

Chapter 2

Examination of the Shoulder

The shoulder girdle consists of three joints and one articulation – namely:

1. The sternoclavicular joint
2. The acromioclavicular joint
3. The glenohumeral or shoulder joint and
4. The scapulothoracic articulation.

Inspection

Asymmetry of the shoulder is very obvious when examined by bilateral compression of the two shoulder joints. This may be very easily noticed when the arm is hanging down the side, if it is internally rotated and adducted, as in Erb's palsy, like a waiter receiving a tip.

The deltoid region is next inspected as it is normally full and round, but may be vacant as in cases of anterior shoulder dislocation. The arm is then held slightly away from the trunk (Fig. 2.1).

The deltopectoral groove is located just medial to the shoulder mass, between the anterior fibers of the deltoid and the pectoralis major, and it contains the cephalic vein which can be used for a venous cutdown. It is also a very important site for incisions in the shoulder region.

Over the posterior aspect of the shoulder girdle is the most prominent part which is the scapula. This is very easy to locate as it is situated over the ribs two to seven in the resting position, and its medial border is nearly 2 in. away from the spinous processes. Occasionally the scapula has only partially descended from the neck to the thorax resulting in a Sprengel's deformity. Occasionally the midline spinous processes may show a lateral scoliotic deformity resulting in elevation or depression of the shoulders. Very rarely do the spinous processes show a rounded kyphotic deformity due to Scheuermann's disease in adolescents.

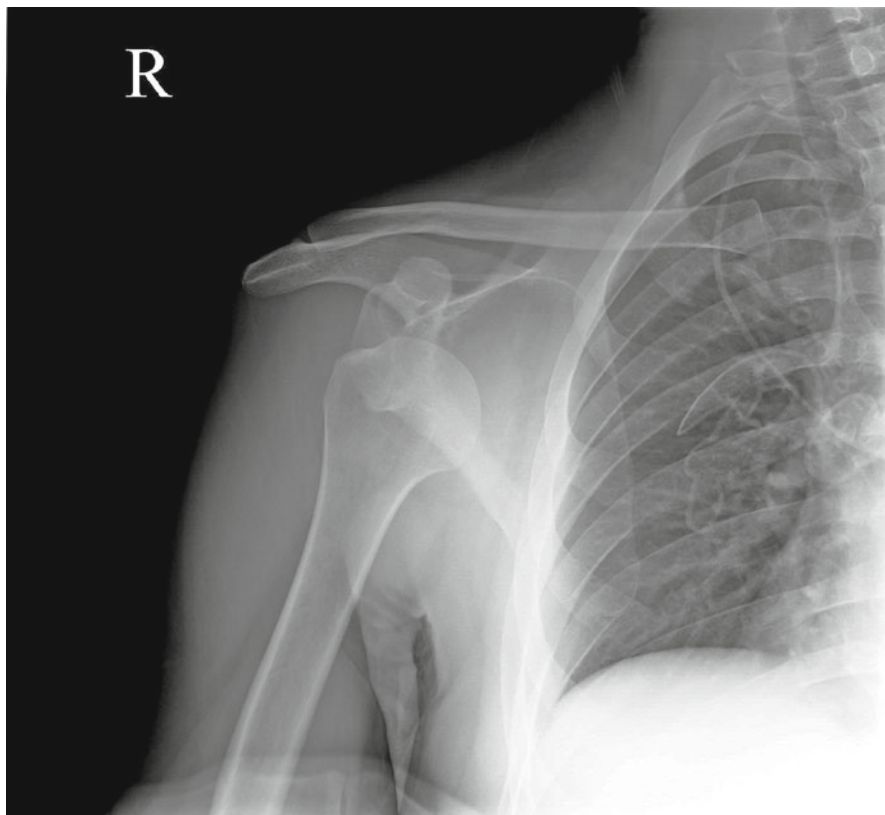


Fig. 2.1 Anteroposterior radiograph showing an anterior dislocation of the right shoulder (Courtesy Dilip Malhotra, Bahrain)

Palpation

Bony landmarks can be palpated systematically by beginning from the suprasternal notch. The joint that is immediately lateral is the sternoclavicular joint which is best appreciated when palpated bilaterally. The clavicle is normally slightly superior to the manubrium sternum, and it rises from it. Dislocations of the sternoclavicular joint are frequently seen when the clavicle has shifted over the manubrium sternum. Proceeding with the palpation laterally, the clavicle represents a medial convex smooth surface which is well felt in its full length, becoming concave at its lateral end. The lateral end of the clavicle forms the coracoid process which faces anterolaterally and lies deep under cover of the pectoralis major muscle. The acromioclavicular joint lies immediately lateral to the coracoid process and can be easily felt by asking the patient to flex and extend his or her shoulder several times. This joint may be prominent and tender in dislocations of the lateral end of the clavicle. Palpating just lateral to the acromioclavicular joint, one finds the acromion process. Continuing palpation just lateral to

the acromion and slightly inferiorly, one reaches the greater tuberosity of the humerus. The bicipital groove is located just medial and anterior to the greater tuberosity and is best felt when the arm is externally rotated, when the tendon of the long head of the biceps can be rolled. Palpating posteriorly and medially, one finds the acromion tapering into the spine of the scapula as one continuous arch. The medial border of the scapula is about 2 in. from the spinous process of the thoracic vertebrae, and the triangle at the medial end of the spine of the scapula is at L3 level.

The soft tissue palpation is mainly into four regions, namely (1) the rotator cuff, (2) the subacromial and subdeltoid bursa, (3) the axilla, and (4) the muscles around the shoulder girdle.

1. *The rotator cuff:* This cuff is composed mainly of three muscles which form an insertion into the greater tuberosity of the humerus – namely, the supraspinatus, the infraspinatus, and the teres minor. The fourth muscle is the subscapularis which is located anteriorly. The rotator cuff is clinically important because the supraspinatus is the most commonly ruptured muscle near its insertion.
2. The subacromial bursa has two main components – namely, the subacromial and the subdeltoid parts. This is a frequent pathologic finding causing tenderness and limitation of shoulder movements.
3. The axilla is a pyramidal space through which nerves and vessels pass into the upper arm. Enlarged lymph nodes can be well palpated in this space. The axilla is formed anteriorly by the pectoralis major muscle and posteriorly by the latissimus dorsi muscle, while its medial wall is formed by the second to sixth ribs with its overlying serratus anterior muscle, and the lateral wall is limited by the bicipital groove of the humerus. The shoulder joint is the apex of the pyramid, and the axilla is supplied by the brachial plexus and the axillary arteries.
4. The muscles of the shoulder girdle:

The sternocleidomastoid is palpated on the side opposite to which the head is turned and is mainly important for hematomas in the muscle which can cause a wry neck, swollen lymph nodes due to infection, and may frequently be traumatized in injuries of the neck, such as a whiplash injury.

The pectoralis major muscle is very important clinically as it may be absent congenitally, most frequently either in whole or in part. The costochondral junctions which lie just next to the sternum are the frequent site of costochondritis when they are tender on palpation.

The biceps muscle is palpated with the elbow in resisted flexion and can be seen curled up in the midarm when the long head of the biceps is torn. The long head of the biceps may be involved in tenosynovitis when it is tender or may be dislocated in the bicipital groove which is well palpated when the shoulder is laterally rotated.

The deltoid may be atrophied in cases of axillary nerve damage usually because of shoulder dislocations. The deltoid muscle converges down to the midpoint of the lateral aspect of the arm to a bony prominence known as the deltoid tuberosity.

The trapezius is a fan-shaped muscle which extends from the occiput along the spinous processes of the cervical spine into the clavicle, acromion, and the spine of the scapula where it merges into the origin of the deltoid.

The rhomboids retract the scapulae and run from the spinous processes of the cervical spine vertebrae obliquely downward and laterally, to insert into the medial border of the scapula. They can be palpated by asking the patient to put his arm behind his back with the elbows flexed and the arms internally rotated when the patient pushes posteriorly as this movement is resisted.

The latissimus dorsi has a broad origin at the iliac crest and twists upon itself toward the shoulder before being inserted into the floor of the bicipital groove of the humerus.

The serratus anterior muscle prevents winging of the scapula by anchoring the medial border of the scapula to the thoracic cage.

Range of Movements

The range of movements possible in the shoulder girdle are mainly abduction, adduction, flexion, extension, internal rotation, and lateral rotation. These movements are tested both actively and passively.

The Apley's scratch test evaluates all the ranges of movements of the shoulder girdle. Firstly, ask the patient to touch the superomedial angle of the opposite scapula behind her head. This tests abduction and lateral rotation. Next ask the patient to touch the opposite acromion in front of her head, which tests internal rotation and adduction. Finally, further test adduction and internal rotation by asking the patient to touch the opposite scapula at its inferior angle, from behind.

Another way in which all of these movements are tested is by asking the patient to abduct his arm to 90° while keeping the elbows extended. Then, with his forearms supinated, ask him to carry on abduction at the shoulders until the palms touch each other over the top of the head, which tests full bilateral abduction at the shoulders. Next ask the patient to keep his hands behind his neck and push his elbows posteriorly which tests abduction and lateral rotations. Finally, ask the patient to keep his hands behind his back as high as they will go to test for adduction and internal rotations.

The glenohumeral joint is tested passively through its full range, but when it has a full passive range but is limited in its active range, that signifies that muscular weakness is the problem.

To differentiate between extra and intra-articular block, feeling at the point of blockage will determine which is involved: It is rubbery in cases of soft tissue extra-articular block, as compared with a bony block which is abrupt and bony in nature.

All of these active and passive movements are tested in three different stages: namely, pure glenohumeral motion, scapulothoracic motion, and a combination of both.

1. *Abduction/adduction*: This occurs in a ratio of 2:1 at the glenohumeral joint and the scapulothoracic joint. It is normally 180° and 45° at both the joints. Another way to test this is by firmly anchoring the scapula and then testing for abduction, when the pure glenohumeral movement is about 90° at which point the scapula begins to move, which can be felt. Full abduction is completed when the arm is externally rotated so as to increase the articulating surface of the humeral head.

In cases of a frozen shoulder, the movement occurs mainly by scapulothoracic movement and never in the glenohumeral joint.

2. *Flexion/extension*: Normal movement is about 90° for flexion and 45° for extension. These movements may be limited in cases of bursitis of the shoulder or bicipital tendinitis.
3. *Internal rotation/external rotation*: This is best tested by keeping the elbows close to the waist which prevents substitutions of rotation, and flexing the elbows to 90° and then rotating the arm laterally and medially. The normal range of internal rotation is about 55°, and the normal range of external rotation is about 45°. The alternative technique to test for internal and external rotations is by asking the patient to abduct both her shoulders to 90° with bent elbows to 90° and then test for rotations with palms facing upward and downward.

Neurologic Examination

This is mainly done through tests in the shoulder girdle: namely, flexion, extension, abduction, adduction, external rotation, internal rotation, scapular elevation, scapular retraction, and shoulder protraction.

1. *Flexors*:

- (a) Primary flexors – anterior fibers of the deltoid
 - Axillary nerve – C5
 - Coracobrachialis-musculocutaneous nerve – C5, C6.
- (b) Secondary flexors – pectoralis major (clavicular head)
 - Biceps
 - Anterior fibers of deltoid.

Flexion is tested by flexing the elbow to 90° and then starting flexion of the shoulder. Gradually and slowly increase resistance as flexion at the shoulder begins (Table 2.1).

2. *Extensors*:

- (a) Primary extensors – latissimus dorsi – thoracodorsal nerve – C6, C7, C8
 - Teres major-lower scapular nerve – C5, C6
 - Posterior fibers of the deltoid – axillary nerve – C5, C6

Table 2.1 Muscle grading chart

Muscle gradations	Description
5 Normal	Complete range of motion against gravity with full resistance
4 Good	Complete range of motion against gravity with some resistance
3 Fair	Complete range of motion against gravity
2 Poor	Complete range of motion with gravity eliminated
1 Trace	Evidence of slight contractility. No joint motion
0 Zero	No evidence of contractility

- (b) Secondary extensors – teres minor
 - Triceps (long head)

Test for extension by gradually increasing resistance to flexion over the posterior aspect of the distal humerus (Table 2.1).

3. *Abduction:*

- (a) Primary abductors – middle fibers of the deltoid – axillary nerve – C5, C6
 - Supraspinatus-suprascapular nerve – C5, C6
- (b) Secondary abductors – anterior and posterior fibers of the deltoid
 - Serratus anterior

This is tested by asking the patient to abduct his arm against gradually increasing resistance.

4. *Adduction:*

- (a) Primary adductors – pectoralis major-medial and lateral anterior thoracic nerve – C5, C6, C7, C8, T1
 - Latissimus dorsi-thoracodorsal nerve – C6, C7, C8
- (b) Secondary adductors – teres major
 - Anterior fibers of the deltoid

This is tested by adduction of a slightly abducted arm against gradually increasing resistance offered on the medial side of the arm.

5. *External rotation:*

- (a) Primary external rotators
 - Infraspinatus-suprascapular nerve – C5, C6
 - Teres minor – branch of the axillary nerve – C5
- (b) Secondary external rotators
 - Posterior fibers of the deltoid

This is tested by holding a flexed elbow at the waist with the forearm in a neutral position and asking the patient to rotate her arm outward against gradually increasing resistance.

6. *Internal rotators:*

- (a) Primary internal rotators
 - Subscapularis – upper and lower subscapular nerves – C5, C6
 - Pectoralis major – medial and lateral anterior thoracic nerves – C5, C6, C7, C8, T1
 - Latissimus dorsi – thoracodorsal nerve – C6, C7, C8
 - Teres major – lower subscapular nerve – C5, C6
- (b) Secondary internal rotator
 - Posterior fibers of the deltoid

The test is carried out in the same way as above, and the patient is asked to rotate his arm inward against gradually increasing resistance.

7. *Scapular elevation:*

- (a) Primary elevators
 - The trapezius-spinal accessory nerve or cranial nerve XI
 - Levator scapulae – C3, C4 along with branches from the dorsal scapular nerve, C5
- (b) Secondary elevators
 - Rhomboid major
 - Rhomboid minor

Ask the patient to shrug his shoulders against gradually increasing resistance.

8. *Scapular retraction:*

- (a) Primary retractors – rhomboid major – dorsal scapular nerve – C5
– Rhomboid minor – dorsal scapular nerve – C5
- (b) Secondary retractors – the trapezius

This can be tested by asking the patient to throw his shoulders back against gradually increasing resistance, whereby the patient assumes a position of attention.

9. *Scapular protraction:*

- (a) The primary protractor is the serratus anterior – long thoracic nerve – C5, C6, C7

This is tested by asking the patient to reach forward when the scapula moves anteriorly on the thorax. Winging is seen when the patient pushes against a wall or when doing a push-up, when the serratus anterior is weak.

Reflex Testing

Both the muscles, biceps, and triceps which cross the shoulder joint should be tested.

Sensation Testing

These can be tested by well-delineated dermatomes as follows:

1. The lateral arm – C5 nerve root – which is examined by a rounded area just on the lateral aspect of the deltoid muscle – axillary nerve.
2. The medial arm, supplied by the T1 nerve root.
3. The axilla which is supplied by the T2 nerve root.
4. The area from the axilla to the nipple is supplied by the T3 nerve root.
5. The nipple which is supplied by the T4 nerve root.

Abnormal sensations (paresthesia) may either be increased (hyperesthesia) or decreased (hypoesthesia) or may be completely absent (anesthesia). The axillary nerve is frequently damaged in shoulder dislocations, when it leaves an anesthetic patch over the lateral aspect of the deltoid muscle.

Special Tests

Certain special tests are helpful in the examination of the shoulder girdle.

1. The Yergason test which is performed to test for the stability of the long head of the biceps. This is done by externally rotating the arm as the patient resists and at the same time pulling downward on his elbow. If the biceps tendon is unstable, it will jump out of the groove giving rise to pain.
2. *Drop arm test:* This is done by asking the patient to abduct her arm and then slowly lowering it arm to her side. This test is mainly for integrity of the rotators, and if those are damaged or torn, the arm drops off after abduction to fall by the side.

3. *Apprehension test*: This is mainly an indication of anxiety while testing for the integrity in a movement toward dislocating a shoulder, which is seen on the patient's facial expression while doing the test. This test is done by abduction and external rotation of the arm in an attempt to dislocate the shoulder.

Examination of Related Areas

The shoulder joint area is the site for referred pain in certain conditions, which must be borne in mind.

Shoulder symptoms due to an irritated diaphragm being supplied by the same nerve root innervations (C4, C5) may be seen in a myocardial infarction. Certain problems such as a prolapsed cervical disc may be referred to the medial angle of the scapula. Occasionally a spinal fracture may have radiation to the shoulder along its muscle inserted into the scapula. Sometimes pain may radiate retrograde proximally in cases of injuries to the distal humerus or the elbow.

Certain specific conditions affecting the shoulder joint should be borne in mind, such as:

1. Scapular disorders such as:

- (a) *Sprengel's shoulder*: Sometimes one scapula remains high due to incomplete descent from the neck, which is usually around the third month of fetal life. In these cases, deformity along with limitation of movements is the only symptom, along with a web of skin which runs along the side of the neck. Radiographs may show an extra bony mass (omovertebral) between the upper scapula and the cervical spine. Mild cases are left untreated, and excision of the superomedial part of the scapula may help in reducing the deformity.
- (b) *Winged scapula*: This is a condition seen in paralysis of the serratus anterior. Winging along with backward projection of the vertebral border of the scapula becomes obvious when the patient is asked to push his hands against the wall. The disability is very slight and is best accepted without treatment.
- (c) *Grating scapula*: This is a painless and noisy or grating sound which is heard when arm movements are attempted, and no treatment is advised for this condition.

2. Tuberculosis of the shoulder:

This is usually seen in advanced cases, and when there is no discharge, the term 'caries sicca' is used. This condition usually mimics a frozen shoulder in many cases, with overall decrease of all movements, with pain. On radiography, generalized rarefaction is seen. Treatment is generally by resting the shoulder in an abduction splint, resulting in decrease of pain and healing by fibrosis. Very rarely a clearance operation is indicated, if the symptoms do not settle.

3. *Musculotendinous cuff lesions*:

The rotator cuff comprising the supraspinatus, infraspinatus, subscapularis, and the teres minor may show varying pathology in its tendinous portions, such as degeneration, trauma with tears, and a reaction of inflammation indicative of repair.

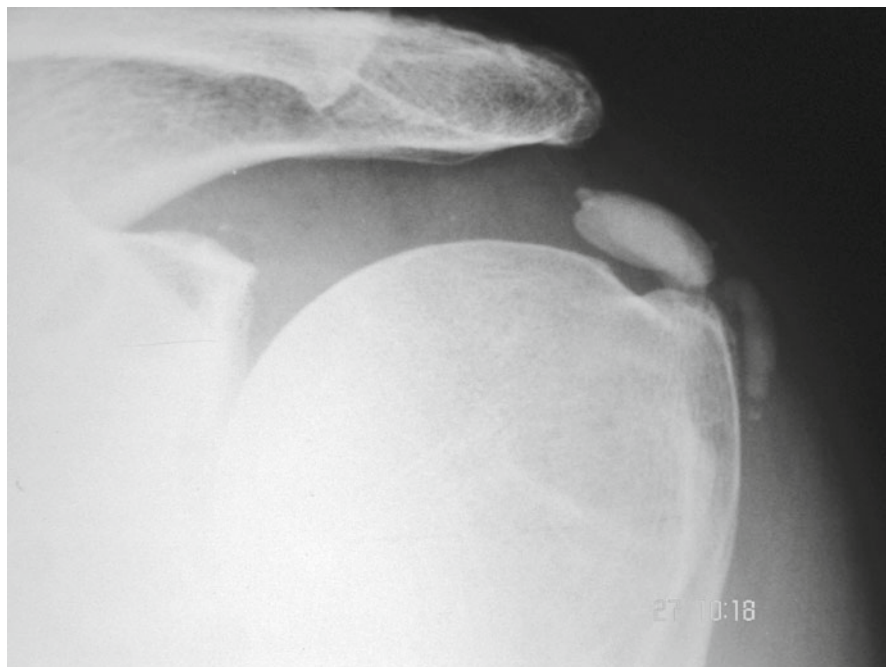


Fig. 2.2 Anteroposterior radiograph of the shoulder showing supraspinatus calcification (Courtesy Dilip Malhotra, Bahrain)

In acute tendinitis, degeneration is usually seen as a small localized area in the supraspinatus tendon due to deposition of calcium. This is usually seen in younger adults with a markedly painful shoulder along with marked decrease in range of movement. Radiographs may show a dense area of calcification just above the greater tuberosity (Fig. 2.2). Treatment is by rest in a sling, along with analgesics. Very rarely is aspiration of the calcific mass necessary under image-intensifier control.

In chronic tendinitis or the painful arc syndrome, the patient is usually older, and only certain movements of the shoulder are painful, such as in the mid arc of abduction. This is usually treated by conservative measures such as rest, along with heat. In refractory cases, an injection of hydrocortisone along with a local anesthetic is helpful. Very rarely is operative treatment in the form of an acromionectomy indicated.

4. *Frozen shoulder:*

This is a fairly common condition, which is also known as adhesive capsulitis or periarthrititis of the shoulder. It usually starts in the supraspinatus tendon and gradually spreads to involve the entire tendinous cuff. Initially there is pain, which gradually settles down, along with limitation of all movements, both active and passive. This condition must be differentiated from posttraumatic stiffness, tuberculosis, and osteoarthritis. Treatment of this condition is usually conservative in the form of rest, analgesics, and heat in the form of short-wave diathermy. Exercises are gradually encouraged and at times an injection of hydrocortisone

along with a local anesthetic may be helpful. In extremely refractory cases, a manipulation under an anesthetic may hasten recovery.

5. *Supraspinatus tears:*

This may be partial or complete, and it usually follows degeneration in the tendon. The patient may gradually recover if it is a partial tear, when the pain subsides. When complete, the pain subsides, but active abduction is impossible, and the patient demonstrates a characteristic shrug, whereas passive abduction is possible above a right angle, but cannot be held, thus allowing the shoulder to drop. Treatment of this condition depends on whether the tear is partial or complete. Partial tears are usually treated by rest, analgesics, exercises, and injections of hydrocortisone with a local anesthetic. When the tear is complete, surgical repair is always desirable.

6. *Lesions of the biceps tendon:*

- (a) *Tendinitis:* This is fairly common, with the shoulder joint normal with tenderness which is felt in the bicipital groove only on external rotation. This condition usually responds to rest, local heat, and injections of hydrocortisone along with a local anesthetic.
- (b) *Ruptured biceps tendon:* This is due to a tear of the long head of the biceps, with the tendon usually being avulsed from its insertion. The clinical picture is characteristic: On asking the patient to flex both his elbows, the belly of the biceps is lower and more rounded when compared with the opposite normal side. Usually this is often left alone, but occasionally it may be repaired in patients engaged in heavy manual labor.

7. *Brachial neuralgia:*

This is a term which is usually applied to pain extending over a large part of the upper limb. It can be conveniently classified on an anatomical basis into three parts:

- (a) Disorders around the shoulder: In all of these conditions, the shoulder joint movements are limited and painful.
- (b) Disorders proximal to the shoulder: In all of these cases, the shoulder joint movements are essentially normal along with a normal radiographic appearance.
- (c) Disorders distal to the shoulder: In all of these cases, the shoulder joint and the neck movements are normal along with a normal radiographic appearance. Lesions such as tennis elbow and carpal tunnel syndrome must be kept in mind.



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