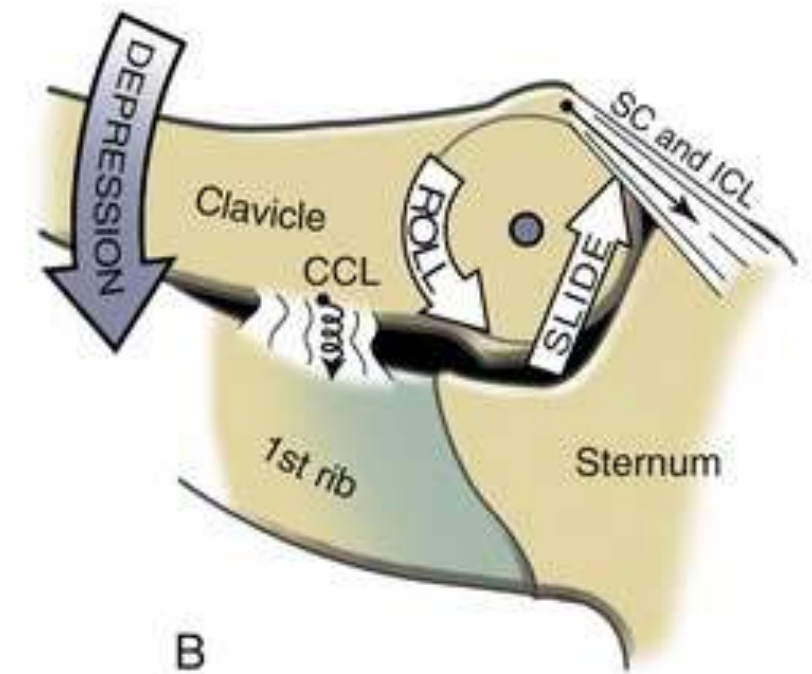
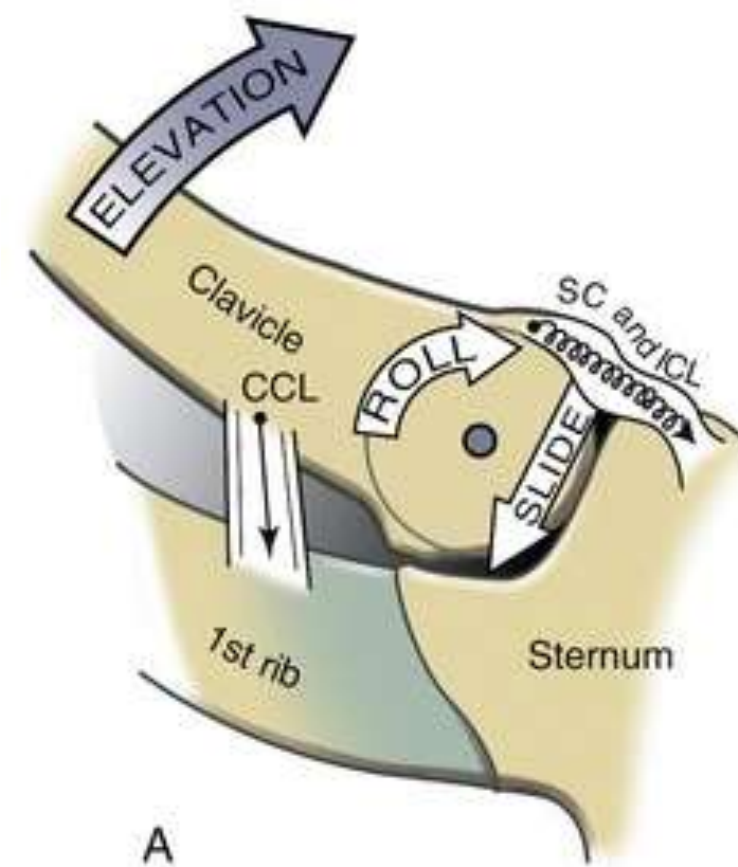
- ***Blood supply:***
Internal thoracic and
suprascapular arteries.

- ***Nerve supply:*** Medial
supraclavicular nerve

Movements: The SC Joint has 3 Degrees of Movement

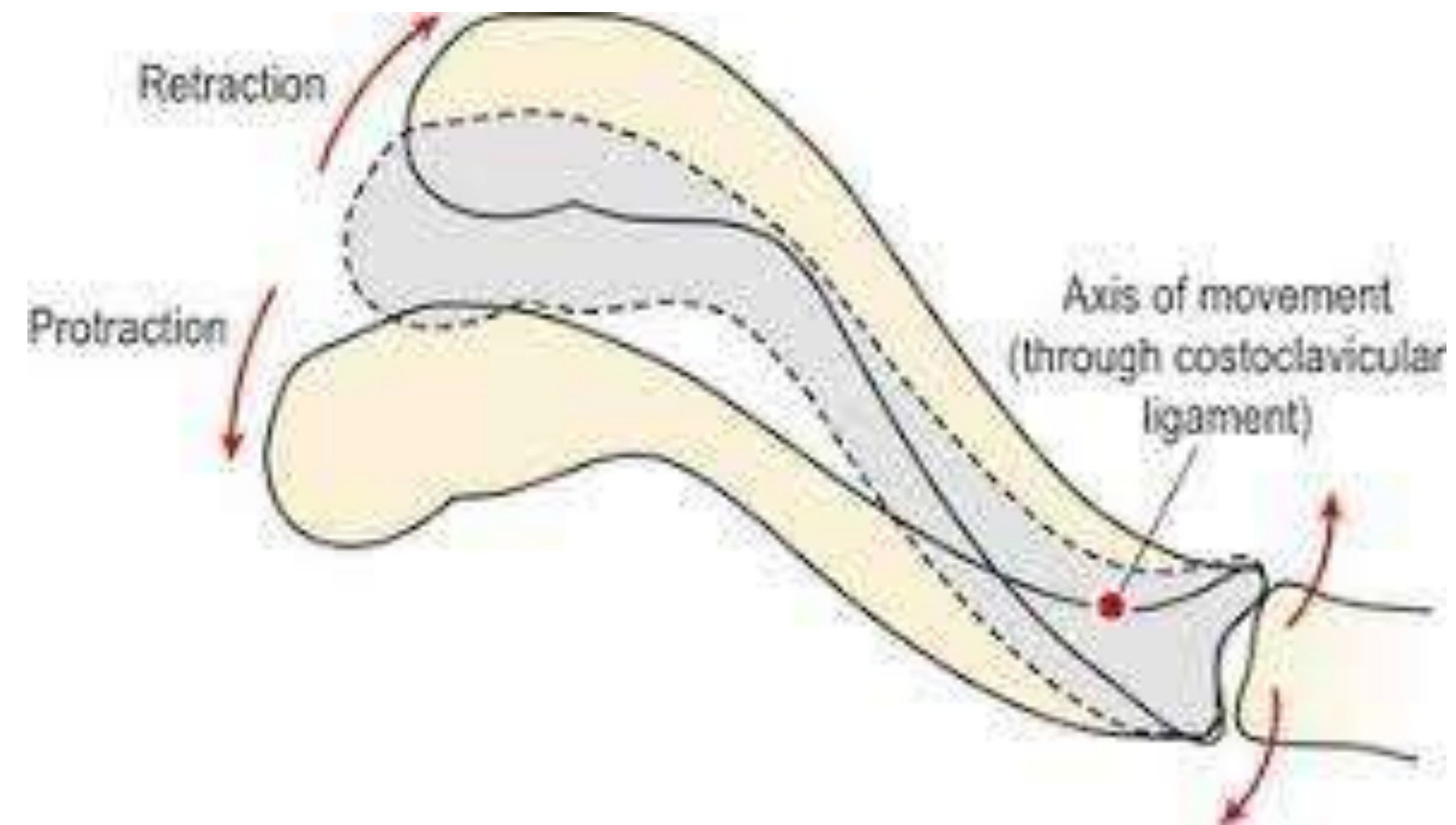
1. Elevation/ depression

Frontal Plane



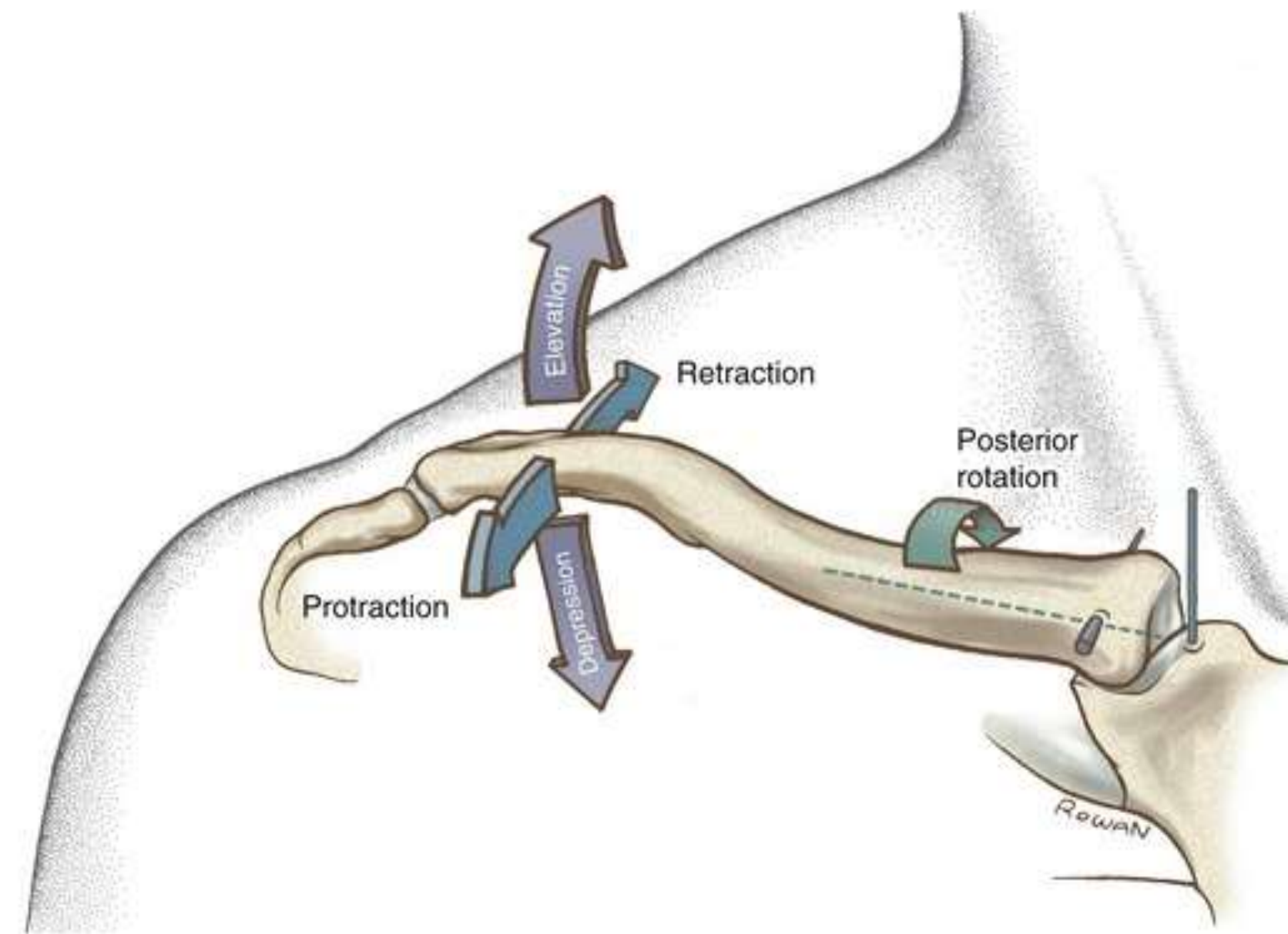
2. Protraction/retraction

- Transverse Plane



3. Anterior and posterior rotation of the clavicle

- Sagittal Plane
- The anterior and posterior rotation of clavicle is utilized in overhead movements of the shoulder girdle





Muscle action



- There are no muscles that act directly on the SC Joint.
- However, the SC Joint motions closely mimic the reciprocal motions of the scapula.
- In addition, the following muscles have an attachment of the clavicle and therefore may produce movement of the clavicle:
 - A. Deltoid
 - B. Pectoralis major (Clavicular Head)
 - C. Trapezius
 - D. Sternocleidomastoid
 - E. Subclavius muscle
 - F. Scalene muscles

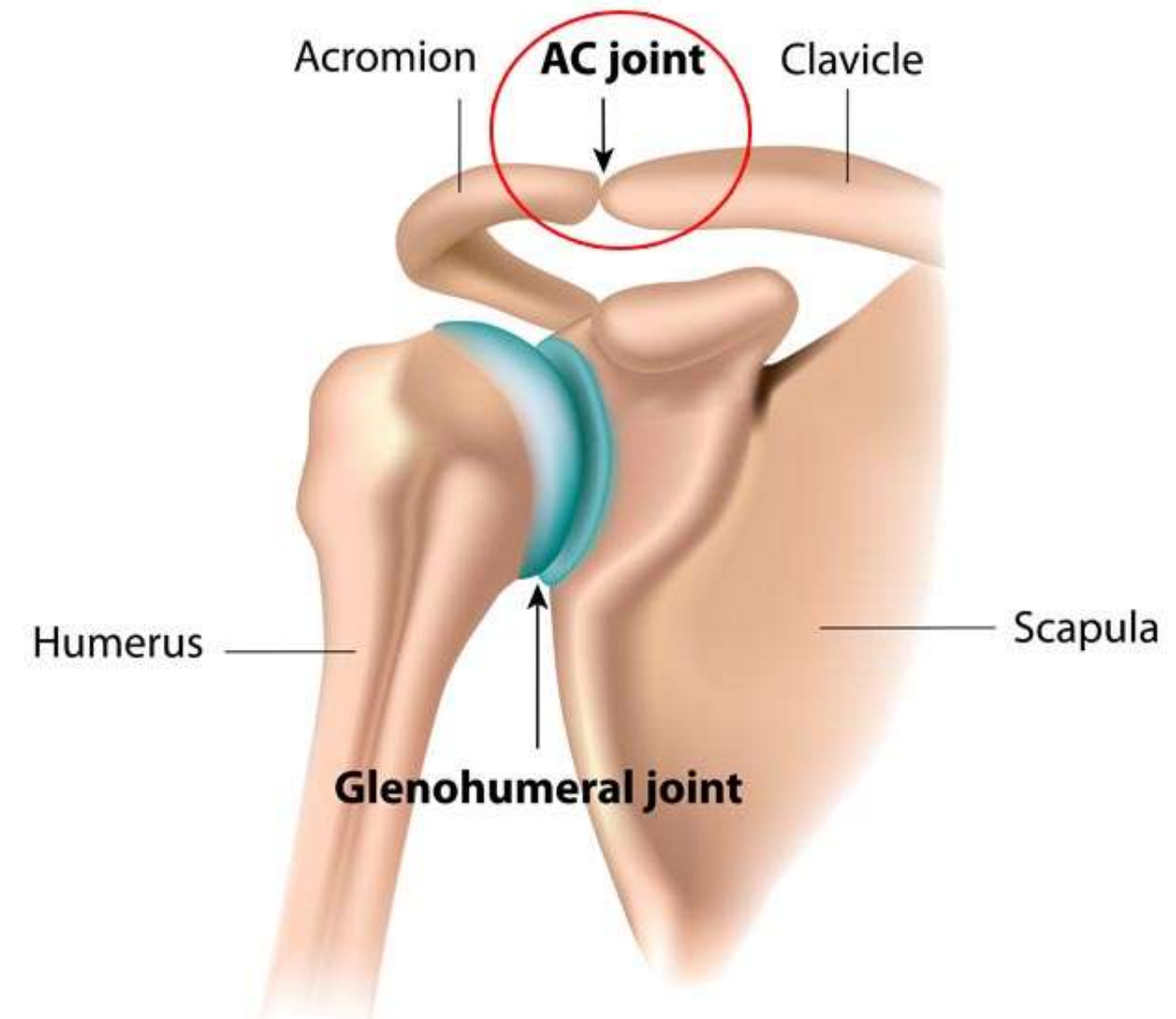
Acromioclavicular joint

Type: plane synovial joint

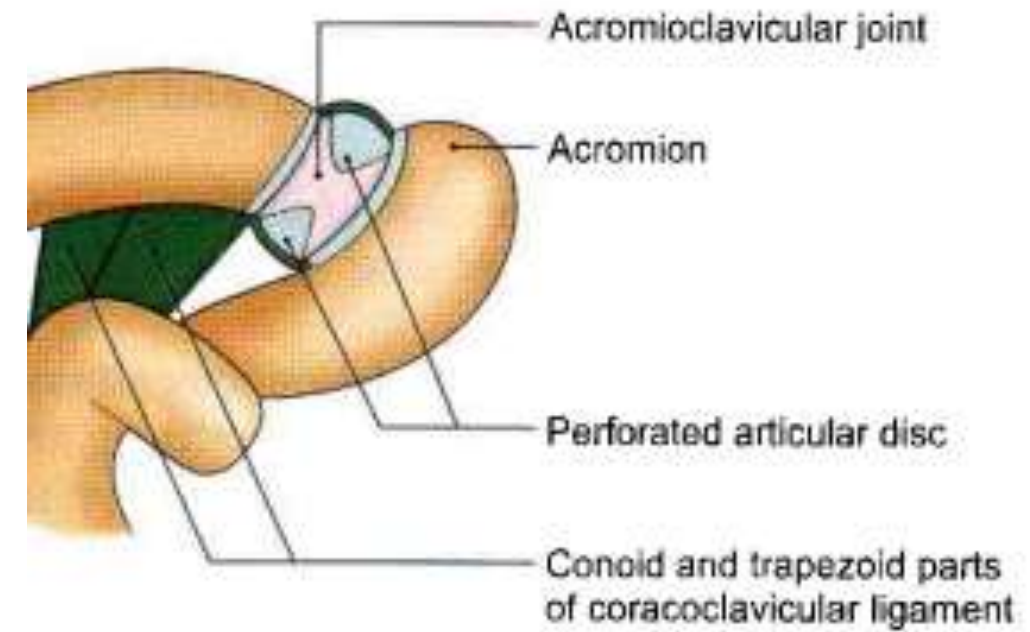
The acromioclavicular joint is located about 2.5 cm medial to the point of the shoulder.

Articular Surfaces:-

- **Lateral end of clavicle** (small facets)
- **Medial margin of the acromion process of the scapula.**



- The articular surfaces are covered with fibrocartilage.
- The joint cavity is subdivided by an incomplete wedge shaped articular disc.
- Joint Capsule It is thin, lax fibrous sac attached to the margins of articular surfaces.





Blood supply :-

- Suprascapular artery
- thoracoacromial artery

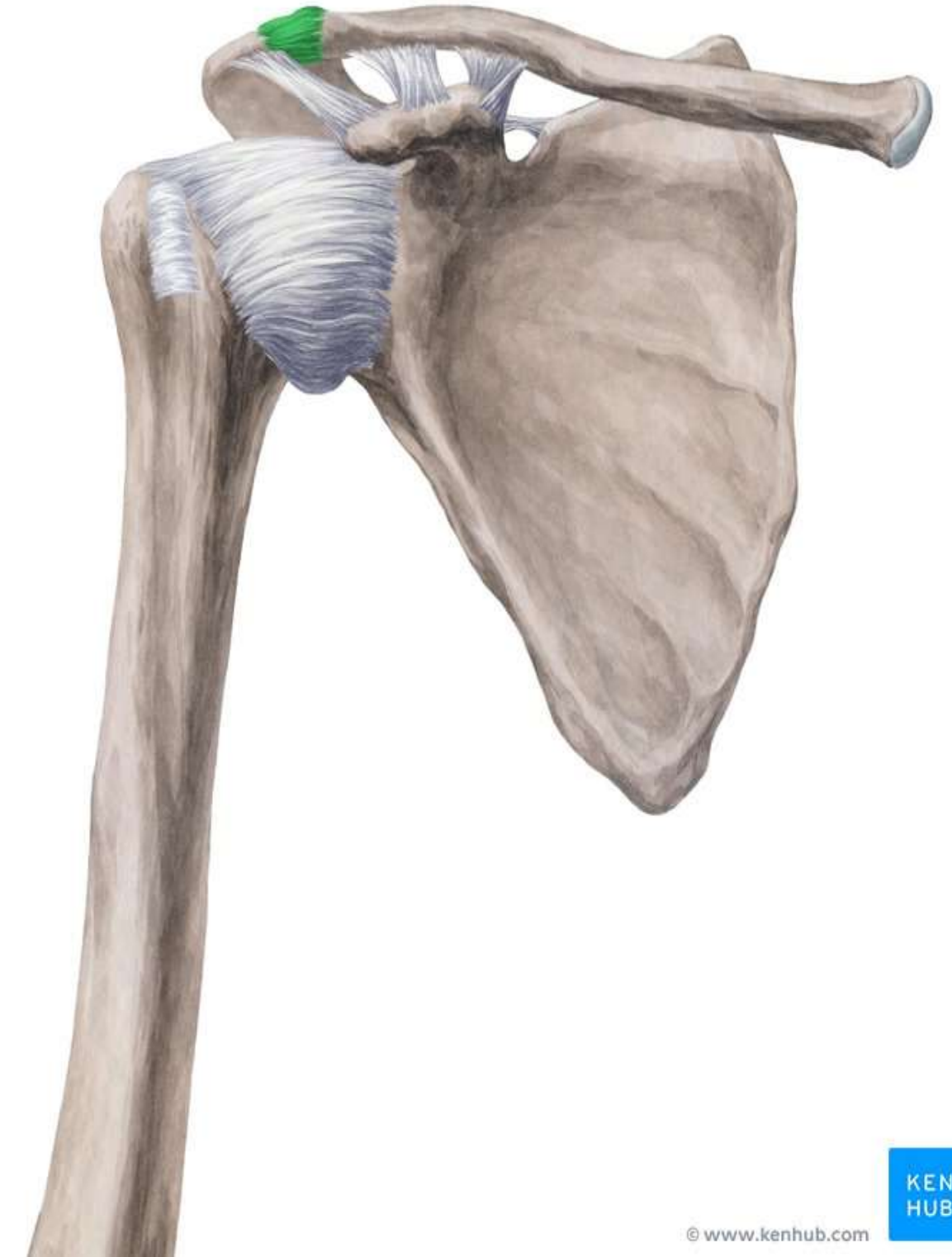
Nerve supply :-

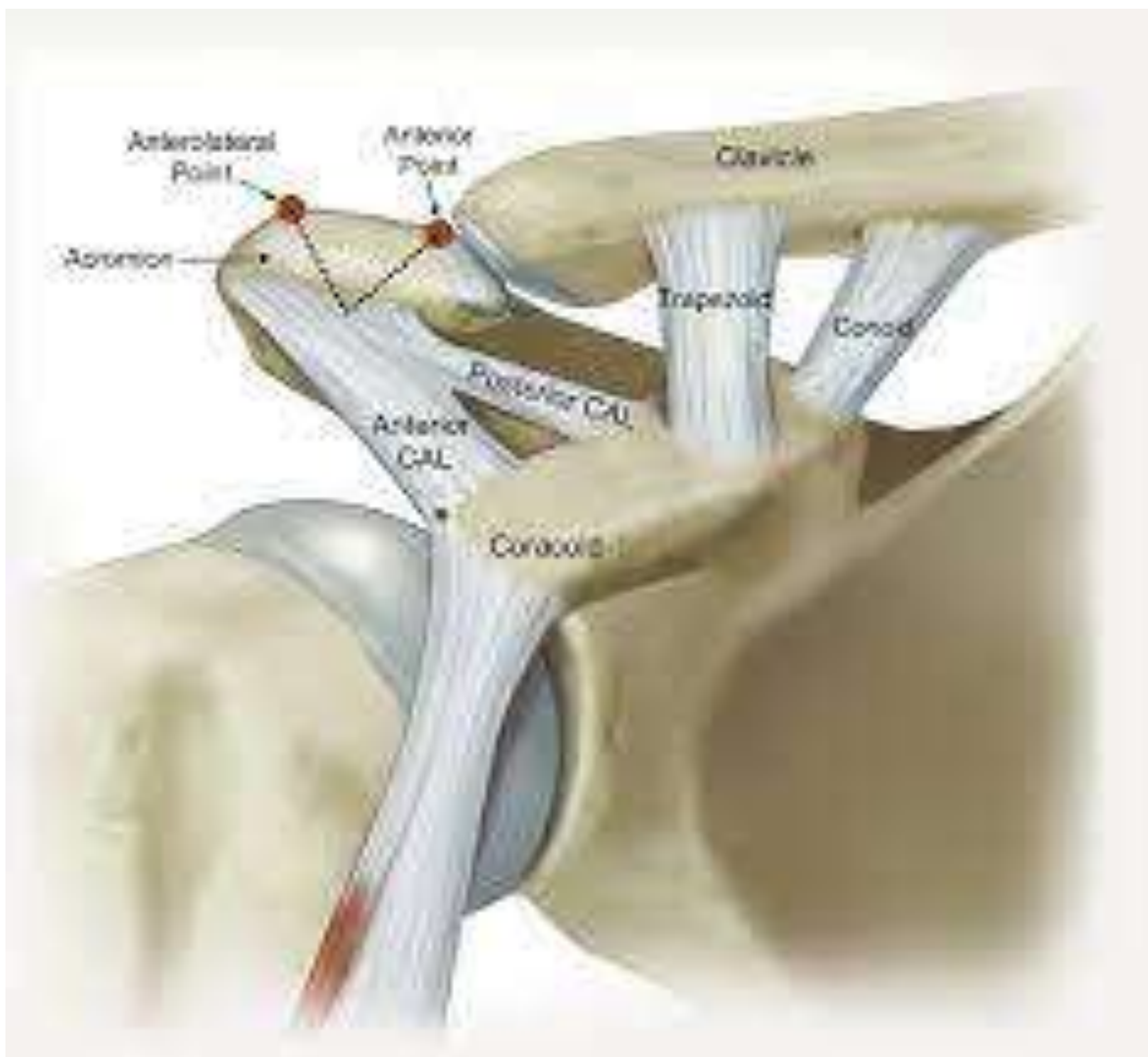
Lateral supraclavicular nerve.

Ligaments

1. Acromioclavicular ligament:

- It is a fibrous band that extends from acromion to the clavicle.
- It strengthens the acromioclavicular joint superiorly.





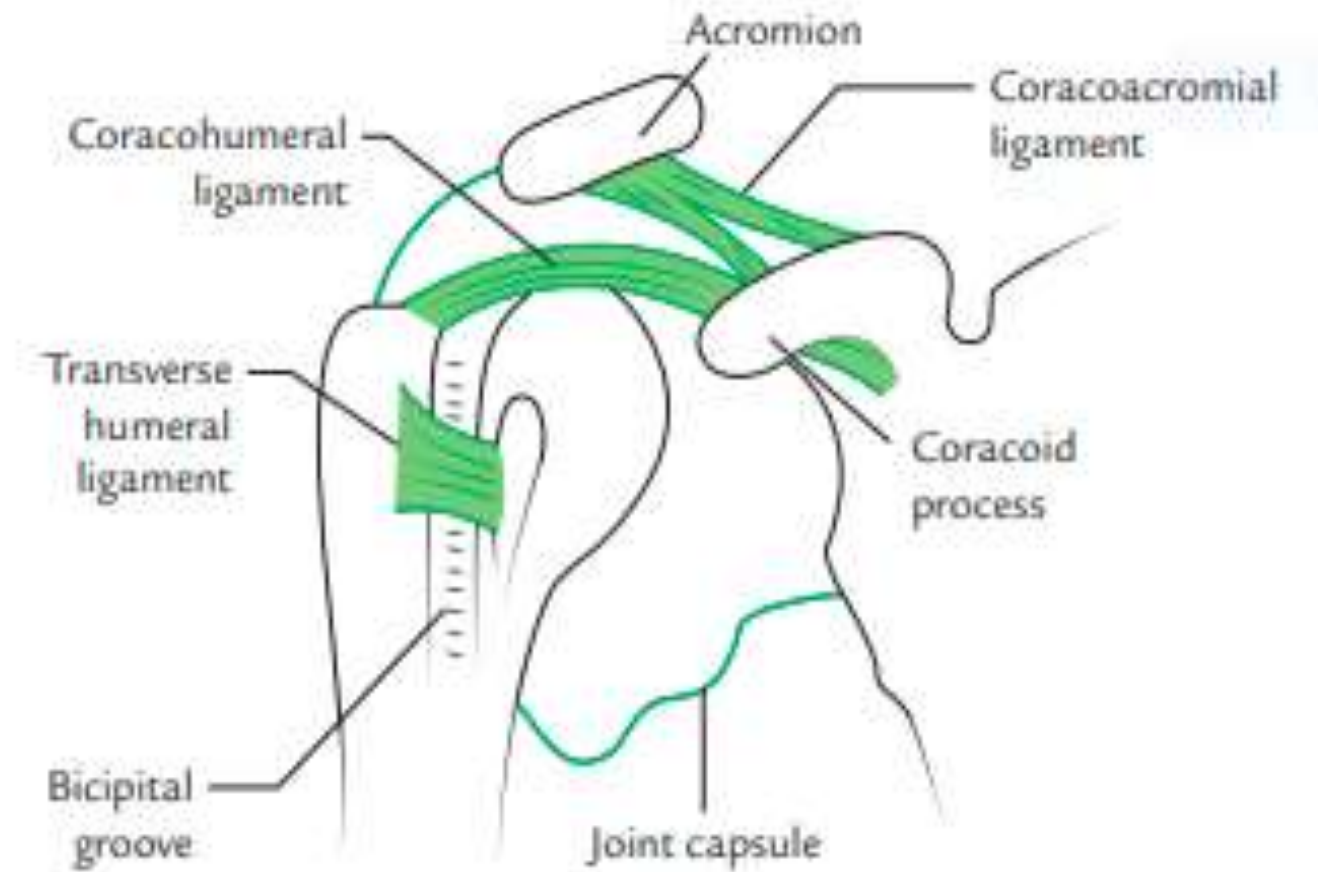
2. Coracoclavicular ligament:

- Little away from the joint
- Important role in maintaining the integrity of the joint.

Consists of two parts: united posteriorly and often separated by a bursa

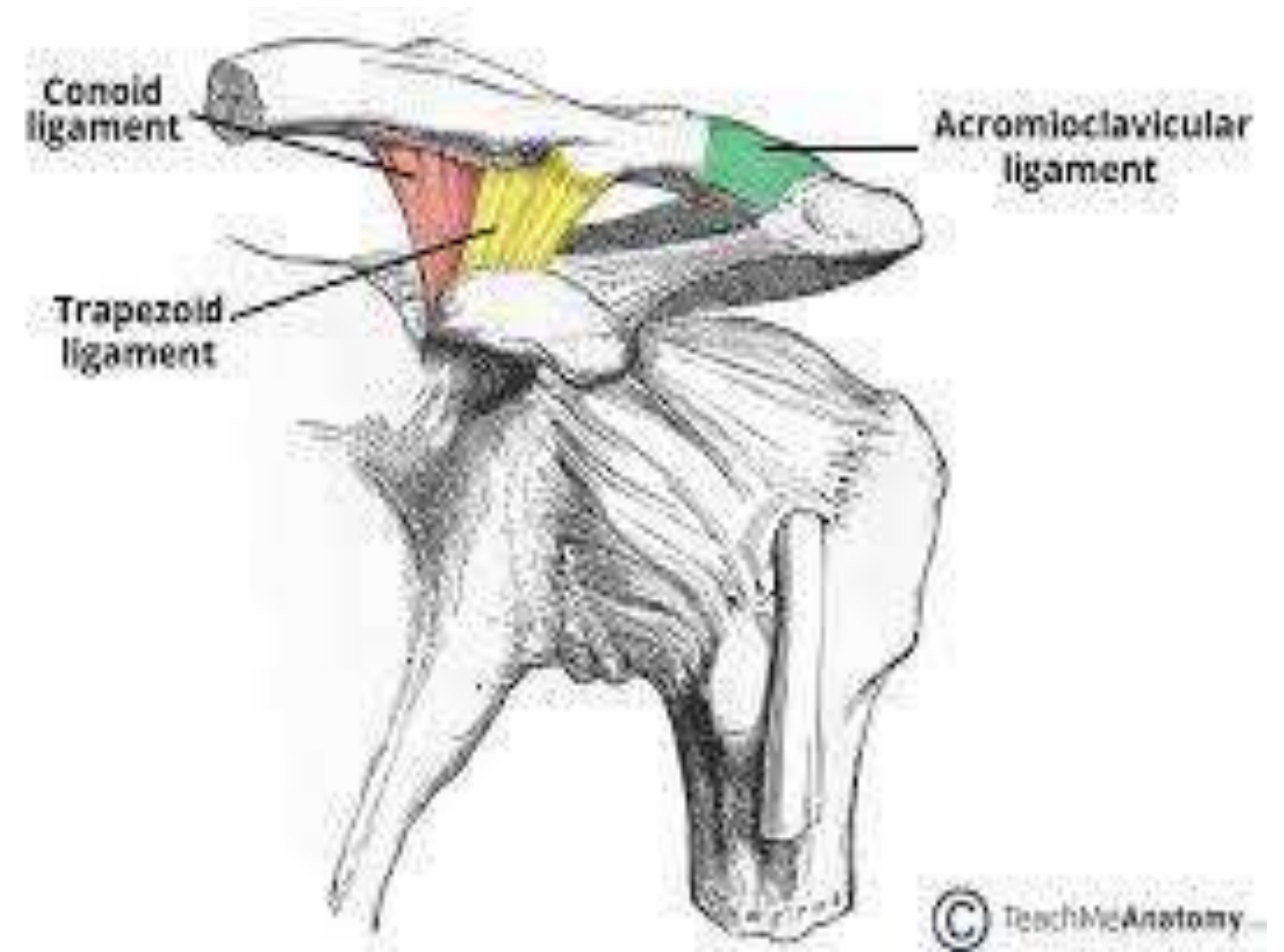
(a) **Conoid** :-

- inverted cone-shaped fibrous band.
- **apex** is attached to the root of the coracoid process just lateral to the scapular notch
- **base** is attached to the conoid tubercle on the inferior surface of the clavicle



(b) **Trapezoid :-**

- horizontal fibrous band
- stretches from **upper surface of the coracoid process** to **the trapezoid line on the inferior surface of lateral end of the clavicle.**





Movements :-

- Permits the rotation of acromion of scapula at the acromial end of the clavicle.
- These movements are associated with movements of scapula at the scapulothoracic joint/linkage



Movements of the Shoulder Girdle



- Movements at the two joints (ST and AC joints) of the girdle are always associated with the movements of the scapula.
- The movements of the scapula may or may not be associated with the movements of the shoulder joint.



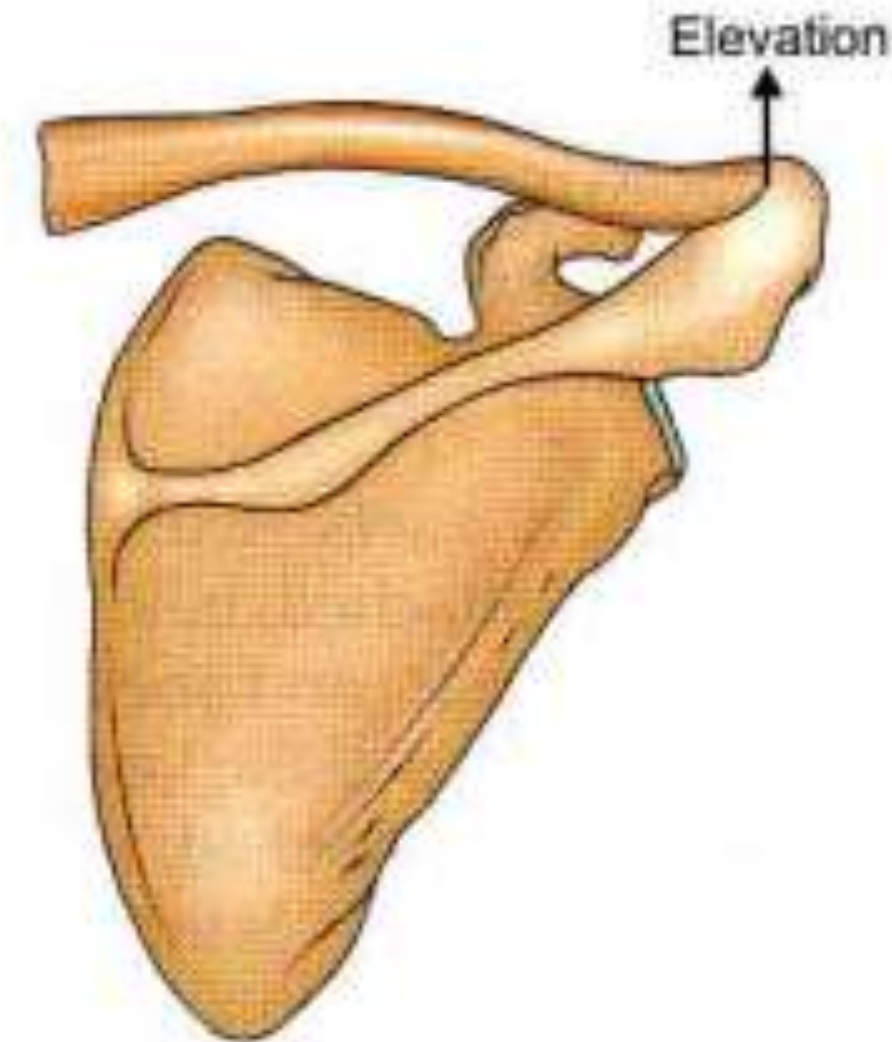
Elevation of the scapula (as in shrugging the shoulders).



- Muscles involved :-
- upper fibres of the trapezius
- levator scapulae.

Associated Joint involved :-
elevation of the lateral end, and depression of the medial end of the clavicle.

(Note :-The clavicle moves round an anteroposterior axis formed by the costoclavicular ligament)





Depression of the scapula (drooping of the shoulder)

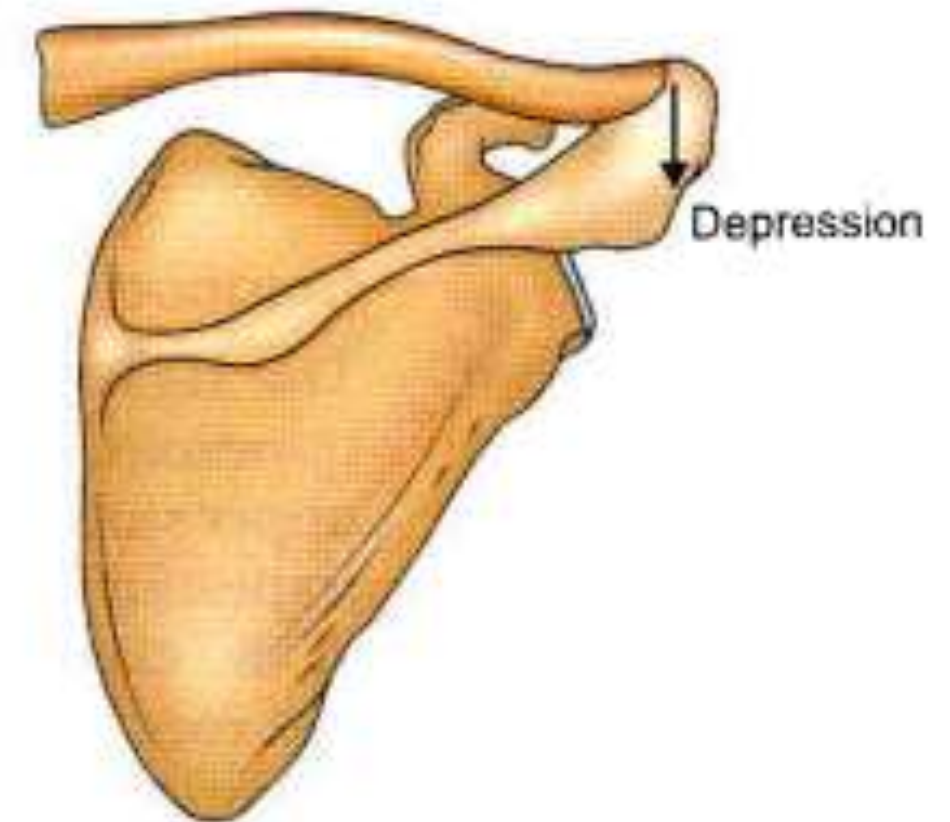


It is brought about by gravity

Muscle involved :-

- lower fibres of the serratus anterior
- pectoralis minor.

(Note :- It is associated with the depression of the lateral end and elevation of medial end of clavicle)





Protraction of the scapula (as in pushing and punching movements).

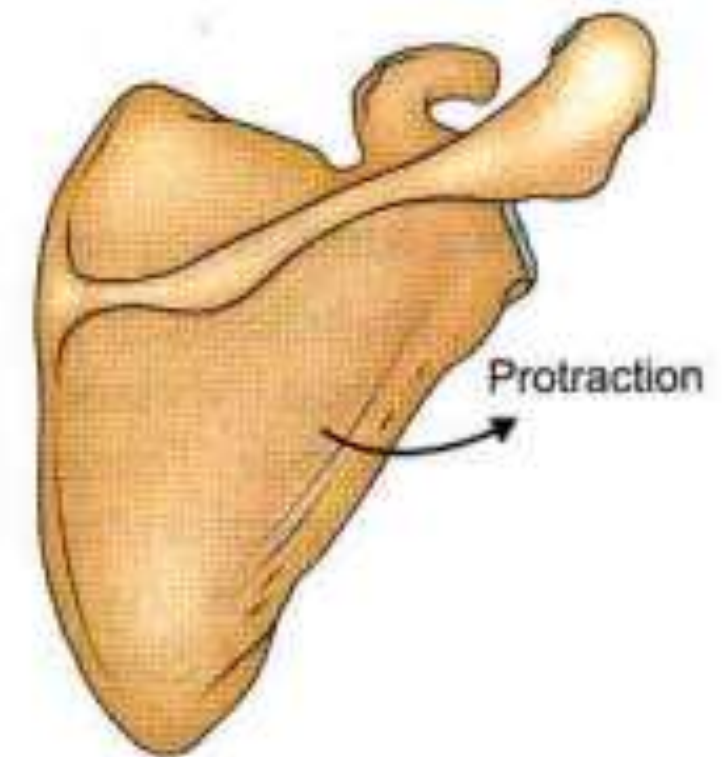


Muscle involved :-

- the serratus anterior
- pectoralis minor.

Associated joint movement :-

- Forward movements of the lateral end and backward movement of the medial end of the clavicle





Retraction of the scapula (squaring the shoulders)

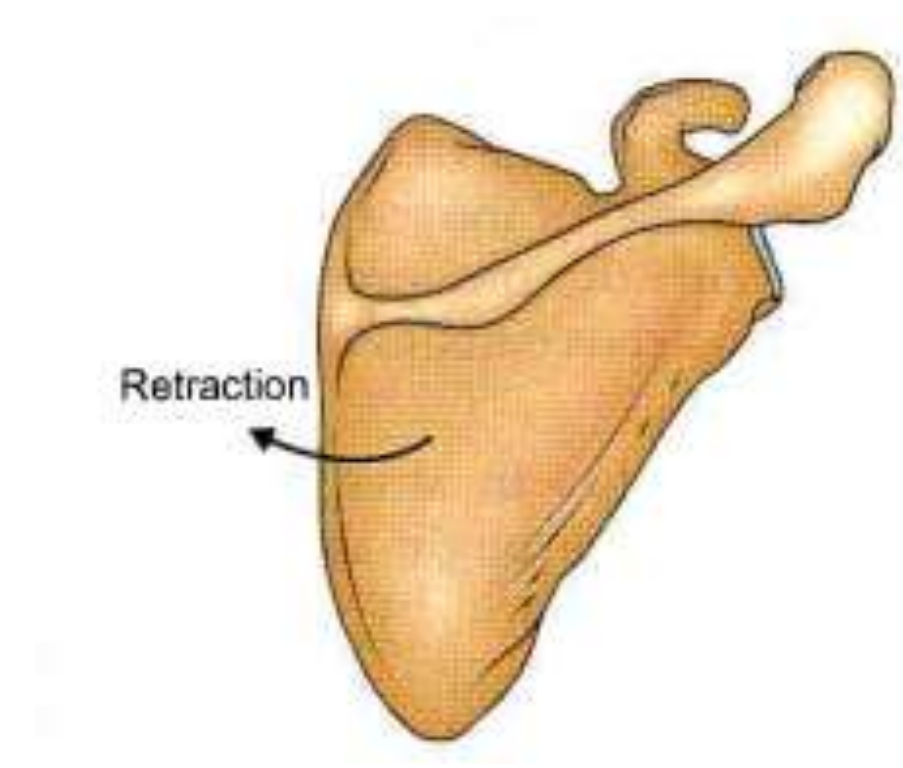


Muscles involved :-

- rhomboids
- middle fibres of the trapezius.

Associated joint movement :-

- Backward movement of the lateral end and forward movement of the medial end of the clavicle



Lateral or forward rotation of the scapula

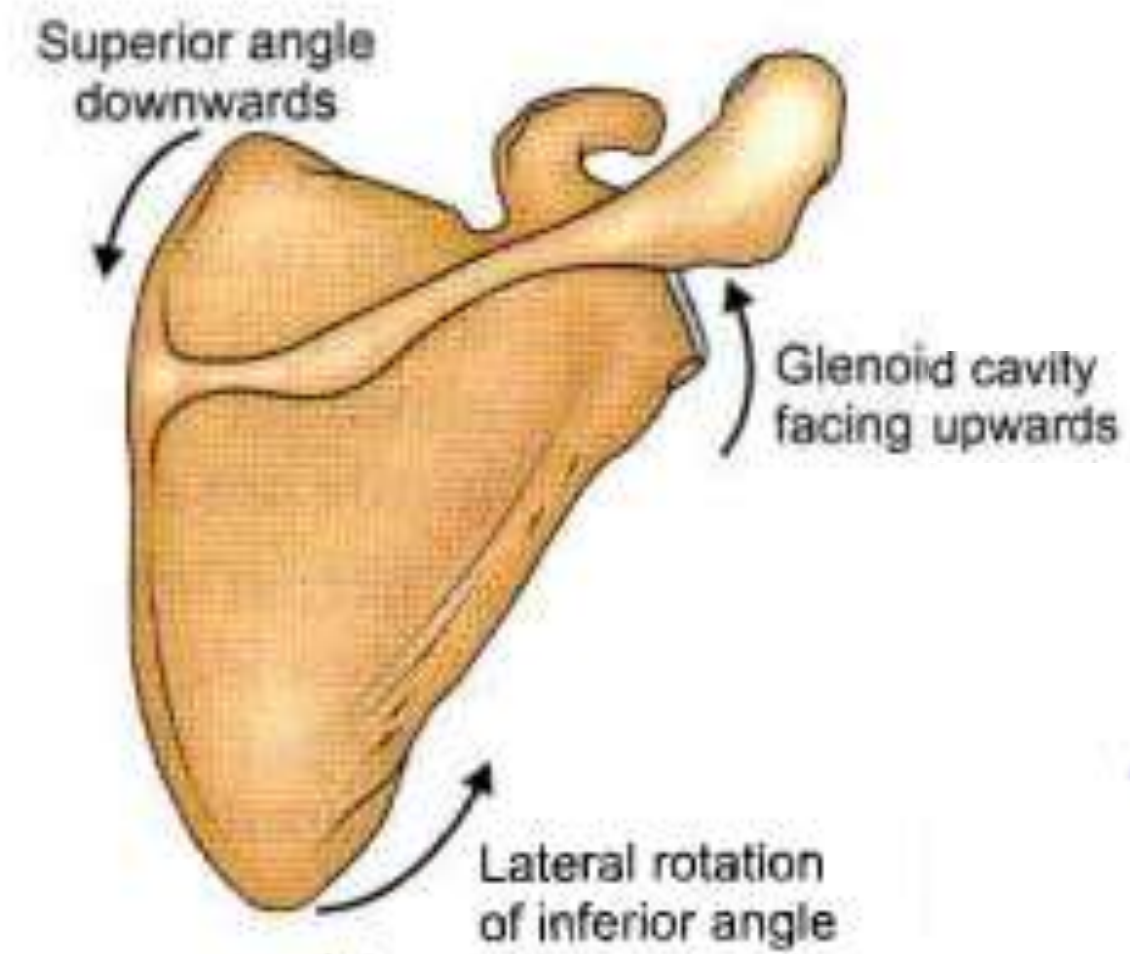
- Round the chest wall takes place during overhead abduction of the arm.
- The scapula rotates around the coracoclavicular ligaments.

Muscles involved :-

- upper fibres of the trapezius
- lower fibres of the serratus anterior.

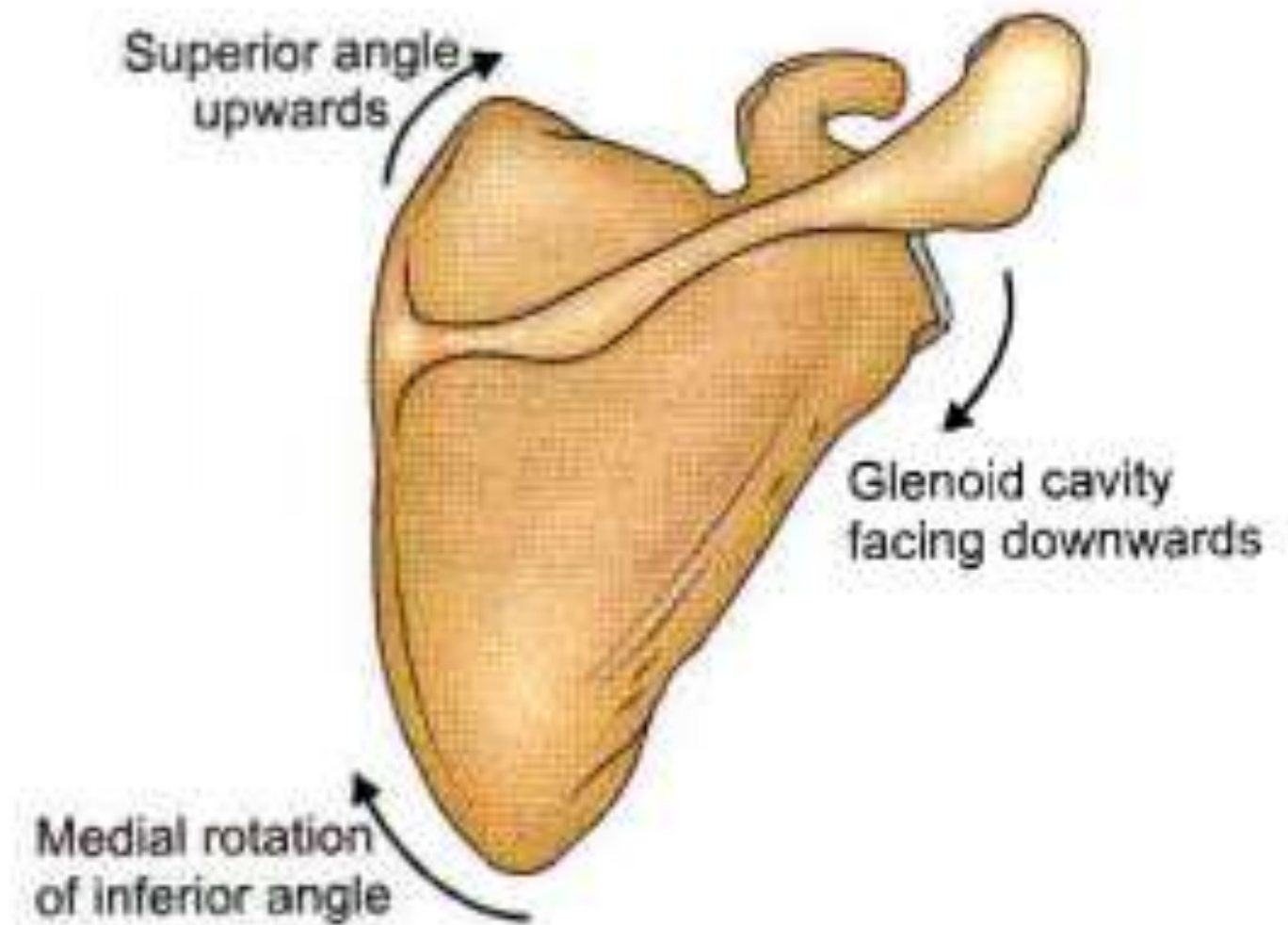
Associated joint movement :-

- rotation of the clavicle around its long axis



Medial or backward rotation of the scapula

- Occurs under the influence of gravity
- Muscle involved :- the levator scapulae and the rhomboids.



Glenohumeral Joint

- **Type:** ball and socket variety, synovial joint
- Articular surface :-
 - ❖ large round **head of humerus** with the relatively shallow **glenoid cavity** of the scapula.
 - ❖ The glenoid cavity is deepened slightly but effectively by the **fibrocartilaginous ring called glenoid labrum**





How strong the joint is?



- Structurally, it is a weak joint because the glenoid cavity is too small and shallow to hold the head of the humerus in place as the head is four times the size of the glenoid cavity
- this arrangement permits great mobility.



Stability of the joint is maintained by the following factors

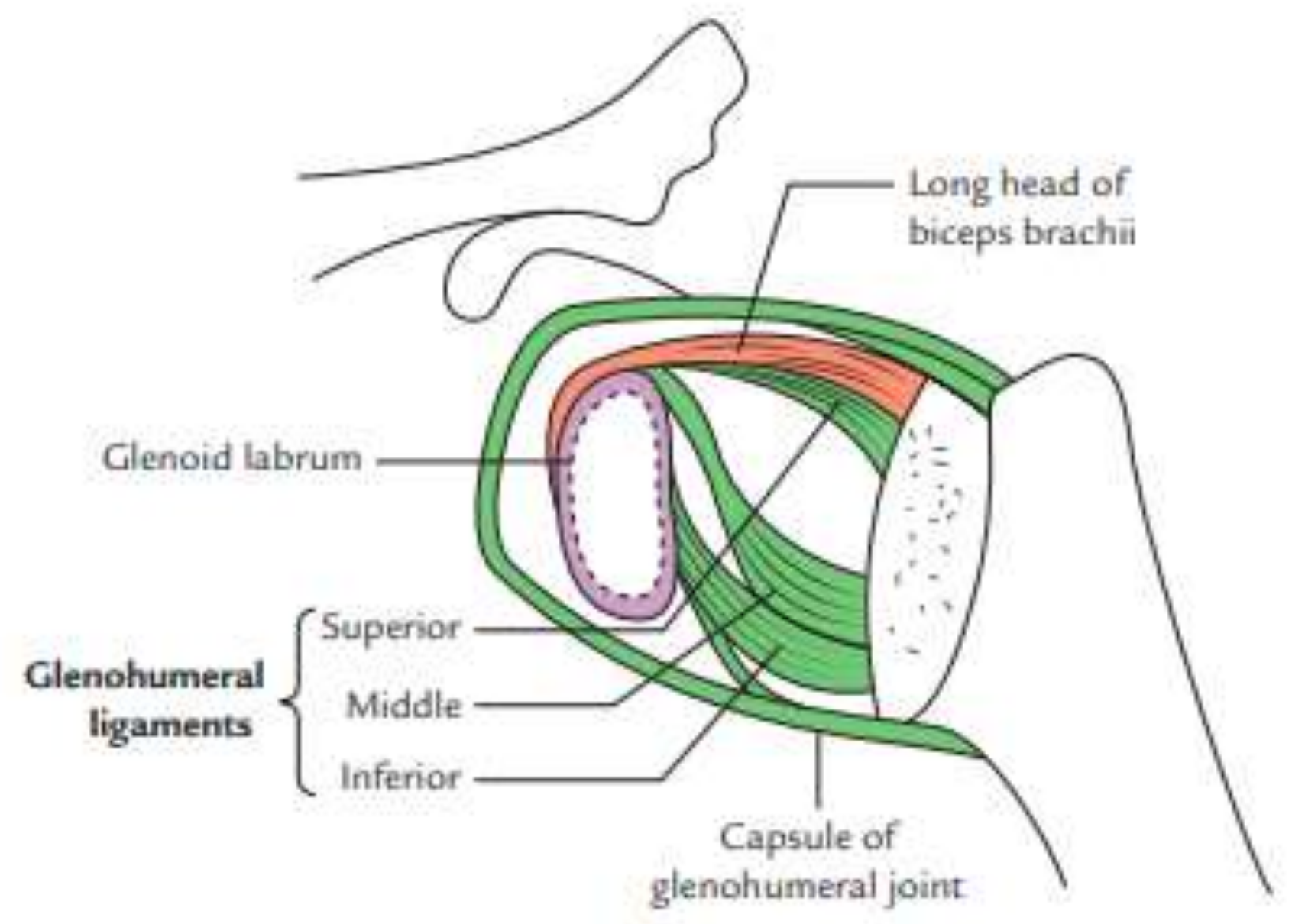


1. **The coracoacromial arch** or secondary socket for the head of the humerus
2. **The musculotendinous cuff** of the shoulder
3. **The glenoidal labrum** (Latin lip) helps in deepening the glenoid fossa.

Others..... Muscular attachments

e.g., the **long head of the biceps brachii**, the **long head of the triceps brachii**.

(Note:- Atmospheric pressure also stabilises the joint)





LIGAMENTS



1. Capsular ligament (joint capsule):

- Thin fibrous layer of the joint capsule surrounds the glenohumeral joint.
- Permits free mobility because of the congruence of articular surfaces



Attachment of Capsule



- **Medial** –

Margins of the glenoid cavity beyond the glenoid labrum, extends beyond the supraglenoid tubercle (enclosing the long head of biceps brachii within the joint cavity).

- **Lateral** - Anatomical neck of the humerus

- **Inferior** - Extends downwards 1.5 cm or more on the surgical neck of the humerus.

- **Superior** - Deficient for passage of the tendon of the long head of the biceps brachii

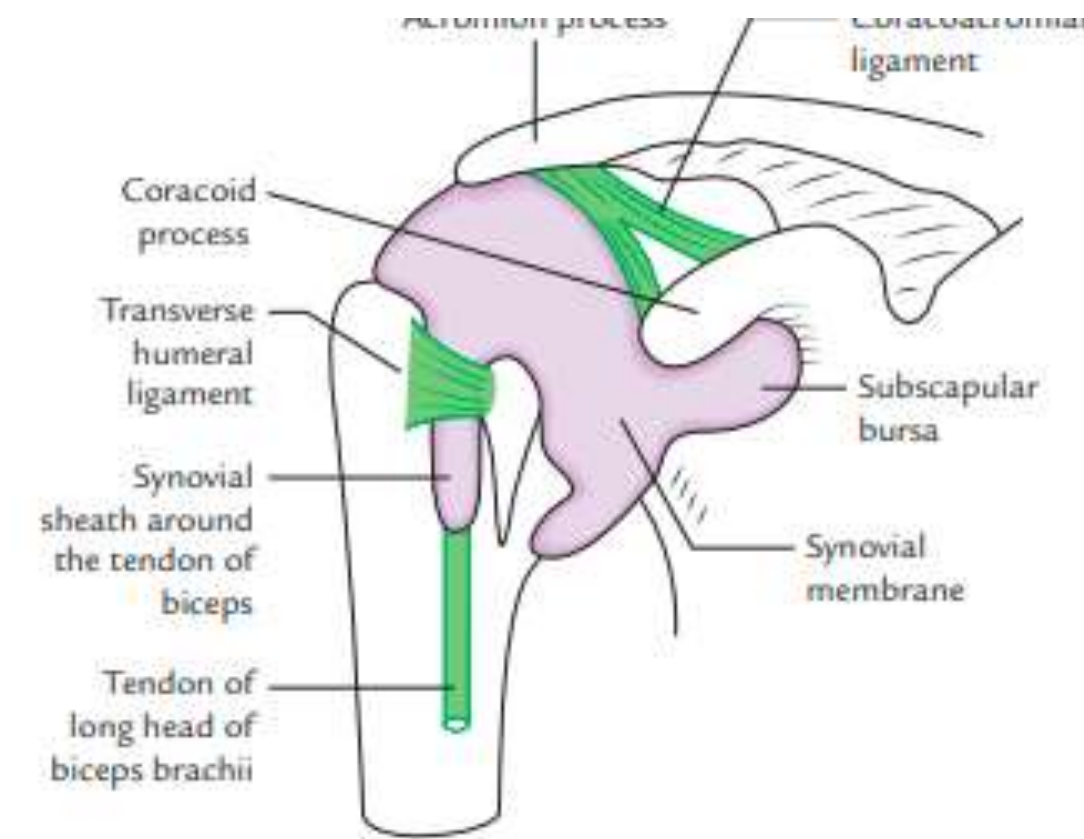




The synovial membrane



- Lines the inner surface of the joint capsule and reflects from it to the glenoid labrum and humerus as far as the articular margin of the head.
- Synovial cavity of the joint presents the following features:
 - (a) It forms tubular sheath around the tendon of biceps brachii where it lies in the bicipital groove of the humerus.
 - (b) It communicates with subscapular and infraspinatus bursae, around the joint. Thus there are





3 apertures in the joint capsule:



(a) Location: Opening **between the tubercles of the humerus**
Purpose: Passage of tendon of long head of biceps brachii.

(b) Location: Opening **situated anteriorly inferior to the coracoid process**

Purpose : To allow communication between the synovial cavity and subscapular bursa.

(c) Location: Opening **situated posteriorly**

Purpose : to allow communication between synovial cavity and infraspinatus bursa.



Glenohumeral ligaments:



There are three thickenings in the anterior part of the fibrous capsule; to strengthen it.

They are :-

- Superior glenohumeral ligament
- Middle glenohumeral ligament
- inferior glenohumeral ligament

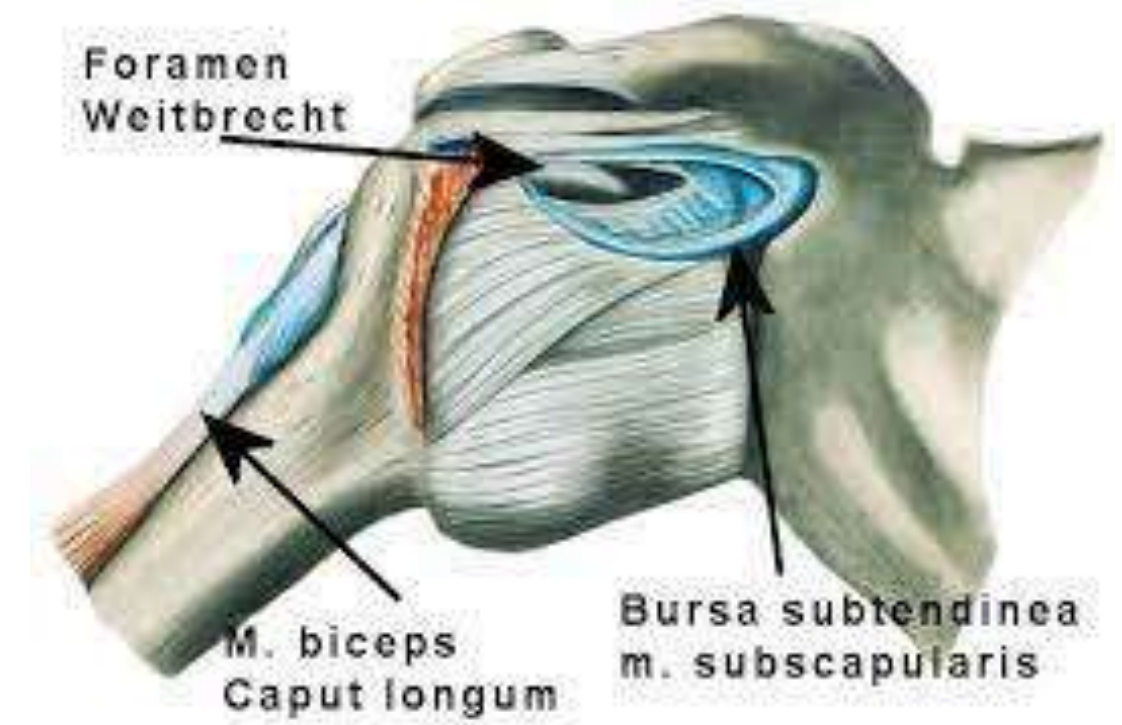
(They are visible only from interior of the joint).

Clinical Importance

- **Foramen of Weitbrecht :**

A defect/ point of weakness exists between superior and middle glenohumeral ligaments.

It is a common site of anterior dislocation of humeral head.

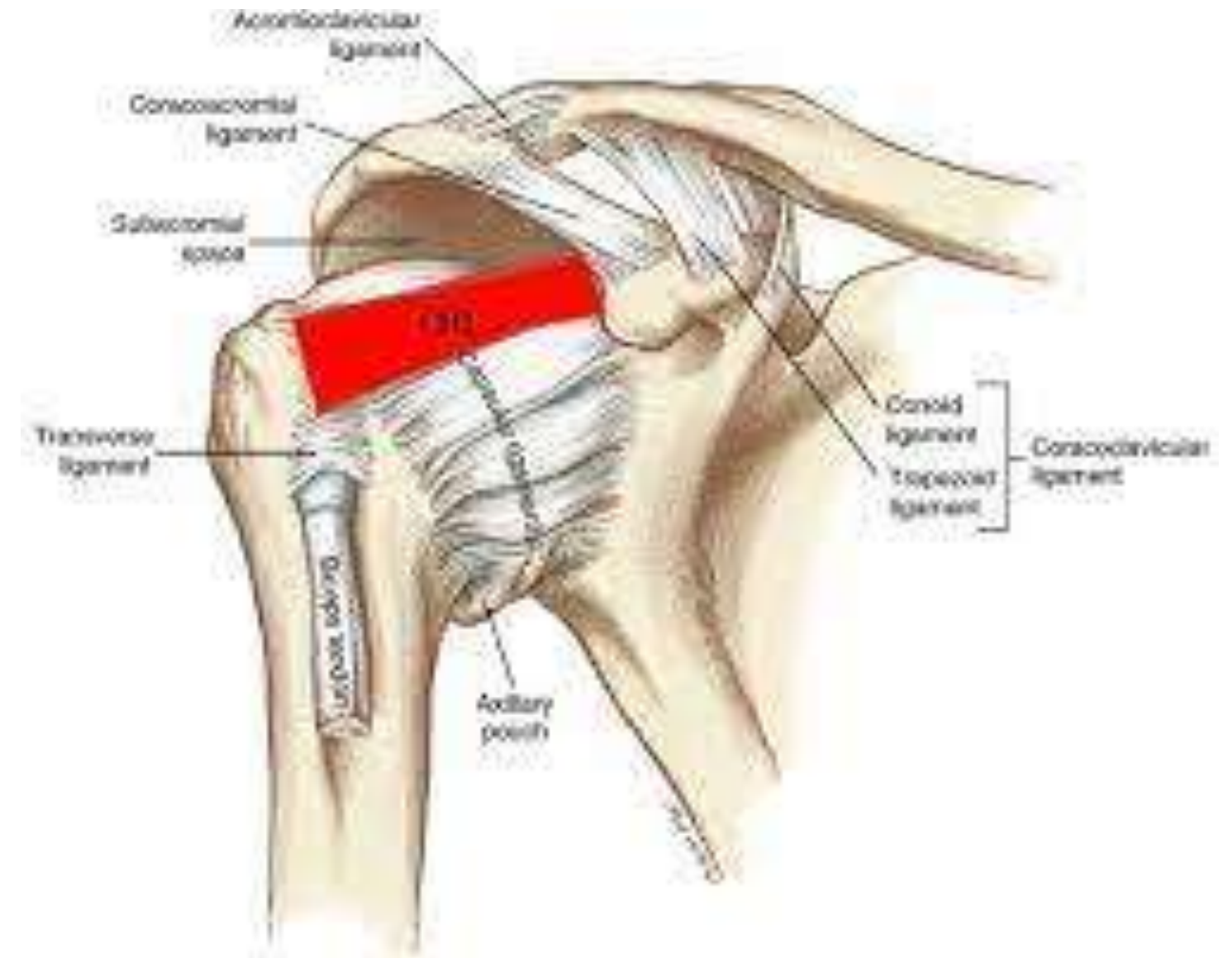


Coracohumeral ligament

Strong band of fibrous tissue

Attachment :-

- **From** the base / root of the coracoid process (coracoid portion)
- **To** neck of the humerus, the anterior aspect of the greater tubercle of the humerus. (humaeral portion)



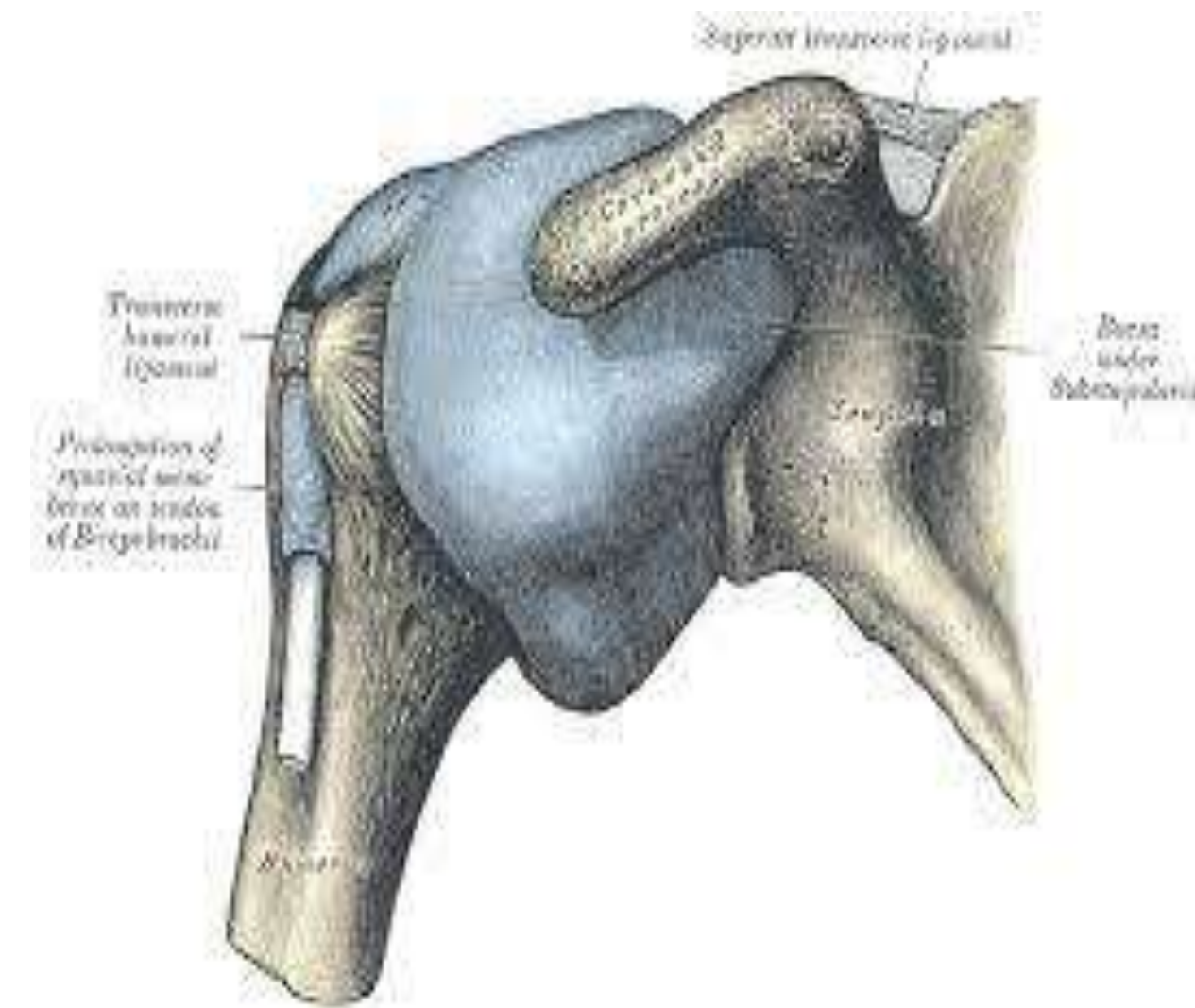
TRANSVERSE HUMERAL LIGAMENT

Broad fibrous band

Attachment :- Bridges the upper part of the bicipital groove of the humerus (between the greater and lesser tubercles).

Purpose :- This ligament converts the groove into a canal

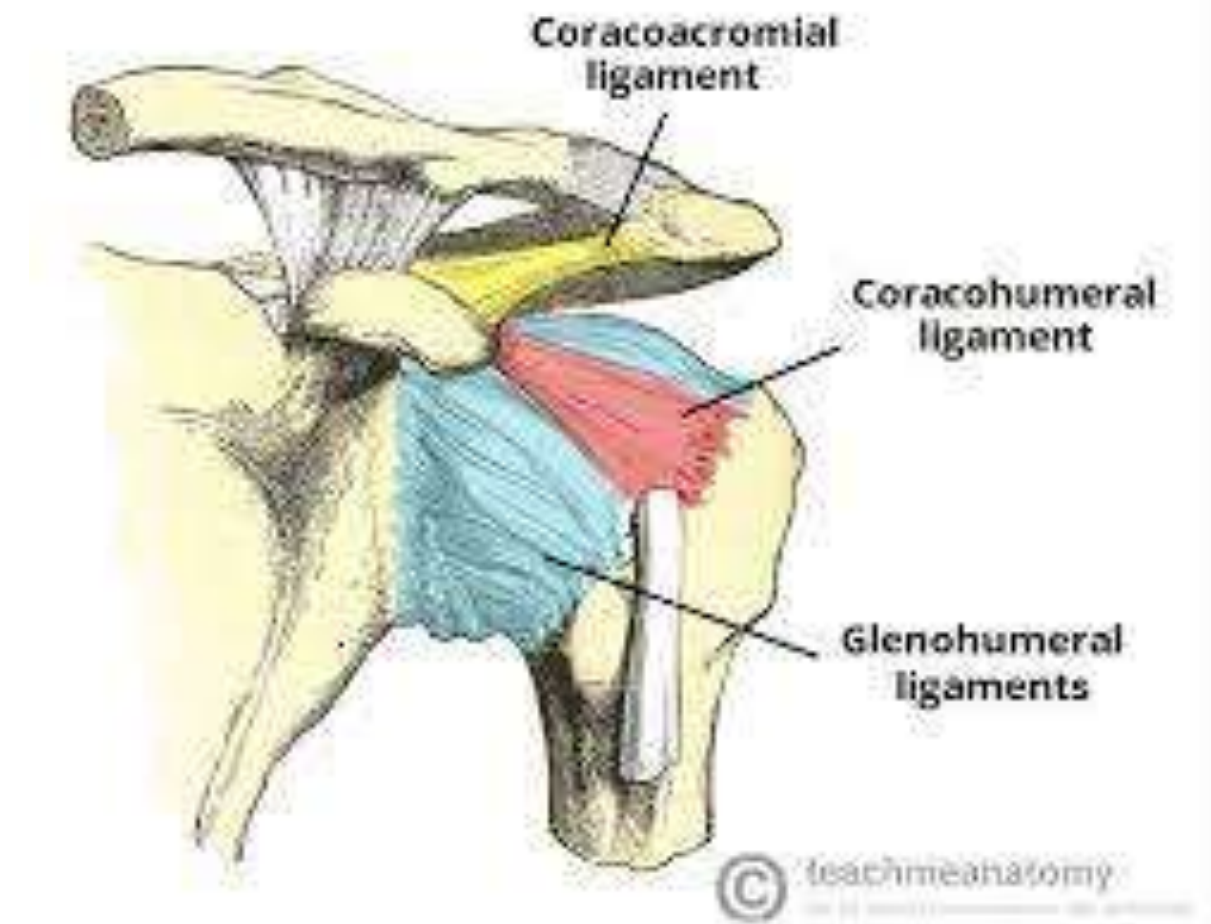
The tendon of the long head of the biceps brachii passes through the canal surrounded by synovial sheath.

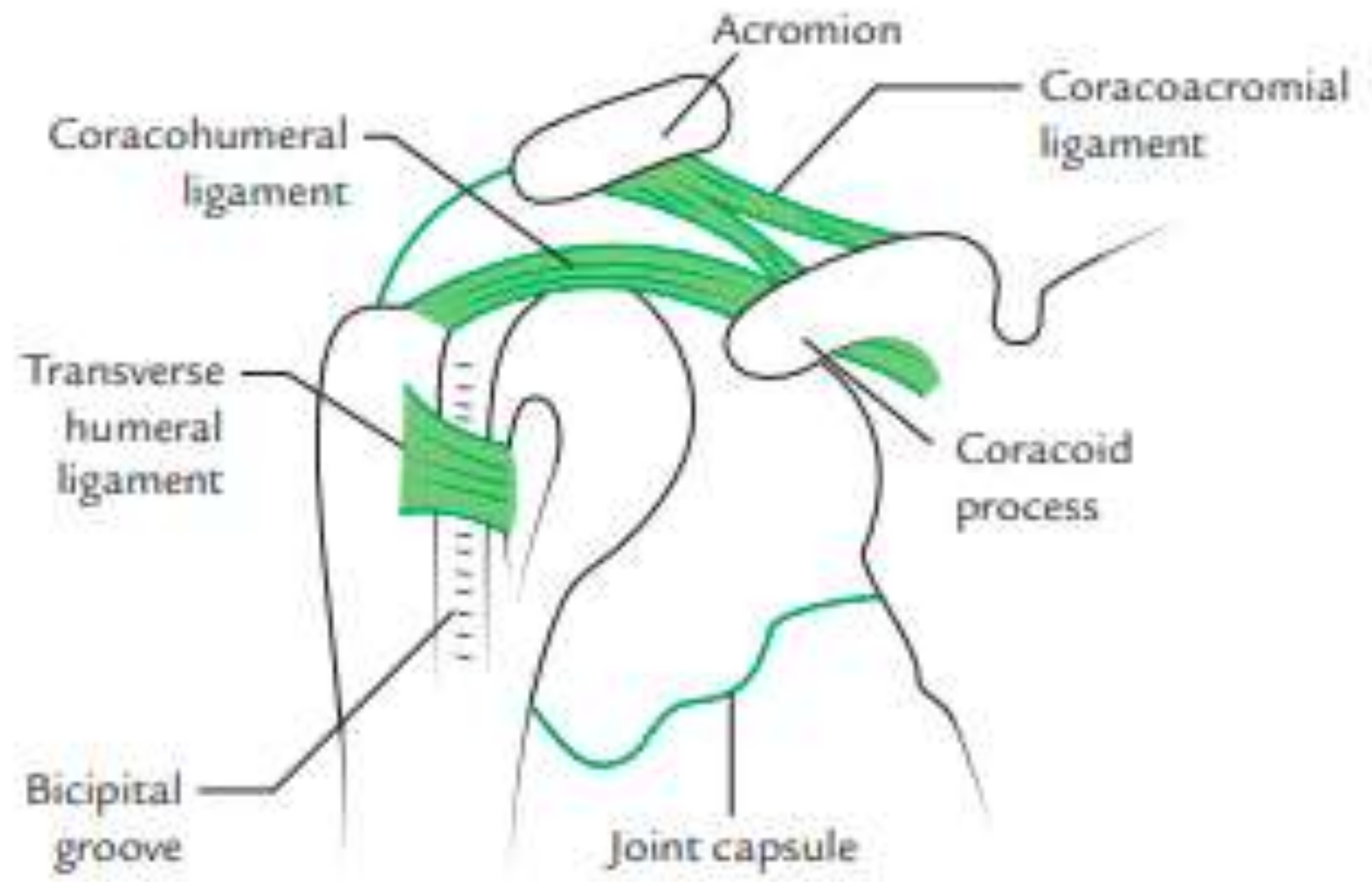


ACCESSORY LIGAMENT

Coracoacromial ligament:

- Extends between coracoid and acromion processes.
- It protects the superior aspect of the joint.



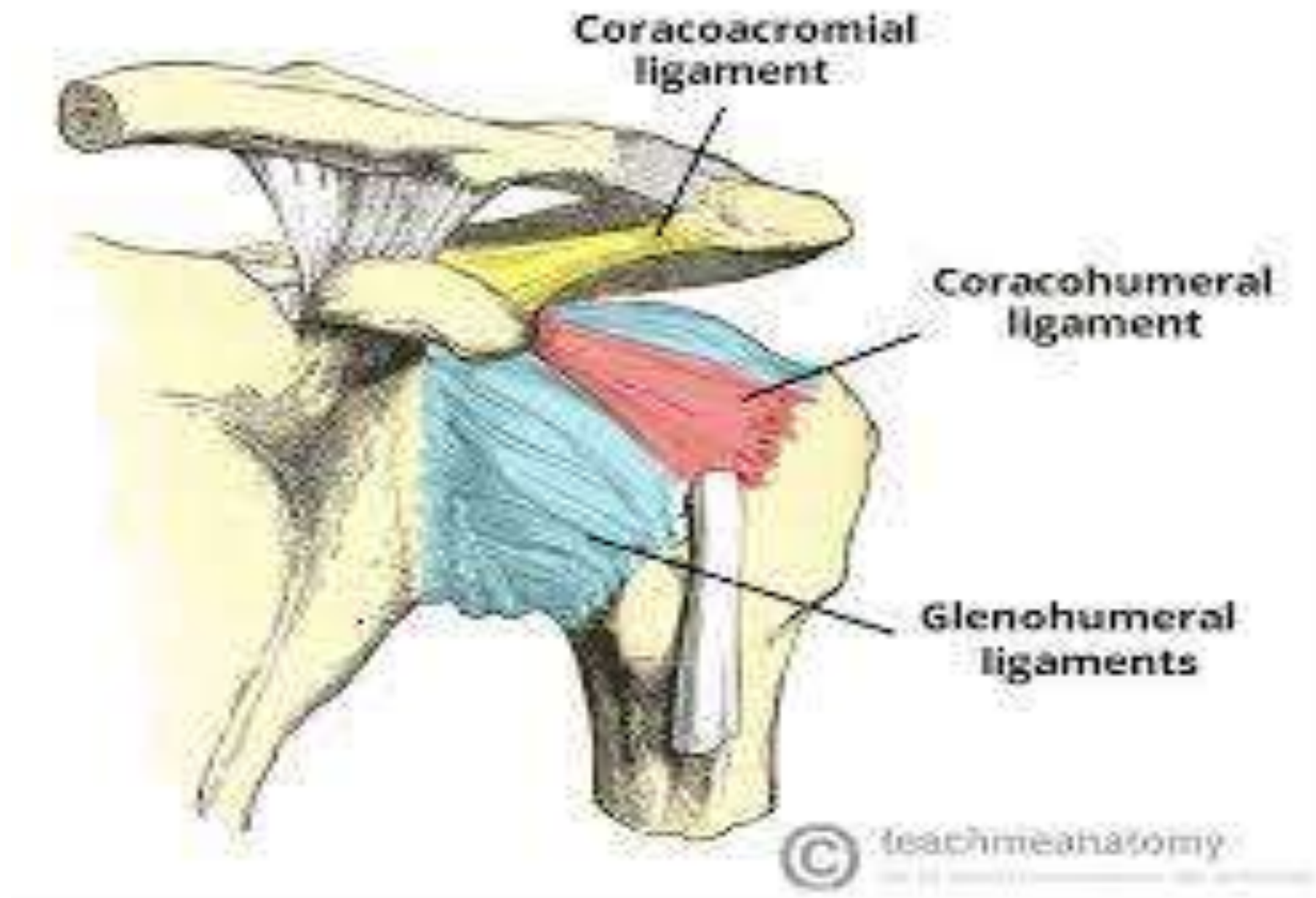




CORACOACROMIAL ARCH

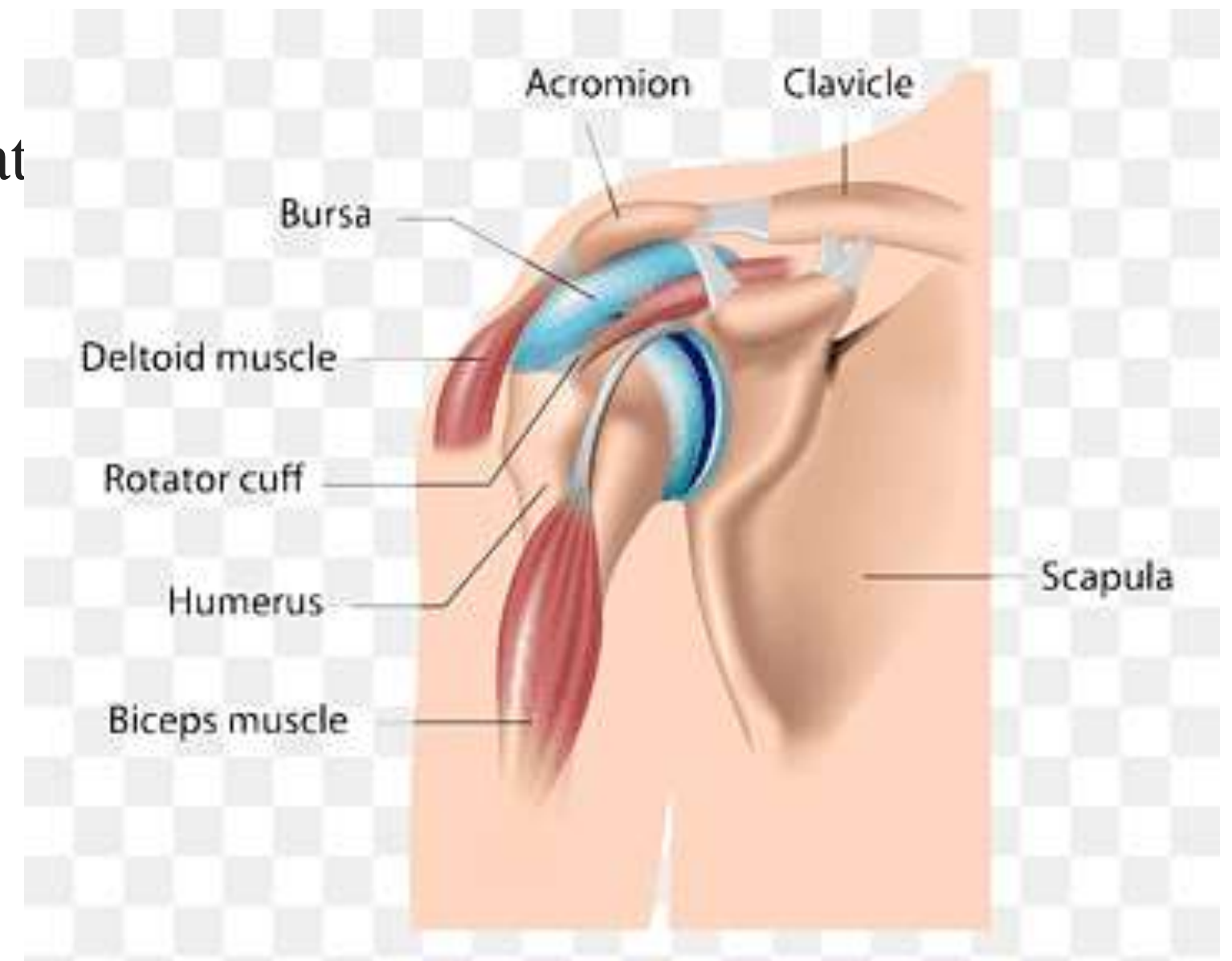
Formed by : Coracoid process, Acromion process, and Coracoacromial ligament

- This osseoligamentous structure forms a protective arch for the head of humerus above and prevents its superior displacement above the glenoid cavity.
- The supraspinatus muscle passes under this arch and lies deep to the deltoid where its tendon blends with the joint capsule.
- The large subacromial bursa lies between the arch superiorly and tendon of supraspinatus and greater tubercle of humerus inferiorly. This facilitates the movement of supraspinatus tendon.



Bursae

- Bursa is a small, fluid-filled sac within your body that lies near bony prominences and joints.
-
- Acts as a cushion between muscles, ligaments, and bones
- Allows structures to glide and slide past one another with ease and with minimal friction.

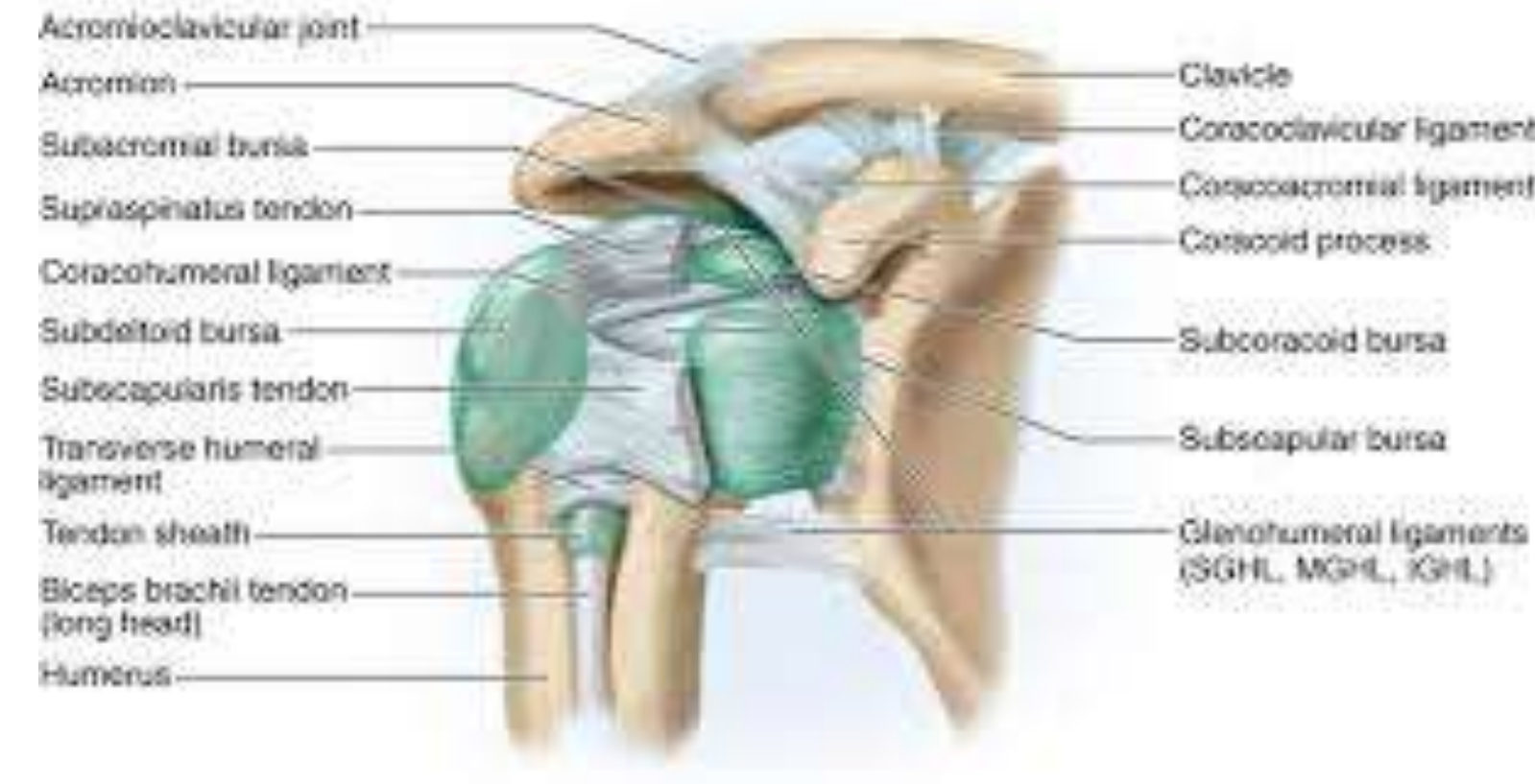


Subscapular Bursae

LOCATION: Lies between the tendon of subscapularis and the neck of the scapula.

PURPOSE: Protects the tendon from friction against the neck.

This bursa usually communicates with the joint cavity.





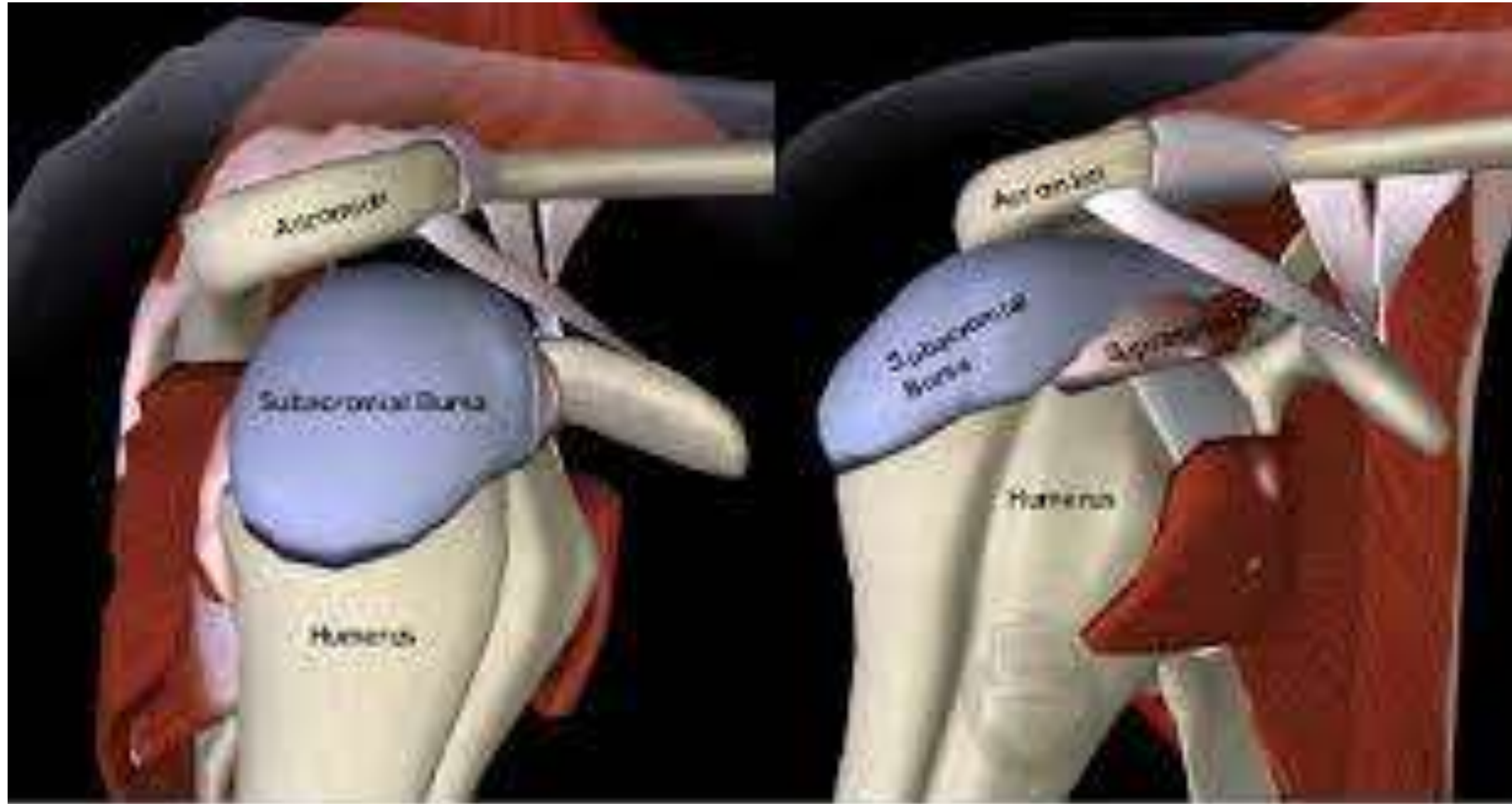
SUBACROMIAL BURSA

LOCATION: Lies between the coracoacromial ligament and acromion process above, and supraspinatus tendon and joint capsule below. It continues downwards beneath the deltoid

PURPOSE: Facilitates the movements of supraspinatus tendon under the coracoacromial arch.

SPECIAL FEATURES:

- Also referred to as subdeltoid bursa.
- It is the largest synovial bursa in the body



Lateral view

Anterior view





INFRASPINATUS BURSA

- Lies between the tendon of infraspinatus and posterolateral aspect of the joint capsule.
- It may sometime communicate with the joint cavity



Blood Supply



- ❖ Anterior circumflex humeral vessels.
- ❖ Posterior circumflex humeral vessels.
- ❖ Suprascapular vessels.
- ❖ Subscapular vessels



Nerve Supply



- ❖ Axillary nerve.
- ❖ Musculocutaneous nerve.
- ❖ Suprascapular nerve.



MOVEMENTS IN SHOULDER JOINT

- ❖ The shoulder joint has more freedom of mobility than any other joint in the body.

- ❖ Due to the following factors:
 1. Laxity of joint capsule.

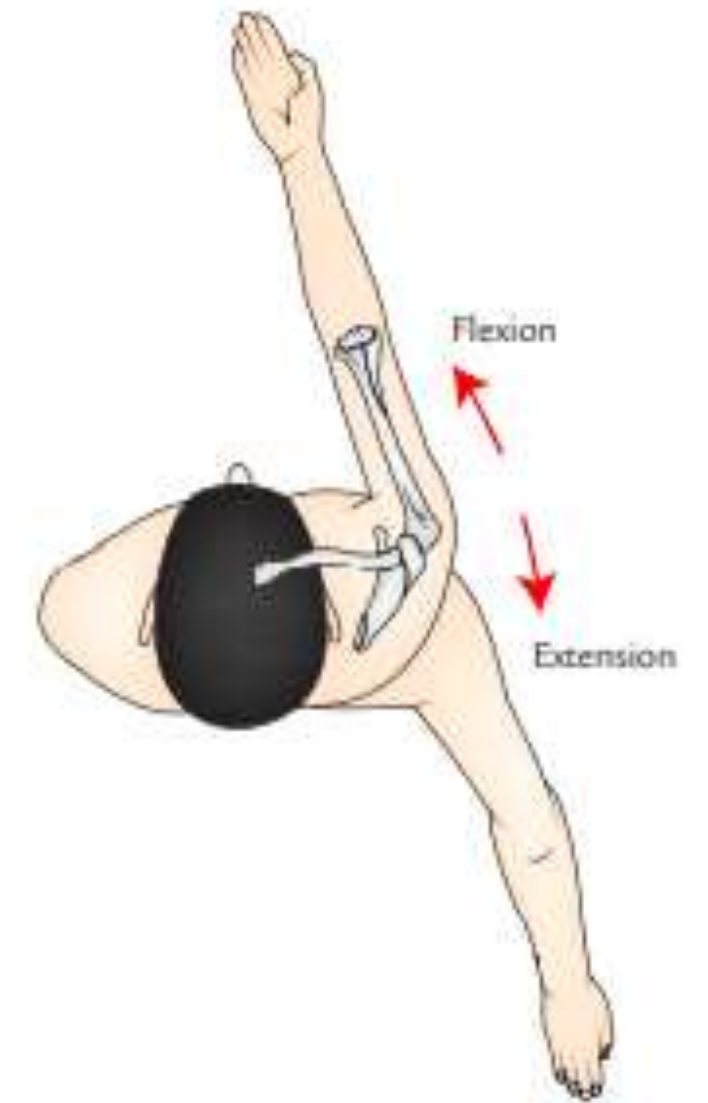
 2. Articulation between relatively large humeral head and smaller and shallow glenoid cavity. (head is four times larger than glenoid cavity)



Flexion and extension

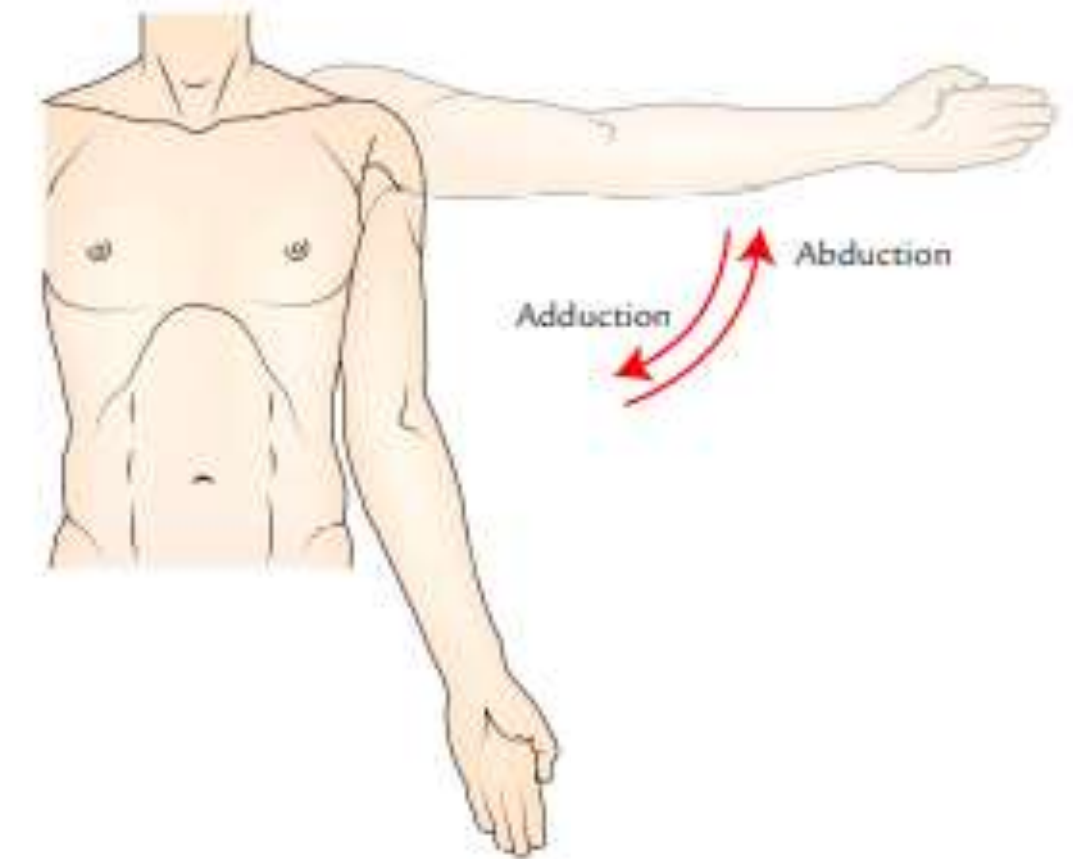
- ❖ Plane: Saggital plane
- ❖ Axis : Frontal axis

- ❖ During flexion, the arm moves forwards and medially
- ❖ During extension it moves backwards and laterally.
- ❖ These movements take place parallel to the plane of glenoid cavity (i.e., midway between the coronal and sagittal plane).



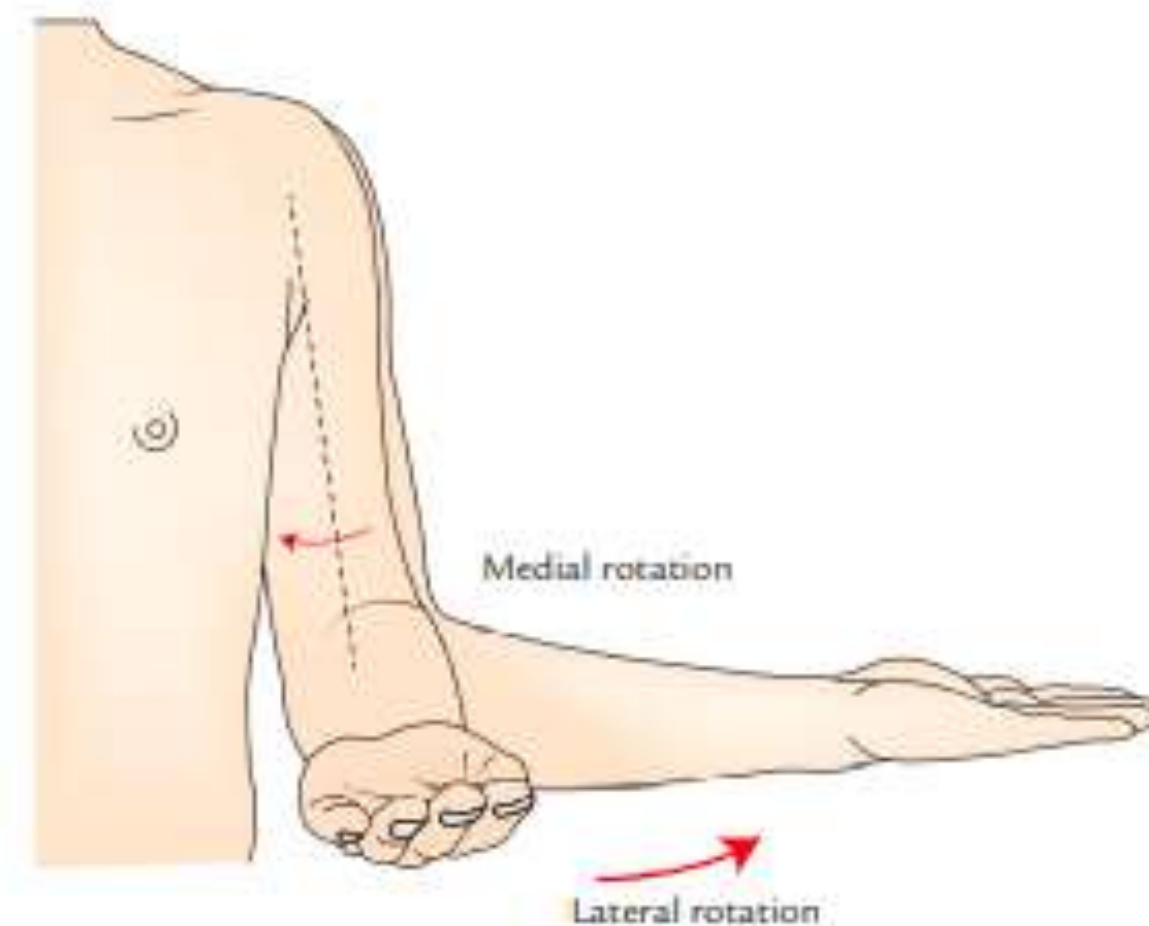
Abduction and adduction

- ❖ **Plane:** Frontal plane
- ❖ **Axis:** Saggital axis
- ❖ During abduction, the arm moves anterolaterally away from the trunk
- ❖ During adduction the arm moves posteromedially towards the trunk.
- ❖ These movements occur at right angle to the plane of flexion and extension (i.e., in the plane of the body of the scapula).



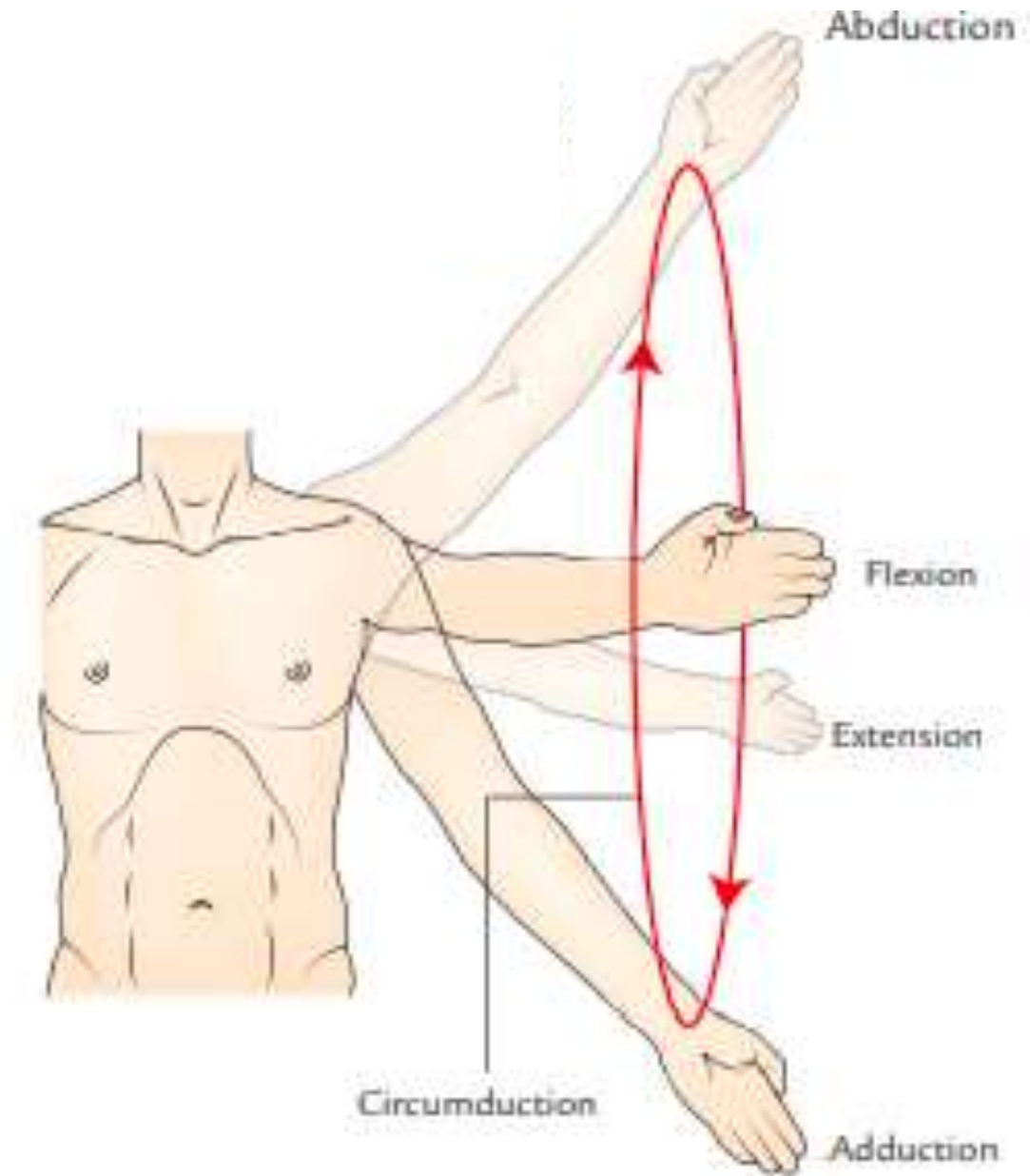
Medial and lateral rotation

- ❖ **Plane:** Transverse plane
- ❖ **Axis:** Vertical axis
- ❖ These movements are best demonstrated in mid flexed elbow.
- ❖ In this position, the hand moves medially in medial rotation and laterally in lateral rotation.



Circumduction

- ❖ The circumduction at glenohumeral joint is an orderly sequence of flexion, abduction, extension and adduction or the reverse.
- ❖ Hence this movement happens in multiple planes and axis.
- ❖ During this movement the upper limb moves along a circle.





Muscle Action



Movements	Main muscles (prime movers)	Accessory muscles (synergists)
Flexion	<ul style="list-style-type: none"> • Pectoralis major (clavicular part) • Deltoid (anterior fibres) 	<ul style="list-style-type: none"> • Biceps brachii (short head) • Coracobrachialis • Sternocostal head of pectoralis major
Extension	<ul style="list-style-type: none"> • Deltoid (posterior fibres) • Latissimus dorsi 	<ul style="list-style-type: none"> • Teres major • Long head of triceps
Adduction	<ul style="list-style-type: none"> • Pectoralis major (sternocostal part) • Latissimus dorsi 	<ul style="list-style-type: none"> • Teres major • Coracobrachialis • Short head of biceps • Long head of triceps
Abduction	<ul style="list-style-type: none"> • Deltoid (lateral fibres) • Supraspinatus 	<ul style="list-style-type: none"> • Serratus anterior • Upper and lower fibres of trapezius
Medial rotation	<ul style="list-style-type: none"> • Subscapularis 	<ul style="list-style-type: none"> • Pectoralis major • Latissimus dorsi • Deltoid (anterior fibres) • Teres major
Lateral rotation	<ul style="list-style-type: none"> • Deltoid (posterior fibres) 	<ul style="list-style-type: none"> • Infraspinatus • Teres minor



Range of Motion



Movements	Range of motion
• Flexion	90°
• Extension	45°
• Abduction	180°
• Adduction	45°
• Lateral rotation	45°
• Medial rotation	55°



CLINICAL CORRELATION

Dislocation of the shoulder joint:

- ❖ Dislocation of shoulder joint mostly occurs inferiorly because the joint is least supported on this aspect.
- ❖ It often injures the axillary nerve because of its close relation to the inferior part of the joint capsule.

Shoulder Dislocation



Normal
anatomy

Anterior
dislocation

Posterior
dislocation

Frozen shoulder (adhesive capsulitis):

- ❖ It is a clinical condition characterized by pain and uniform limitation of all movements of the shoulder joint
- ❖ though there are no radiological changes in the joint.
- ❖ Cause : due to shrinkage of the joint capsule
- ❖ Hence the name adhesive capsulitis.
- ❖ This condition is generally seen in individuals with 40–60 years of age.



- ❖ Clinically, it is described as **anterior or posterior dislocation** (indicating whether the humeral head has descended anterior or posterior or to the infraglenoid tubercle of the scapula and long head of the triceps)
- ❖ Mechanism: Dislocation is usually caused by **excessive extension and lateral rotation of the humerus.**

Clinically, it presents as

- ❖ (a) Hollow in rounded contour of the shoulder
- ❖ (b) Prominence of shoulder tip







JOINTS OF HAND



The joints of hand are:

1. Intercarpal joints.
2. Midcarpal joint.
3. Carpometacarpal joints.
4. Intermetacarpal joints.



Intercarpal joints

Interconnect the carpal bones

Type : Plane type of synovial joints.

❖ They include the following joints:

1. Joints between the carpal bones of the **proximal row**.
2. Joints between the carpal bones of the **distal row**.
3. **Midcarpal joint** between the **proximal and distal rows** of the carpal bones.
4. Pisotriquetral joint formed between pisiform and palmar surface of triquetral bone.



Carpometacarpal joints



- **Type** : Plane type of synovial joints (except for the 1st joint of the thumb).
- **Articulation**: The distal surfaces of the carpals of distal row articulate with the bases of metacarpals.
- **Functionally and clinically**, first carpometacarpal joint is the most important carpometacarpal joint.



Intermetacarpal joints



Type : Plane type of synovial joints

Articulation : bases of adjacent metacarpals of the fingers.



Joint cavities



1. A continuous common cavity of all intercarpal and metacarpal joints, except that of first carpometacarpal joint
2. Separate cavity of first carpometacarpal joint.
3. Separate cavity of pisotriquetral joint.



Joint cavities



1. A continuous common cavity of all intercarpal and metacarpal joints, except that of first carpometacarpal joint
2. Separate cavity of first carpometacarpal joint.
3. Separate cavity of pisotriquetral joint.



Ligaments

❖ 1. **Capsular ligament (joint capsule):**

Thick loose fibrous sac, which encloses the joint cavity.

Attachment :

- Proximally to the margins of articular surface of the trapezium
- Distally to the circumference of the base of first metacarpal bone.

The inner surface of the capsule is lined by the synovial membrane.



2. Lateral ligament:

Broad fibrous band stretching from lateral surface of the trapezium to the lateral side of the base of 1st metacarpal bone.

3. Anterior (palmar) ligament:

Extends obliquely from palmar surface of trapezium to the ulnar side of the base of 1st metacarpal.

4. Posterior (dorsal) ligament:

Extends obliquely from dorsal surface of trapezium to the ulnar side of the base of 1st metacarpal



Blood supply : Radial artery.

Nerve supply : Median nerve.

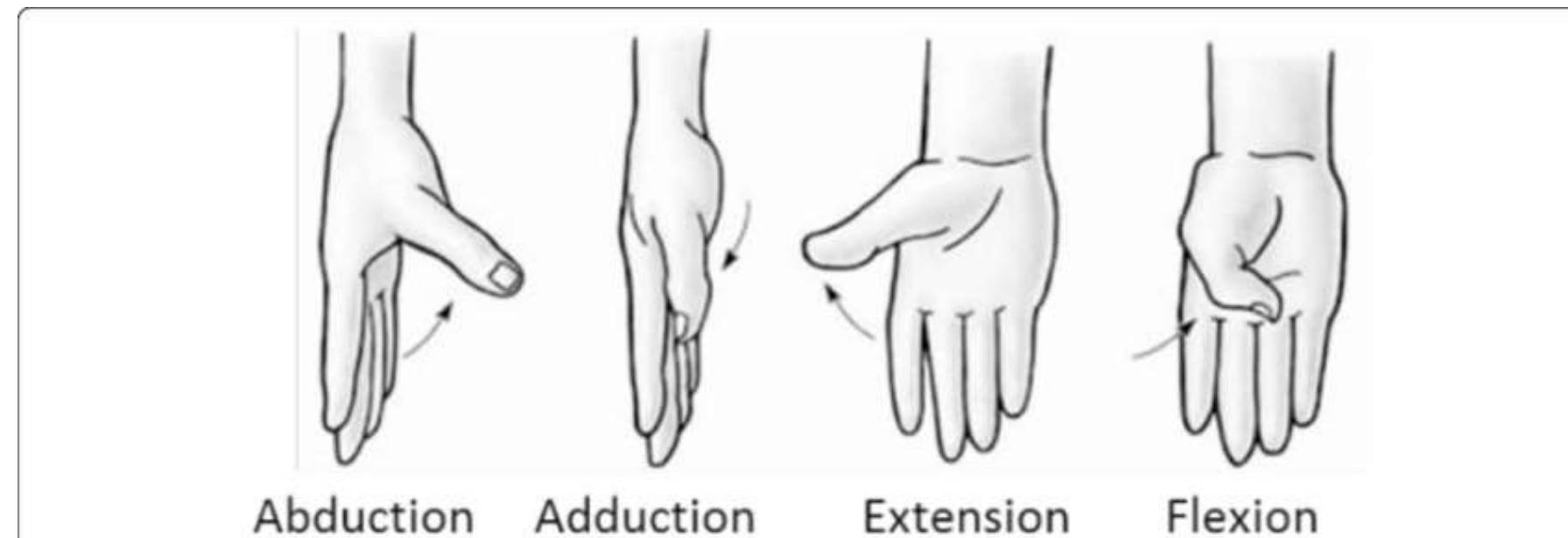
Movements

1) Flexion and Extension.

Plane : coronal plane; sagittal axis

Muscle action :

- Flexor pollicis brevis
- Opponens pollicis
- Extensor pollicis brevis
- Extensor pollicis longus



2) Abduction and Adduction.

Plane and axis : Sagittal plane and coronal axis

Muscle action :

- Abductor pollicis brevis
- Abductor pollicis longus
- Adductor pollicis



OPPOSITION



Sequential movement of abduction, flexion, adduction of the 1st metacarpal with simultaneous rotation.

Biaxial movement

Muscle action:

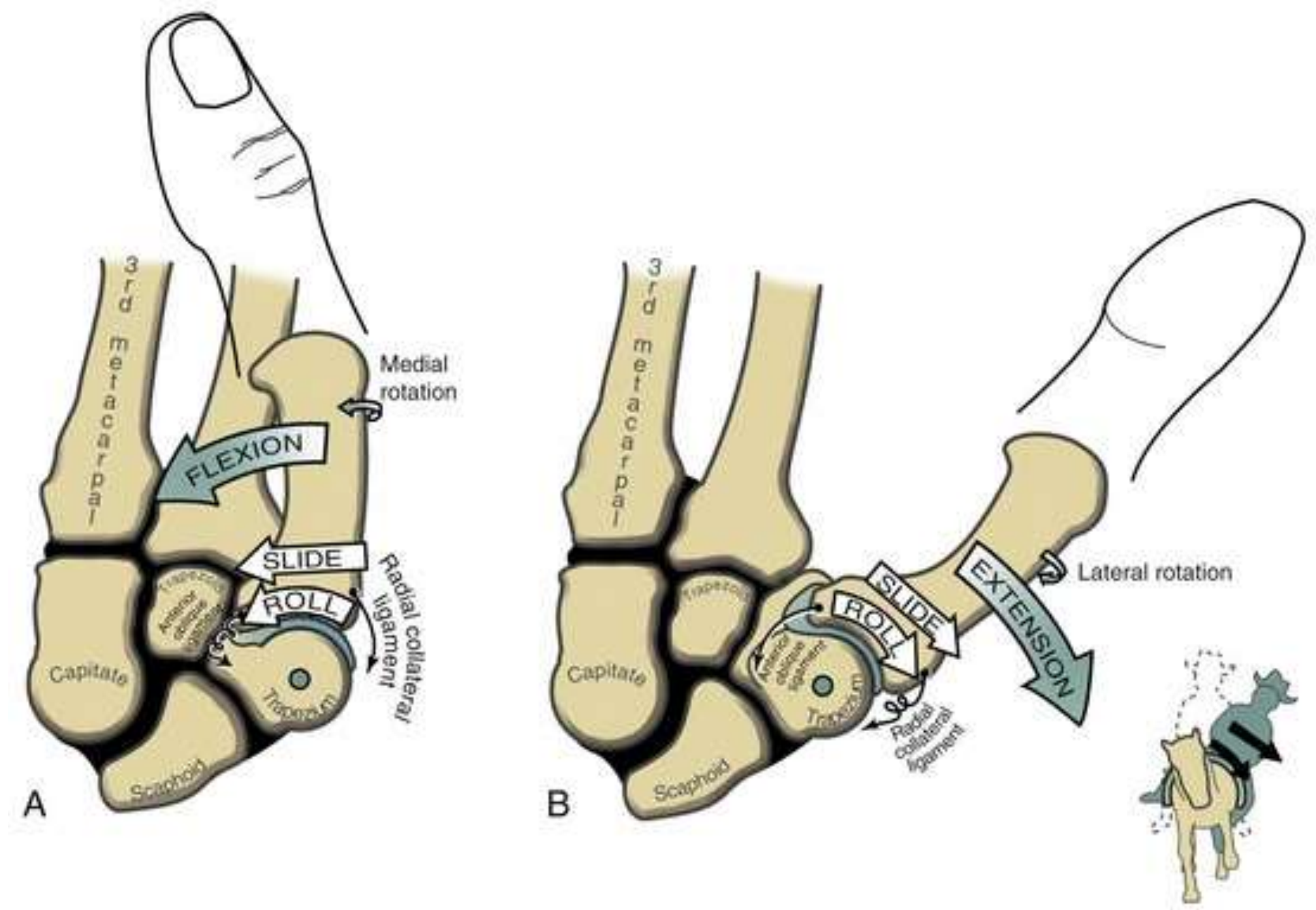
- Opponens pollicis.
- Flexor pollicis brevis





Opposition is unique to human beings and is one of the most important movements of the hand considering that this motion is used in almost all types of gripping actions

Medial and Lateral Rotation





Metacarpophalangeal joints



Type :

Metacarpophalangeal joints are synovial joints of the ellipsoid variety.

Articular surfaces:

Proximal – head of metacarpal

Distal – base of the proximal phalanx

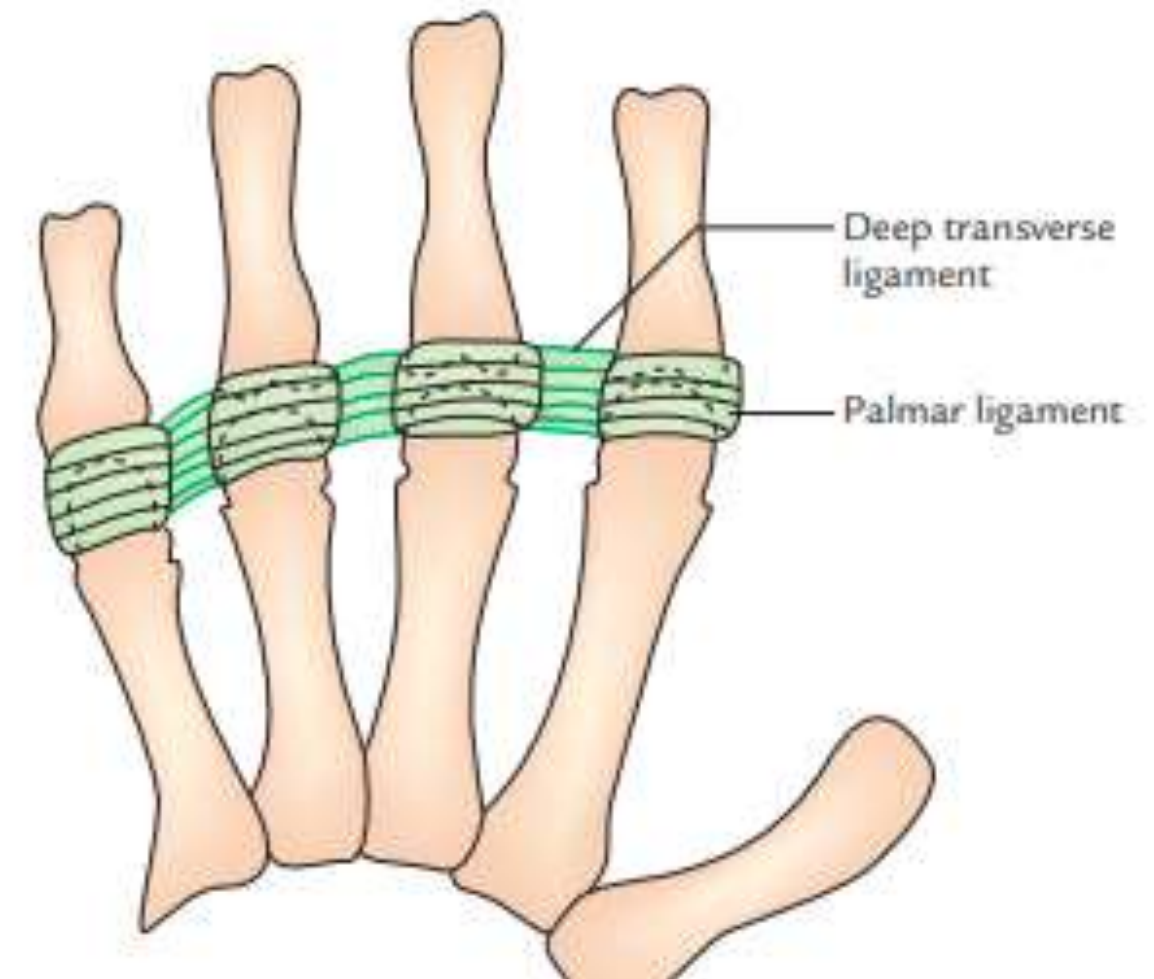


Metacarpophalangeal joints - Ligaments

1. Capsular ligament: This is thick in front and thin behind.

2. Palmar ligament:

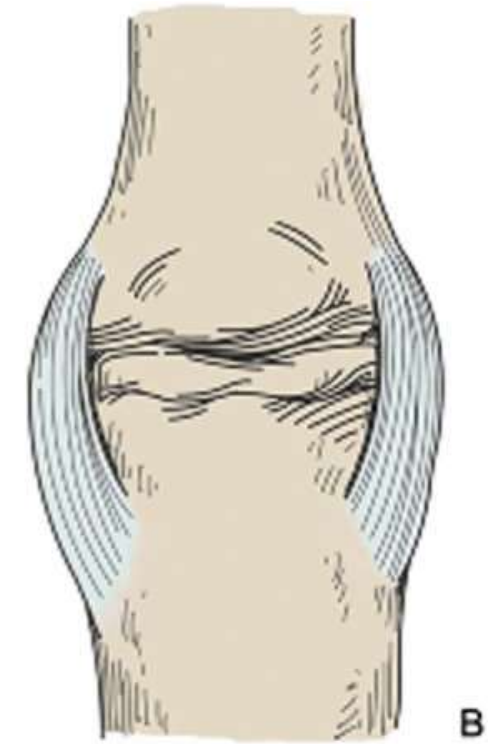
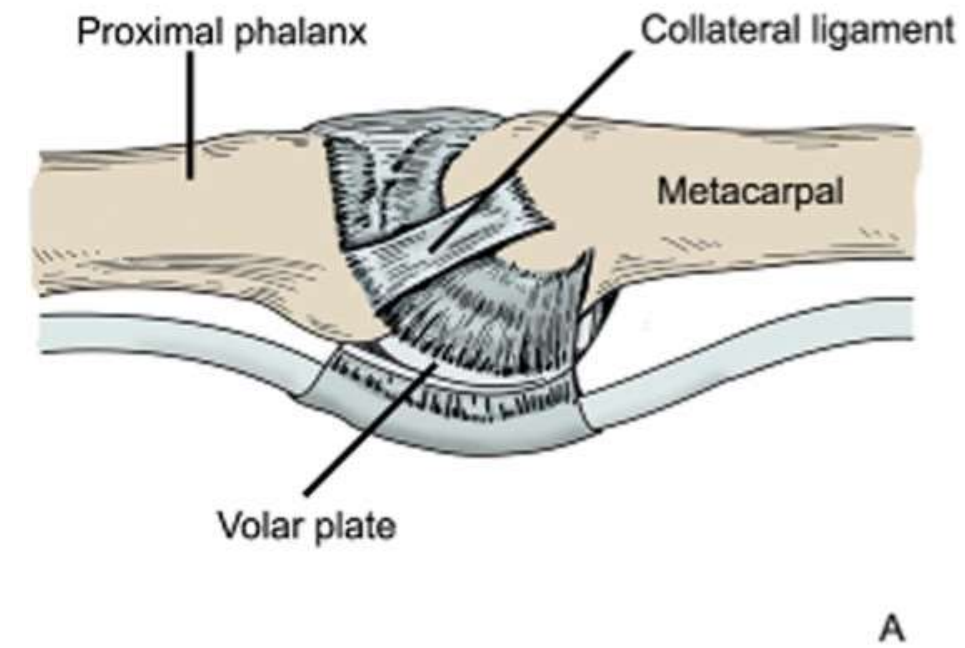
- Strong fibrocartilaginous plate (replaces the anterior part of the capsule).
- Attached to the phalanx than to the metacarpal.
- The various palmar ligaments of the metacarpophalangeal joints are joined to one another by the **deep transverse metacarpal ligament**.



Metacarpophalangeal joints - Ligaments

3. Medial and lateral collateral ligaments:

- Oblique bands placed at the sides of the joint.
- Each runs downwards and forwards from the head of the metacarpal bone to the base of the phalanx.
- Taut in flexion and relaxed in extension.





Movements of First Joint and Muscles Action

Flexion:

Flexor pollicis longus and flexor pollicis brevis.

Extension:

Extensor pollicis longus and extensor pollicis brevis

Abduction:

Abductor pollicis brevis

Adduction:

Adductor pollicis



Movements of Second to Fifth Joints and Muscle Action



Flexion: Interossei and lumbricals

Extension: Extensors of the fingers

Abduction: Dorsal interossei

Adduction: Palmar interossei

Circumduction: Above muscles in sequence

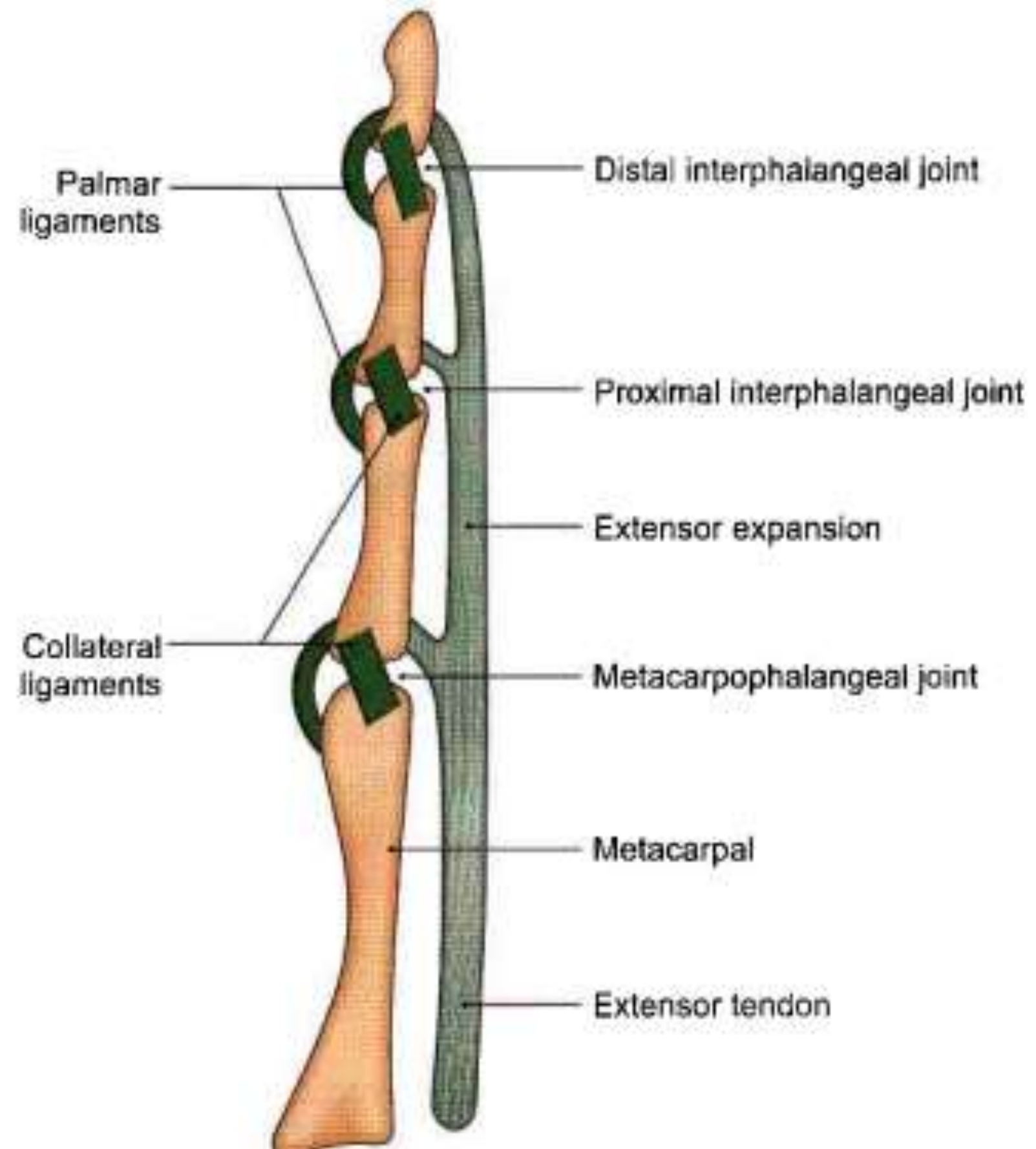
INTERPHALANGEAL JOINTS (PROXTMAL AND DTSTAL)

Type : Hinge variety of synovial.

Ligaments:

- One palmar fibrocartilaginous ligament
- Two collateral bands running downwards and forwards.







Movements of Second to Fifth Joints and Muscle Action



❖ Movements of Interphalangeal Joint of thumb

Flexion: Flexor pollicis longus.

Extension: Extensor pollicis longus.

❖ Movements of Second to Fifth Digits

Flexion:

Flexor digitorum superficialis at the proximal IP joint

Flexor digitorum profundus at the distal IP joint

Extension : Interossei and lumbricals





Clinical correlation



1st Carpometacarpal joint arthritis



The first carpometacarpal (trapeziometacarpal) joints are a frequent site of osteoarthritis in hand.

Clinical Features :

tenderness, stiffness, crepitus, swelling, and pain on wringing movements or other motions

