

Anatomy of Shoulder Girdle

The shoulder girdle consists of the glenohumeral, acromioclavicular, sternoclavicular and scapulothoracic joints

Glenohumeral Joint

A ball and socket synovial joint with a large range of movement at the expense of stability. Stability is imparted by

1. Static restraints :glenoid labrum, capsule, ligaments and negative pressure
2. Dynamic restraints: Muscles of the rotator cuff including the tendon of long head of biceps. Shoulder girdle muscles by differential contractions and also influencing indirectly through the scapula. The most important of the latter are the pectoralis major, trapezius, serratus anterior and Lattissimus Dorsi.

Ligaments involved in the stability of the glenohumeral joint include coracohumeral ligament(CH), superior glenohumeral ligament (SGHL), Middle glenohumeral ligament (MGHL) and inferior glenohumeral ligament complex (IGHLC).

1. Superior glenohumeral ligament (SGHL): primary static restraint against anterior translation with the arm at the side. With the CH ligament, the SGHL forms a pulley that provides restraint against medial subluxation of the long head of the biceps tendon.
2. Middle glenohumeral ligament (MGHL) is a primary static restraint against anterior translation with the arm in external rotation and 45° of abduction.
3. Anterior inferior glenohumeral ligament (IGHL) is a primary static restraint against anterior-inferior dislocation of the glenohumeral joint in 90° of abduction and external rotation (position of apprehension).
4. Posterior IGHLC is a primary static restraint against posterior-inferior translation in internal rotation and adduction.

The Rotator Interval:

The triangular space separating the anterior edge of the supraspinatus from the superior edge of the subscapularis is the rotator interval. It is normally bridged by a tissue considered capsule. Anatomically, the rotator interval includes the underlying superior glenohumeral ligament and is reinforced by the overlying coracohumeral ligament. The rotator interval is the usual anatomic window for exposure of the joint and for anterior arthroscopic portals. The interval is widened and deficient in some patients with multi directional instability.

Acromioclavicular joint: A gliding atypical synovial joint that has a fibrocartilagenous disc. The static stabilisers include the capsule,

acromioclavicular ligament, and coracoclavicular ligament of which the Coraco Clavicular ligaments are the most important – the conoid medially and trapezoid laterally.

Sternoclavicular joint: Gliding atypical synovial joint with articular disc. Static stabilisers include capsule, anterior and posterior sternoclavicular ligaments, interclavicular ligament and costoclavicular ligament (between first rib and clavicle and is the most important)

Scapulothoracic joint. Not a true joint but allows movements of the scapula against the rib cage. Stabilised by the scapular muscular attachments.

Ligaments of the scapula

1. superior tranverse scapular ligament (separates the suprascapular nerve from the overlying vessels.
2. Inferior tranverse scapular ligament
3. Coracoacromial ligament which act as a restraint to superior anterior translation of the humeral head with cuff deficiencies.
This with the anterior acromion form the coraco acromial arch which serves a superior stabilising factor in preventing superior luxation of shouder. It si also the arch against which impingement occurs.

Anatomy of Impingement

The shoulder joint is closely covered by the rotator cuff tendons with the supraspinatus, infraspinatus and teres minor attached to the greater tuberosity and the subscapularis attached to the lesser tuberosity. The long head of biceps tendon is attached intra articularly to the supraglenoid tubercle and enters the joint from the intertubercular groove between the tendons of supraspinatus and subscapularis. The classical impingement occurs as a pressure symptom between the soft tissues of supraspinatus tendon, biceps tendon, subacromial bursa and coraco acromial ligament and the bony anterior acromion and the superior surface of the humeral head.

Muscles of the Shoulder Girdle

Muscle	Origin	Insertion	Innervation	Action
Trapezius	Spine	Scapular spine, acromion, clavicle	Cranial nerve XI	Scapular elevation
Latissimus dorsi	Spine	Humerus	Thoracodorsal	Extension, adduction, internal rotation
Serratus anterior	Ribs	Scapula	Long thoracic	Scapular stability
Pectoralis major	Anterior ribs, sternum, clavicle	Humerus	Medial/lateral pectoral	Adduction, internal rotation
Pectoralis minor	Anterior ribs	Coracoid	Medial pectoral	Scapular protraction
Deltoid	Scapular spine, acromion, clavicle	Humerus	Axillary	Abduction
Teres major	Scapula	Humerus	Lower subscapular	Extension, adduction, internal rotation
Subscapularis	Scapula	Lesser tuberosity	Upper/lower subscapular	Stability, internal rotation

Supraspinatus	Scapula	Greater tuberosity	Suprascapular	Stability, elevate, external rotation
Infraspinatus	Scapula	Greater tuberosity	Suprascapular	Stability, external rotation
Teres minor	Scapula	Greater tuberosity	Axillary	Stability, external rotation

Nerves of the shoulder girdle

The brachial plexus provides the nervous supply to the shoulder girdle. It is formed by the anterior ramus of C5-T1 and emerges between scalenus anterior and medius

There are 5 components:

1. roots : 5 (C5 to T1)
2. trunks: 3 (upper, middle, lower)
3. divisions: 6 (2 from each trunk)
- 4 cords :3 (medial, lateral and posterior based on there relationship to the axillary artery)
- 5 branches: multiple

BE PREPARED TO DRAW THE BRACHIAL PLEXUS IN THE EXAM

1 Axillary nerve (posterior cord) splits into the posterior and anterior branches at the 6 o'clock position on the glenoid. It exits posteriorly with the posterior humeral circumflex artery through the quadrilateral space (medial: long head of triceps, lateral: humeral shaft, superior: teres minor, inferior: teres major)

- i. The posterior branch terminates into a muscular branch to the teres minor and a sensory branch to the skin overlying the lateral deltoid (superior-lateral brachial cutaneous nerve). Loss of sensation over the lateral deltoid can signify palsy of the teres minor.
- ii. The anterior branch innervates and courses along the undersurface of the deltoid.
- iii. On average, the anterior branch is located 5 cm from the lateral acromial edge, but it can be found as close as 3.5 cm.

iv. The lateral deltoid should not be split more than 3.5 cm from the lateral acromial edge to avoid axillary nerve injury and anterior deltoid denervation.

2. Musculocutaneous nerve (lateral cord) i.

i. The main trunk penetrates the coracobrachialis muscle 3 to 8 cm distal to the tip of the coracoid.

ii. It innervates the biceps brachii and the brachialis.

iii. It terminates as the lateral antebrachial cutaneous nerve to the anterolateral forearm.

3. Suprascapular nerve (preclavicular branch)

i. This nerve transverse through the suprascapular notch (under the superior transverse scapular ligament), where it innervates the supraspinatus.

ii. It transverse the spinoglenoid notch to innervate the infraspinatus.

iii. It is found approximately 1.5 cm medial to the posterior rim of the glenoid

4. Long thoracic nerve (preclavicular branch)—Injury (axillary dissection, aggressive retraction of middle scalene muscle) results in serratus anterior palsy and medial winging of the scapula (superior elevation of the scapula with medial translation and medial rotation of the inferior pole of the scapula).

5. Spinal accessory nerve (cranial nerve XI)—Injury (cervical lymph node biopsy or radical neck dissection) results in trapezius palsy and lateral winging of the scapula (depression of scapula with lateral translation and lateral rotation of the inferior pole of scapula)

Diagram of brachial plexus

Arterial supply

The subclavian artery arises either from the aorta or the brachiocephalic trunk for the right side. It emerges between scalene anterior and medius in the posterior

triangle of the neck and becomes the axillary artery at the outer border of the first rib.

The axillary artery is divided into three parts by the pectoralis minor muscle.

1st part axillary artery (medial to pectoralis minor) gives 1 branch: Supreme thoracic vessel

2nd part axillary artery (deep to pectoralis minor) gives 2 branches: Thoracromial and lateral thoracic vessels

3rd part axillary artery (lateral to pectoralis minor) gives 3 branches: the subscapular artery (the circumflex scapular branch runs through the triangular space), the anterior humeral circumflex artery (the anterolateral ascending branch is the major blood supply to the humeral head), and the posterior humeral circumflex artery (accompanies the axillary nerve and exits posteriorly through the quadrangular space)

Shoulder Spaces

Quadrangular Space

Boundaries : Superior- Teres minor/ Subscapularis, Inferior- Teres major, Lateral- shaft of humerus, Medial-Long head of triceps

Contents: Axillary nerve and Posterior humeral circumflex artery

Triangular Space

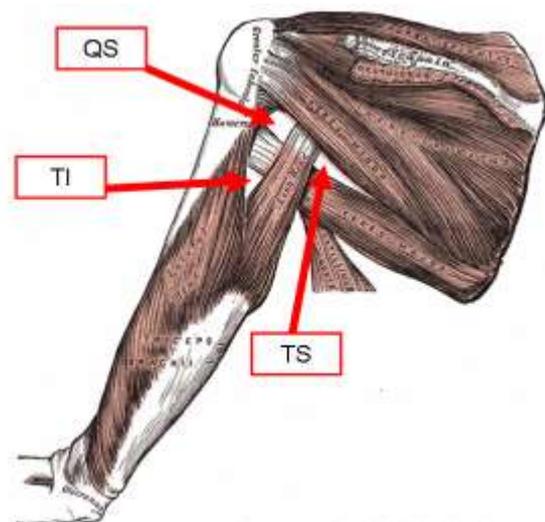
Boundaries : Superior-Teres minor, Lateral- Long head of triceps, Medial-Teres major

Contents: Circumflex scapular artery

Triangular interval

Boundaries: Superior-Teres Major, Lateral- shaft of humerus, Medial- Long head of triceps

Contents: Radial nerve, Profunda brachial artery



Surgical Approaches

Anterior

Deltopectoral

Internervous plane between Delotoid (axillary nerve) and Pectoralis major (medial and lateral pectoral nerves)

Beech chair position. Incision over delotpectoral groove. Cephalic vein identified and retracted laterally (tributaries drain into vein from lateral side) with underlying deltoid. Inferior limit of incision is the superior fibres of pectoralis major as it attaches to lateral part of the bicipital groove, over the biceps. Identify conjoint tendon as it attaches to coracoid and protect musculocutaneous nerve as it pierces the tendon approximately 5 cm below the coracoid. Identify subscapularis and insert stay sutures in the tendonious part to aide repair . Then divide it at it's attachment to humeral head while the arm is adducted and externally rotated to protect the axillary nerve as it passes along the inferior border of subscapularis and then posterior to the humeral neck. Capsule is then divided to enter the joint.

Structures at risk

These include axillary and musculocutaneous nerves ads elucidated above

Useful for fracture fixations , joint replacement and instability surgery and is the workhorse approach for most open surgery.

Lateral and Mckenzie approach

Deltoid splitting procedure and so no internervous plane. Mckenzie approach more anterior. Distal extent of incision should not be further than 5cm from tip of acromion otherwise axillary nerve at risk. Supraspinatus tendon then

identified and split along its fibres to enter the joint. The subscapularis can be detached through the Mckenzie approach to access the joint

Rotator cuff repair or tuberosity fracture repair by a deltoid split and through a Mckenzie for joint replacement, joint access for washout, and allows easy acromioplasty as an adjunct in joint replacement.

Structure at risk

This is mainly the axillary nerve.

Posterior approach

Internervous plane between infraspinatus (suprascapular nerve) and teres minor (axillary nerve).

Lateral position. Skin incision along scapular spine to posterior corner of acromion. Identify and detach posterior fibres of deltoid as it attaches to scapular spine. Interval usually easier to identify lateral end of incision. Infraspinatus multipennate muscle while teres minor a unipennate muscle. Gently retract muscles to expose posterior capsule.

Structures at risk

Axillary nerve at risk, as it passes from quadrangular space if dissection is carried out inferior to teres minor. Suprascapular nerve at risk, as it passes over lateral edge of scapular spine, if infraspinatus is forcibly retracted.

Useful when dealing with Hill Sachs lesion or similar posterior articular damage, posterior glenoid fracture fixations and posterior Bankart lesions when approached through open surgery

Radiography

The most common views taken for the shoulder are the true AP and axillary lateral. The scapular lateral is useful in acutely injured shoulders when an axillary lateral may not be possible. The axillary lateral is useful in looking for posterior dislocations, posterior humeral head defects, Os acromiale defect in the acromion and the alignment of the ACJ.

For impingement some surgeons do a suprascapular outlet view which helps delineate acromial morphology. This is done in the plane of the scapula with the x-ray beam angled 10 degrees caudally.

Ultrasound is useful in detecting full thickness tears and can be a quick and useful adjunct to the clinical diagnosis. MRI is much more useful in looking at multiple pathologies including cuff tears, fatty infiltration in long standing cuff tears and for infection and tumours. MRI arthrograms in addition are more

useful in defining soft tissue lesions like the Bankart, SLAP and capsular tears. Similarly a CT arthrogram is useful in the demonstration of bony pathologies.