Anatomy of the Shoulder

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The shoulder is the region of the body that connects the upper limb with the trunk. The shoulder girdle (composed of the scapula and clavicle) and pelvic girdle are the two points in the body where the axial and the appendicular skeletons meet.

Constituents of the Shoulder Joint

- **Bones**: clavicle, scapula, humerus
- **Joints**: shoulder joint composed of the glenohumeral and acromioclavicular joints
- **Cartilages**: hyaline cartilage, glenoid labrum
- **Muscles**: anterior axioappendicular muscles, posterior axioappendicular muscles and scapulohumeral muscles

Bones

Clavicle

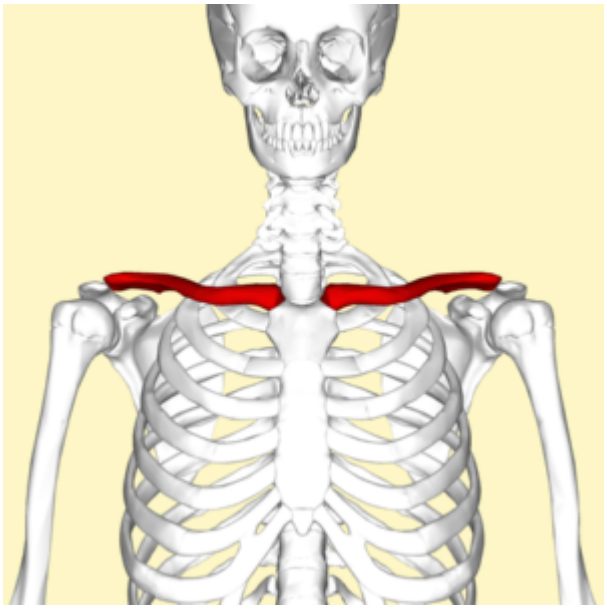

Image: “Diagram identifying the two clavicles between the sternum and the upper limbs.” by Anatomography – en:Anatomography. License: CC BY-SA 2.1 JP

The clavicle is the only horizontal long bone in the body. It is also the only bone connecting the upper limb with the trunk. The clavicle, along with the scapula, contributes to the formation of the shoulder girdle. Due to its location, it serves as a major support for the scapula and the upper limb.

The upper limbs are suspended away from the thorax due to their attachment to the clavicle. Additionally, the clavicle also functions to protect the cervicoaxillary canal that encompasses the long thoracic nerve and other neurovascular structures. The clavicle also transmits physical shock from the upper limb to the axial skeleton.

In the shoulder joint, the clavicle articulates with the clavicular notch of the manubrium to form the sternoclavicular joint and with the acromion of the scapula to form the acromioclavicular joint.

The clavicle also serves as an attachment surface for numerous muscles of the shoulder region.

Scapula

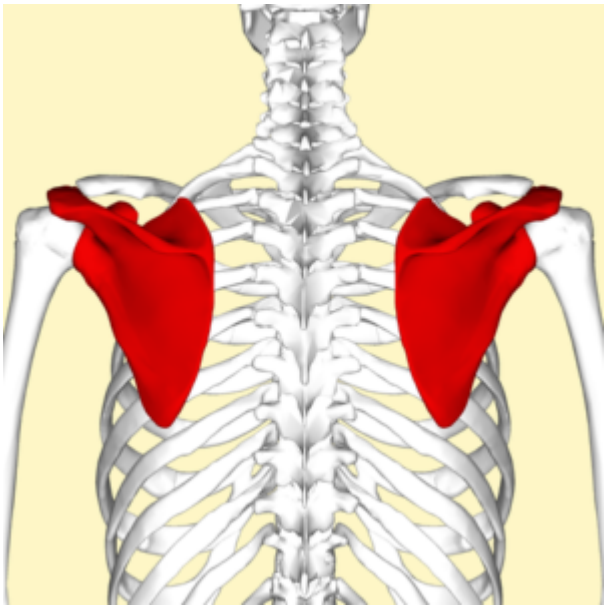

Image: “Image identifying the posterior surface of the scapula.” by Anatomography – en:Anatomography. License: CC BY-SA 2.1 JP

The scapula is a triangular-shaped bone with:

- Lateral, superior, and inferior angles
- Superior, lateral, and medial borders
- Posterior and costal surfaces

The glenoid cavity is found on the lateral aspect of the scapula and articulates with the head of the humerus to form the “ball and socket” glenohumeral joint of the shoulder.

The scapula also consists of three processes:

- **Acromion:** projects from the anterolateral aspect of the spine and articulates with the clavicle.
- **Spine:** divides the posterior surface of the clavicle into supraspinatus and infraspinatus processes.
- **Coracoid process:** hook-like projection from the anterolateral aspect of the scapula right under the clavicle. Functions to stabilize the shoulder joint by providing attachment to various shoulder muscles and ligaments. It is also known as the “surgeon’s lighthouse” due to its palpable nature that marks important neurovascular structures in the upper limb.

The scapula functions to bring about shoulder joint movements by providing attachment to various shoulder muscles. These movements include elevation, depression, abduction (protraction), adduction (retraction), upward rotation (laterally), downward rotation (medially), anterior and posterior tipping.

Proximal part of the humerus

A few structures in the proximal part of the humerus play a vital role in the formation of the shoulder joint. These structures are as follows:

- **Head of the humerus: it is spherical and articulates with the glenoid cavity in the scapula.**

- **Greater and lesser tubercles: projections found on the proximal part of the humerus serve as attachment points for the four rotator cuff muscles. The greater tubercle is located on the lateral side and has the superior, middle, and inferior facet that serve as attachment sites for the supraspinatus, infraspinatus, and teres minor muscles, respectively. The lesser tubercle, located anteriorly, provides attachment for the subscapularis muscle.**

- **Bicipital groove: lies between the greater and lesser tubercles and extends inferiorly towards the shaft of the humerus. It provides attachment for the long head of the biceps brachii muscle.**

The deltoid tuberosity is found on the anterolateral part of the mid-shaft of the humerus and serves as an attachment site for the deltoid muscle.

Joints

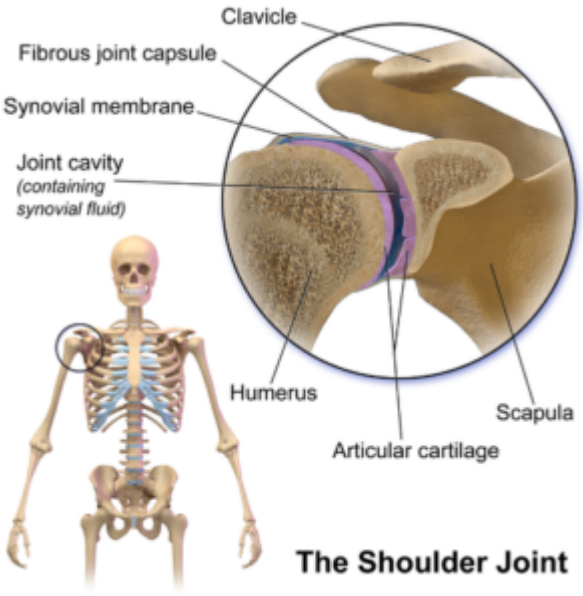

Image: "Shoulder joint." by Blausen.com staff. "Blausen gallery 2014". Wikiversity Journal of Medicine. DOI:10.15347/wjm/2014.010. ISSN 20018762. – Own work.
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Sternoclavicular joint: this is a saddle-shaped joint that resides between the proximal part of the clavicle and the clavicular notch of the manubrium (of the sternum). It is a synovial double plane surrounded by a joint capsule. It brings out the movement of the clavicle on the vertical and anteroposterior plane.

Acromioclavicular joint: a plane synovial joint that resides between the medial surface of the acromion (of the scapula) and the acromial end of the clavicle. Moves on vertical

and anteroposterior planes as well as axial rotation. This joint allows the movement of the arms above the head.

Glenohumeral joint: articulation between the head of the humerus and the glenoid cavity, which is reinforced by the rotator cuff muscles as well as the long head of the biceps brachii muscle. It is a synovial ball in socket and moves for flexion, extension, medial and lateral rotation, abduction and adduction as well as circumduction.

Ligaments

- **Costoclavicular ligament:** connects the proximal half of the clavicle with the first rib and its costal cartilage.
- **Interclavicular ligament**: connects both of the clavicles to each other and the manubrium in between.
- **Posterior sternoclavicular ligament**: situated posterior to the joint
- **Anterior sternoclavicular ligament**: situated anterior to the joint
- **Acriomioclavicular ligament**: situated on top of the joint
- **Coracoclavicular ligament:** divided into two additional ligaments including the trapezoid ligament and the conoid ligament. Extends from the coracoid process to the acromial end of the clavicle (inferior surface).
- The **glenoid labrum** is a cartilaginous fiber ring attached to the circumference of the glenoid cavity; it helps deepen the cavity for articulation with the head of the humerus. The tendon of the long head of the biceps brachii muscle continues from the top of the glenoid labrum and is attached to the supraglenoid tubercle. It passes through the articular cavity. Synovial membrane stretches over all articulating surfaces.

Bursae are fluid-filled spaces that occur between tendons of the muscles. They work to reduce friction between tendons and joint capsules. The bursae found in the shoulder joint include:

1. **Subtendinous bursa** of the subscapularis is located between the subscapularis muscle and fibrous membrane.
2. **Subacromial-subdeltoid bursa** is between the joint capsule and the deltoid muscle.
3. **Subcoracoid bursa** is between the coracoid process and the joint capsule.

Ligaments work to thicken the fibrous membrane of the joint capsule. Ligaments reinforcing the shoulder joint include:

- **Superior glenohumeral ligament, middle glenohumeral ligament, and the inferior glenohumeral ligament stretch from the superomedial aspect of the glenoid cavity to the lesser tubercle found on the proximal part of the humerus.**
- The coracohumeral ligament stretches from the inferior aspect of the coracoid process to the greater tubercle found on the proximal part of the humerus.

Transverse humeral ligament works to stabilize the tendon of the long head of the biceps brachii muscle between the greater and lesser tubercle.

Muscles

Anterior axioappendicular muscles

There are four anterior axioappendicular muscles, and they function to allow the movement of the pectoral girdle. These muscles, along with their origins, insertions, functions, and innervations are as follows:

Pectoralis major consists of two different heads: clavicular head – anterior border of medial clavicle, and sternocostal head – the superior surface of the first six costal cartilages as well as the anterior aspect of the sternum. It inserts into the bicipital groove of the anteromedial aspect of the proximal humerus.

The clavicular head works to flex the humerus, whereas the sternocostal head works to extend the humerus. Together they work to adduct and medially rotate the arm while pulling the scapula anteroinferiorly. The pectoralis major muscle is innervated by the lateral and medial pectoral nerves.

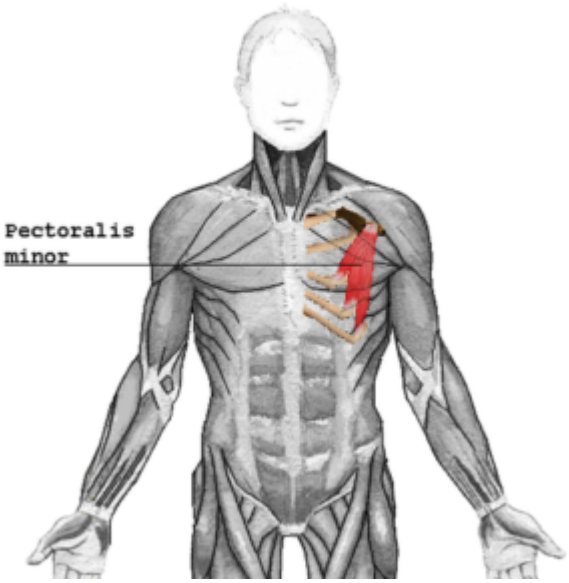

Image: “Location of pectoralis minor.” Original by sv:Användare:Chrizz, 1 June 2005. License: CC BY-SA 3.0

Pectoralis minor originates from the area near the costal cartilages of the 3rd–5th ribs and inserts on the coracoid process superior surface medially. Its function is to pull the scapula anteriorly and inferiorly as well as stabilizing it. It also helps to raise the ribs during breathing. The pectoralis minor muscle is innervated by the medial pectoral nerve.

Subclavius muscle originates from the 1st rib and its cartilage and inserts into the subclavian groove, found inferiorly, in the middle third of the clavicle. It elevates the 1st rib while depressing the clavicle and is innervated by the subclavian nerve.

Serratus anterior originates from the 8th–9th ribs and inserts into the costal surface of the scapula, medially. It moves the scapula anteriorly (protraction) while stabilizing it. It also moves it upwards. Serratus anterior is innervated by the long thoracic nerve.

Posterior axioappendicular muscles

Also known as the “extrinsic group,” the posterior axioappendicular muscles are divided into two additional groups, including superficial and deep.

Superficial muscles, along with their origins, insertions, functions, and innervations are as follows:

1. **Trapezius** originates from the occipital bone and the spinous processes of the C7–T12 vertebrae. It inserts into the acromion process, the lateral third of the clavicle posteriorly, external occipital protuberance, and nuchal ligament. It works to rotate, elevate, and depress the scapula along with retracting it (moving posteriorly). It works antagonistically to the serratus anterior muscle, which causes protraction of the scapula. The trapezius is innervated by the accessory nerve, along with the cervical spinal nerves.
2. **Latissimus dorsi muscle** originates from the spinous processes of the T7–T12 vertebrae and inserts into the intertubercular groove of the humerus. Its functions include the adduction and internal rotation of the arm while working antagonistically to the deltoid and trapezius muscles. It is innervated by the thoracodorsal nerve.

Deep muscles, along with their origins, insertions, functions, and innervations are as follows:

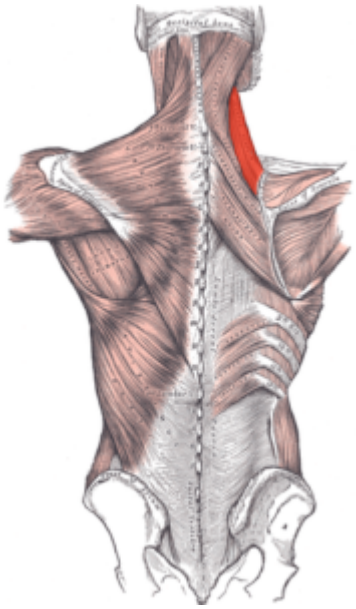

Image: “Location of the levator scapulae muscle.” by modified by Uwe Gille – Gray Image:Gray409.png. License: Public Domain

1. **Levator scapulae muscle** originates from the transverse processes of C1–C4 and their posterior tubercles and inserts into the medial border of the scapula superiorly. Its function is to elevate the scapula. It is innervated by the cervical and dorsal scapular nerve.
2. **Rhomboid minor muscle** originates from the spinous processes of C7–T1 as well as the nuchal ligaments and inserts into the medial border of the scapula superiorly. It retracts the scapula, working antagonistically to the serratus anterior muscle. It also attaches the scapula to the thoracic wall, as well as helping in the

rotation. This muscle is innervated by the dorsal scapular nerve.

3. **Rhomboid major nerve** originates from the spinous processes of vertebrae T2–T5 and inserts into the medial border of the scapula. It retracts the scapula, depresses the glenoid cavity, and works antagonistically to the serratus anterior muscle. It is innervated by the dorsal scapular muscle.

Scapulohumeral muscles are a group of 7 muscles that assist in stabilizing the glenohumeral joint by connecting the humerus to the scapula.

Rotator cuff muscles are a group of 4 muscles that work to stabilize the shoulder joint during its movements. For example, during abduction of the arm, it is the rotator cuff muscles that prevent detachment of the head of the humerus from the glenoid cavity as the deltoid muscle works to elevate the arm. This mechanism is known as ‘concavity compression’.

Similarly, rotator cuff muscles stabilize the glenohumeral joint during external and internal rotation of the arm.

- **Supraspinatus and infraspinatus muscles are innervated by the suprascapular nerve and originate from the supraspinous and infraspinous fossa, respectively. They both insert into the greater tubercle of the humerus. The supraspinatus muscle works to abduct the humerus, while the infraspinatus muscle works to rotate the humerus externally.**
- Teres minor muscle originates from the lateral border of the scapula and inserts into the posterior facet of the greater tubercle of the humerus. It is innervated by the axillary nerve and rotates the humerus externally.
- Subscapularis muscle originates from the subscapular fossa, inserts into the lesser tubercle of the humerus, and is innervated by the subscapular nerve. It rotates the humerus internally.
- The deltoid muscle is responsible for giving the shoulders their shape. It originates from the anterior borders of the clavicle, acromion and the spine of the scapula. It inserts into the deltoid tuberosity of the humerus. The deltoid muscle is innervated by the axillary nerve and flexes, extends, and abducts the shoulders.
- Teres major muscle originates from the inferior angle of the scapula, inserts into the intertubercular sulcus of the humerus, and adducts the humerus as well as rotates it internally. It is innervated by the subscapular nerve (lower).

References

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Notes