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Shoulder examination: a systematic approach

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Abstract

The shoulder is a complex joint with static and dynamic stabilising structures working synchronously. These allow a full range of movement while preserving stability of the joint. Patients may present with pain, stiffness, weakness, deformity or instability. The authors suggest a systematic examination sequence to ensure that important pathology is not overlooked. Adopting this approach allows common pathologies, including tears of the rotator cuff, impingement and tendinopathy, to be easily identified. This shoulder examination sequence may be used by all healthcare professionals and can also act as a revision aid for those undergoing exams in this field, at different levels of training.

Key words: Shoulder examination; shoulder pathology; rotator cuff; shoulder instability; tendinopathy; impingement

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Introduction

As with any clinical assessment, obtaining an adequate history from the patient is crucial. This will often provide insight into suspected pathology and may help focus clinical examination. The type of shoulder pathology seen usually varies with age (Table 1).

Table 1. Age as a first indication of possible shoulder pathology

Age range	Pathology		Relevant examinations
20–30 years	Glenohumeral joint instability		■ Beighton score ■ Sulcus test ■ Apprehension tests
	Acromioclavicular joint dislocation		■ Inspection ■ Palpation
40–50 years	Adhesive capsulitis		■ Range of movement (reduced active and passive)
	Rotator cuff traumatic tear		■ Range of movement (reduced active and resisted) ■ Lag signs ■ Cuff strength tests
	Subacromial impingement		■ Hawkins–Kennedy test ■ Neer's sign ■ Cuff strength tests
	Calcific tendinopathy		■ Hawkins–Kennedy test
>60 years	Rotator cuff traumatic tear		■ Range of movement (reduced active and resisted) ■ Cuff strength tests ■ Lag signs
	Degenerative joint disease	Acromioclavicular joint	■ Palpation ■ Scarf test ■ O'Brien's test ■ End of arc pain
		Glenohumeral joint	■ Range of movement (reduced active and passive) ■ Crepitus ■ Cuff strength tests

It is important to identify pain and discomfort. The examiner may leave potentially painful movements or tests towards the end of the examination to cause as little discomfort to the patient as possible.

The shoulder comprises three articulations: the glenohumeral joint, the acromioclavicular joint and the scapulothoracic functional articulation. The glenohumeral joint is stabilised by static and dynamic stabilising structures (Table 2).

The glenohumeral joint has a great range of movement and can flex or extend, abduct or adduct, internally or externally rotate and perform circumduction. In practice, movements at the glenohumeral joint usually occur synchronously with that of the rest of the shoulder girdle. The ranges of movement for the shoulder girdle can be found in Table 3. Although these values can be useful to recall, it is more important to compare the side with the pathology to the normal shoulder.

Systematic approach

The authors suggest the 'look, feel, move, special test' approach to shoulder examination. It is useful to enquire about pain before examining the patient.

At the start of the examination, the cervical spine is screened for palpation tenderness and restricted range of movement, as cervical pathology very commonly presents as or along with shoulder pathology (Throckmorton et al, 2014).

Table 2. Static and dynamic stabilisers of the shoulder joint

Static	Bone	Retroverted glenoid and humeral head
	Rotator cuff	Supraspinatus
		Infraspinatus
		Teres minor
		Subscapularis
Dynamic	Soft tissue	Glenoid labrum
		Glenohumeral capsule
		Glenohumeral ligament
		Negative intra-articular pressure
		Adhesion-cohesion mechanism
	Muscles	Biceps
		Triceps
		Deltoid
		Pectoralis major
		Trapezius
		Latissimus dorsi

Table 3. Movements of the shoulder joint with their range of movement

Movement	Range of movement (°)
Abduction in scapular plane	170
Flexion (composite movement)	170
Extension (composite movement)	45–60
Internal rotation	Extended thumb between T5 and T10 spinous process level
External rotation	70–90

Inspection

Observe the patient while they remove their clothes to assess their functional status. Those with pathology will often be unable to elevate their affected arm above their head and they may slide the garment down the affected arm.

Systematic inspection of the skin, soft tissues and bony anatomy will help avoid missing any pathology (Table 4). The shoulders should be observed from the front, sides and behind. This should include comparison with the contralateral side with regards to symmetry (Figures 1a and b).

Note the clavicle, acromioclavicular and sternoclavicular joints. Assess the bulk of the deltoid, pectoralis major, supraspinatus and infraspinatus. Note the appearance of the biceps brachii muscle, as distalisation of the muscle belly could be secondary to long head of biceps tendon rupture (termed the Popeye sign), which in turn may be related to rotator cuff pathology (Ditsios et al, 2012).

Scapular winging is divided into lateral (scapular moves inferior and lateral) and medial (scapula moves superior and medial) and should be noted on posterior inspection of both scapulae. Its most common causes are long thoracic nerve lesions for medial winging and spinal accessory nerve lesions for lateral winging. Scapular winging can be confirmed with the push off wall test (Figure 2) (Martin and Fish, 2008).

Palpation

Once again, a systematic method should be used with palpation of the skin, muscle and bony anatomy.

A warm and painful shoulder may indicate septic arthritis. As the shoulder is a deep joint covered by several layers of musculature and soft tissue structures, the clinical picture of septic arthritis can be less obvious than in more superficial joints.

Sensory changes should be noted, with emphasis on the cutaneous distribution of the axillary nerve, which are often abnormal following anterior glenohumeral joint dislocations.

The examiner should stand in front of the patient and palpate both sternoclavicular joints, the clavicles and acromioclavicular joints in turn. The bicipital groove is also palpable with the shoulder in 10° of external rotation, especially in thin individuals; pain in that location may be secondary to long head of biceps pathology.

Table 4. Systematic inspection

Area	Pathology
Skin	Scars, erythema, sinuses
Muscle	Atrophy, swelling, oedema
Bones	Contour, deformity

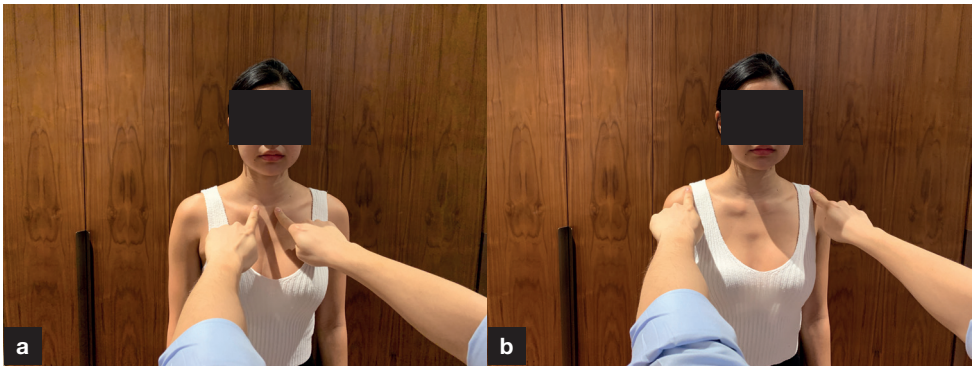

Figure 1. Inspection of the shoulder should include comparison to the contralateral side. a. Examiner's fingers at the level of the sternoclavicular joint. b. Examiner's fingers at the level of the acromioclavicular joint.

Movement

Assessment of range of movement should be separated into passive, active and resisted. While often variable, the range of movement of the two shoulder joints should be compared. Table 3 lists the absolute range of movements. Quick screening tests include asking the patient to raise both hands forward and to the side above their head followed by placing both hands on their waist (Figures 3a–c). As a general principle, start with movements at waist height (such as external and internal rotation), before examining forward flexion and abduction, as the over-shoulder level movements are often painful. It is useful to observe the patient's face when assessing movement, to identify painful positions and avoid these.

Consider starting with active range of movement. As the patient reaches the end of that movement, the examiner should gently try to assess passive and resisted range from that

Figure 2. Push off wall test.

Figure 3. Screening tests. a. Arms outstretched. b. Hands on waist. c. Arms overhead.

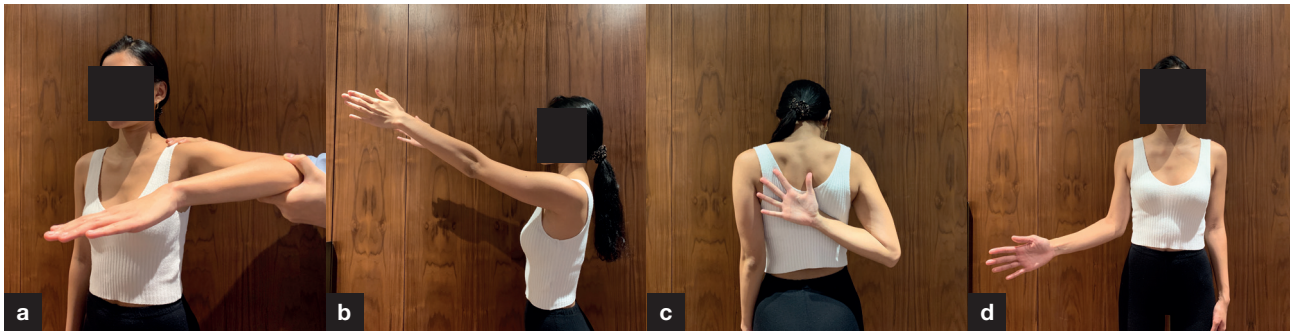

Figure 4. Range of movement. a. Abduction. b. Forward flexion. c. Internal rotation. d. External rotation.

Table 5. Range of movement examination			
		Movement	
Pathology	**Active**	**Passive**	**Resisted**
Rotator cuff tear	Reduced	Normal	Reduced
Osteoarthritis	Reduced	Reduced	Normal
Adhesive capsulitis	Reduced	Reduced	Normal

position (Figure 4 and Table 5). This results in economy of movement, while giving the potential diagnosis easily. An example of this is an infraspinatus tear, where the patient cannot externally rotate actively or under resistance, while passive external rotation is complete and pain free. For adhesive capsulitis, passive and active external rotations are identical and painful.

Figure 4 demonstrates the examination of range of movement with abduction (Figure 4a), forward flexion (Figure 4b), internal rotation (Figure 4c) and external rotation (Figure 4d). Abduction can be tested by standing behind the patient with the examiner stabilising the scapula and thereby isolating the glenohumeral joint. Normal abduction with the scapula free to move is around 170°, and with the scapula fixed it is around 80–90°. Forward flexion is tested passively and actively; normal values are usually 0–170°. Internal rotation is assessed by noting the spinal level that the extended thumb touches when the patient reaches behind their back. Usually, this is between T5 and T10. The inferior scapula angle is approximately equivalent to T8. As demonstrated in Figure 4d, external rotation is tested with the patient's upper arm adducted so that their elbow is in line with their torso before externally rotating their forearm. The normal range of movement is 50–70°.

When faced with a symmetrical decrease in passive and active external rotation of the shoulder, the differential diagnosis should include the pathologies in Table 6. Remember that pain inhibition may confound findings in assessing range of movement.

Forward flexion and extension are composite movements with contribution from the glenohumeral and scapulothoracic articulations. To isolate the glenohumeral joint, the examiner should stabilise the scapula to prevent it from moving. Asking the patient to perform these movements slowly and observing the scapulae from behind allows the examiner to note the scapular rhythm (the symmetry by which the scapulae rotate, while maintaining their intimate relationship to the thoracic wall). This permits the diagnosis of scapular dyskinesia, a common finding in young patients with shoulder pain.

During the assessment of range of movement, look for a painful arc of abduction and note when this occurs, both ascending and descending. Rotator cuff pathology relates to pain in abduction between 60–120°. Pain occurring above 120° is more suggestive of acromioclavicular joint disorders (Kessel and Watson, 1977).

Special tests

Rotator cuff pathology

Next, test each of the rotator cuff muscles in turn to assess for pathology. In general, there are three outcomes for these tests:

1. No pain and ability to resist shows that the muscle is normal

Table 6. Causes of loss of passive and active external rotation
Symmetrical reduction in passive and active external rotation
End-stage glenohumeral osteoarthritis
Adhesive capsulitis
Locked posterior dislocation
Pain inhibition

2. Pain with a maintained ability to resist active movement, indicating tendinopathy or a compensated full-thickness tear
3. Pain and inability to resist suggests a tear (Leroux et al, 1995).

Supraspinatus

Consider Jobe's test (Figure 5). From a position of shoulder abduction by 30° in the scapular plane and the thumbs pointing downwards, the examiner places their hand over the upper arm and asks the patient to abduct against resistance. Pain and weakness are indicative of a torn supraspinatus tendon (Jobe and Jobe, 1983).

Subscapularis

Consider Gerber's (Figure 6a) and the Napoleon tests (Figure 6b). To perform Gerber's test, ask the patient to touch their lower lumbar spine with the elbow flexed to 90°. They should then 'lift off'. If this is impossible, passively lift the arm off the spine, and ask them to hold it in place. The test is positive if the patient is unable to keep the hand at maximal internal rotation after the hand is released by the examiner; this is a positive lag sign (Gerber and Krushell, 1991). If the patient is unable to reach the spine, the Napoleon

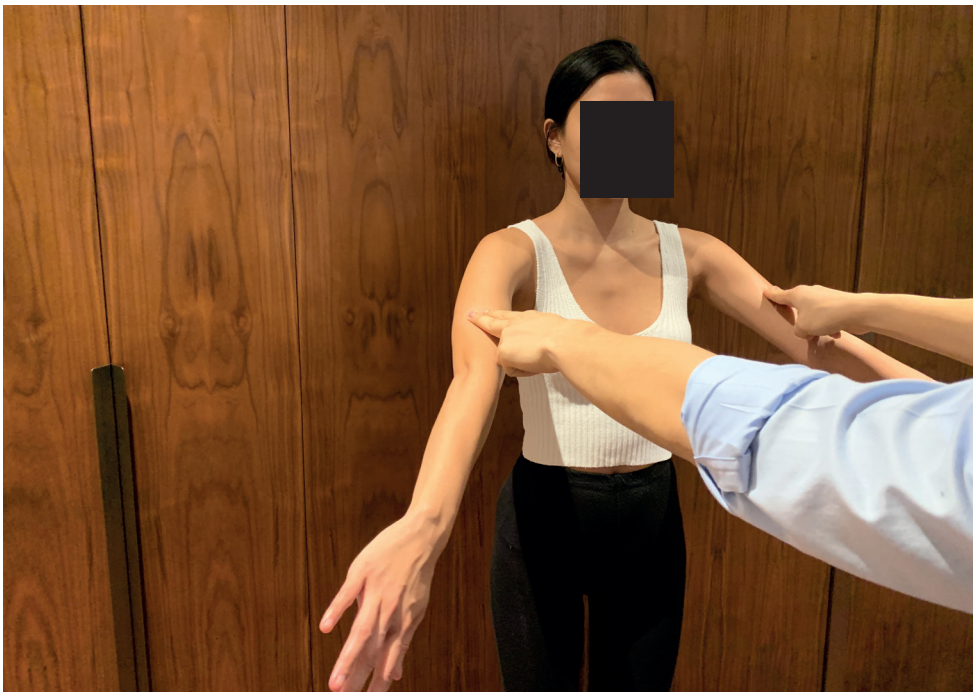

Figure 5. Jobe's test of supraspinatus.

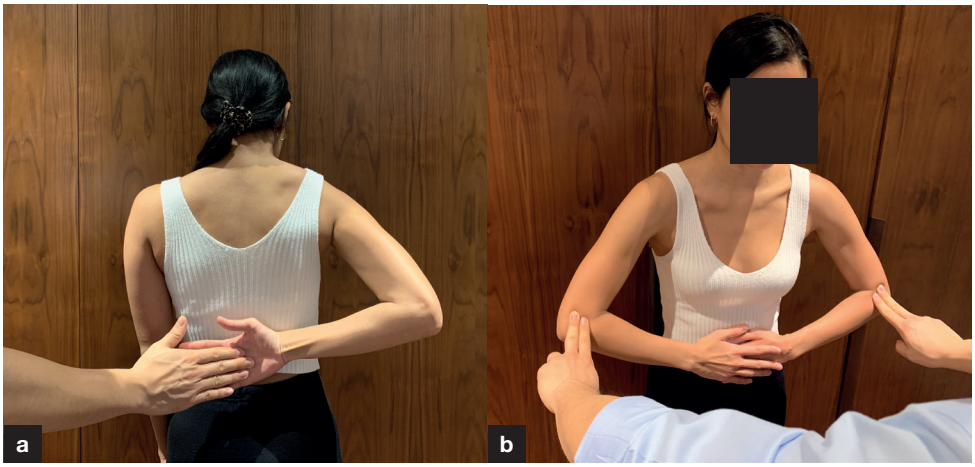

Figure 6. a. Gerber test of subscapularis. b. Napoleon test of subscapularis.

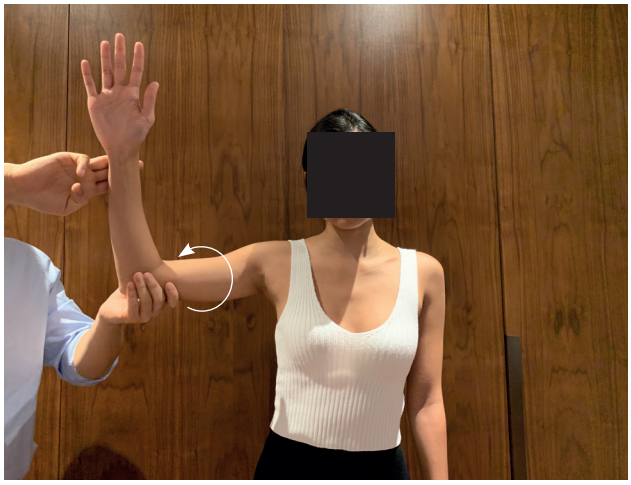

Figure 7. Patte's test of infraspinatus.

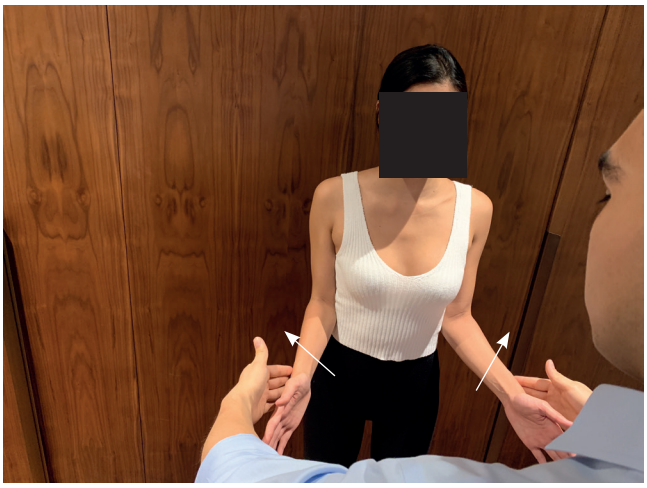

Figure 8. Test of external rotation strength.

test can be used instead. With the hands resting in front of the abdomen, ask the patient to bring the elbows forward and push into the abdomen against resistance. If maximum internal rotation is maintained (without the wrist flexing), the subscapularis is functional (Schwamborn and Imhoff, 1999).

Infraspinatus

Consider Patte's test (Figure 7). From a position of shoulder abduction as in the figure, resisted external rotation is tested. Pain and weakness indicate a positive test and a potential tear of the infraspinatus and/or tear of the teres minor (Patte and Goutallier, 1988). A lag sign is positive when passive external rotation from this position cannot be maintained by the patient. If the patient is unable to comfortably elevate their arm to perform Patte's test, one could assess infraspinatus, as demonstrated in Figure 8, where the patient performs an active resisted maximal external rotation of the upper limb. The test is positive if the patient cannot resist as a result of pain or weakness.

Teres minor

Consider the hornblower's test (Figure 9). The inability to actively externally rotate from a position of 90° of abduction in the scapula plane and the elbow flexed to 90° signifies a positive test (Walch et al, 1998). Figure 9 illustrates a positive hornblower's test.

Figure 9. Hornblower's test.

Other musculo-tendinous injuries

Pectoralis major

From the position demonstrated in Figure 10, the patient contracts their pectoralis major by pushing against their pelvis. Observe for symmetry.

Deltoid

From a position of 90° of abduction and 90° of elbow flexion, test the anterior fibres by resisting the patient as they move their arm forward (Figure 11a). To test the medial fibres, resist the patient as they abduct further (Figure 11b). To test the posterior fibres, resist the patient as they move their arm backwards (Figure 11c).

Instability

While testing for instability, the aims are to determine the presence and direction of instability, and the degree of laxity. While performing instability tests, the examiner should be able to readily identify patient apprehension or discomfort, as early signs of a potential instability event and stop the examination at that point.

Start by recording a Beighton score in order to identify signs of hypermobility (Beighton et al, 1973). This can help to differentiate between atraumatic and traumatic instability.

Figure 10. Testing pectoralis major.

Figure 11. Testing deltoid power. a. Anterior deltoid fibres. b. Middle deltoid fibres. c. Posterior deltoid fibres.

Sulcus sign

The sulcus sign tests for laxity. This translation is graded as 1+ (1 cm), 2+ (1–2 cm) or 3+ (>2 cm) (Neer and Foster, 1980). This should be compared to the contralateral side, as this can be a sign of bilateral inferior hyperlaxity rather than instability (Walch et al, 1998). Figures 12a and b demonstrate this examination, where the relaxed patient has downward traction (white arrow), applied at a point above the elbow, while the acromiohumeral distance is palpated (blue arrows).

Load and shift test

The load and shift test detects anteroposterior laxity (Figure 13). To perform this test, the examiner stands behind the patient with the patient's arm slightly abducted. Load is then applied to the humerus to centralise the head into the glenoid (white arrow). This is followed by anterior (Figure 13a) and posterior (Figure 13b) translation. Normal movement is 25% of the width of the glenoid anteriorly and 50% posteriorly. The results are graded: 1 – head translates to, but not over, the glenoid rim, 2 – translates to over rim, but reduces when force is released, 3 – as for two, but remains dislocated (Hawkins and Mohtadi, 1991).

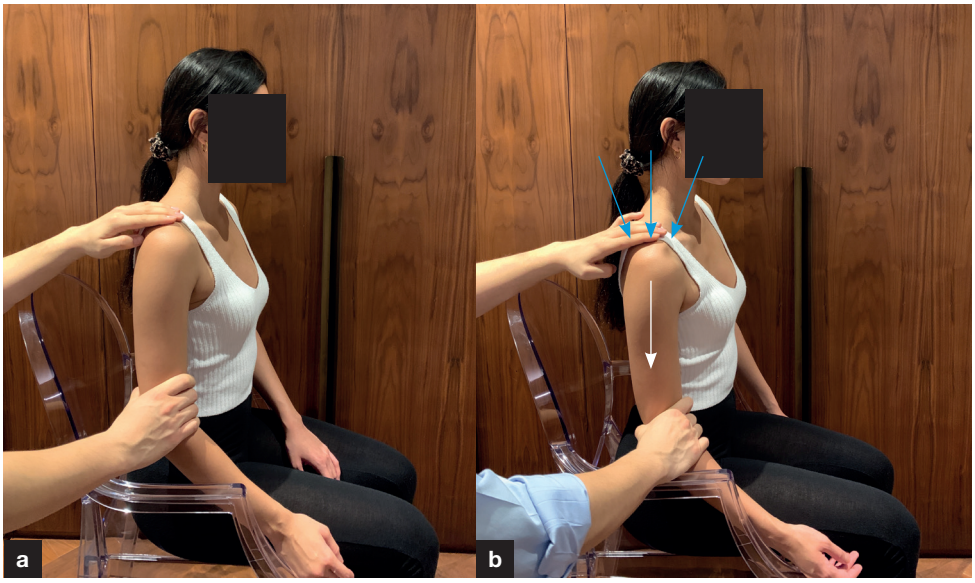

Figure 12. Sulcus sign. a. Relaxed patient. b. Downward traction applied.

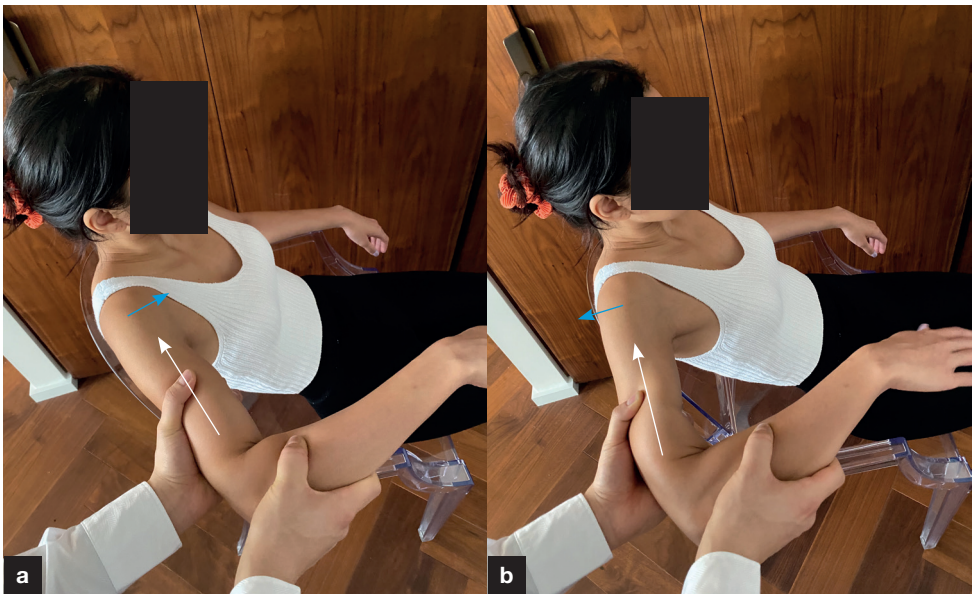

Figure 13. Load and shift test. a. Anterior translation. b. Posterior translation.

Anterior apprehension test

Anterior instability can be elicited with the anterior apprehension test (Gerber and Ganz, 1984) (Figure 14a). This test is performed with the scapula supported, the shoulder is abducted to 90° and with the elbow flexed, the shoulder is externally rotated while pressure is placed on the humeral head from behind. A positive test requires an apprehension response from the patient, and indicates either a bony lesion (Protzman, 1980) or a labral lesion of the anteroinferior glenoid rim (Blazina and Satzman, 1969). This test is pathognomonic for anterior glenohumeral instability (Walch et al, 1995).

Relocation test

The relocation test (Figure 14b) should be performed after the anterior apprehension test. In this test, the patient will be in a supine position with the shoulder protruding from the edge of the bed. The examiner should apply a posterior force on the anterior shoulder and then the shoulder should be gently placed in the same position as the anterior apprehension test. If the patient feels more comfortable in this position with a posteriorly directed force applied, or if the shoulder goes into greater external rotation before apprehension developing, then the test is confirmative for anterior instability (Walch et al, 1995).

Posterior apprehension test

Posterior instability can be elicited with a posterior apprehension test (Figure 15a). With the shoulder and elbow at 90° and the arm held in adduction, posterior force is applied by the examiner. The scapula is stabilised with the examiners other hand. This is repeated in increasing abduction (Figure 15b).

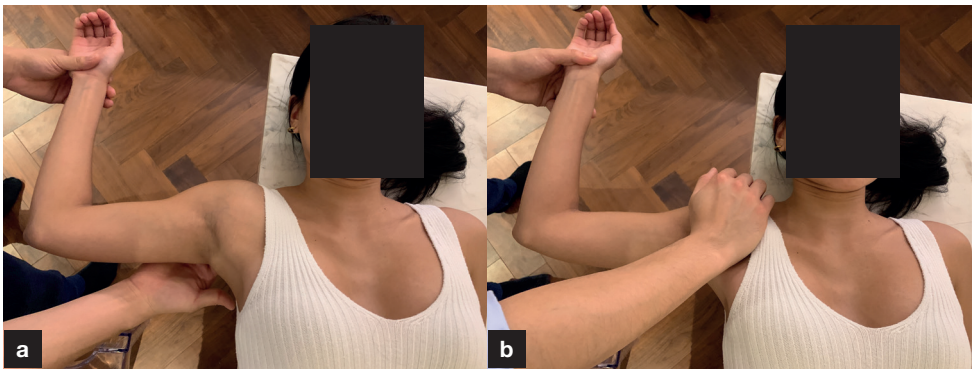

Figure 14. a. Apprehension test. b. Relocation test.

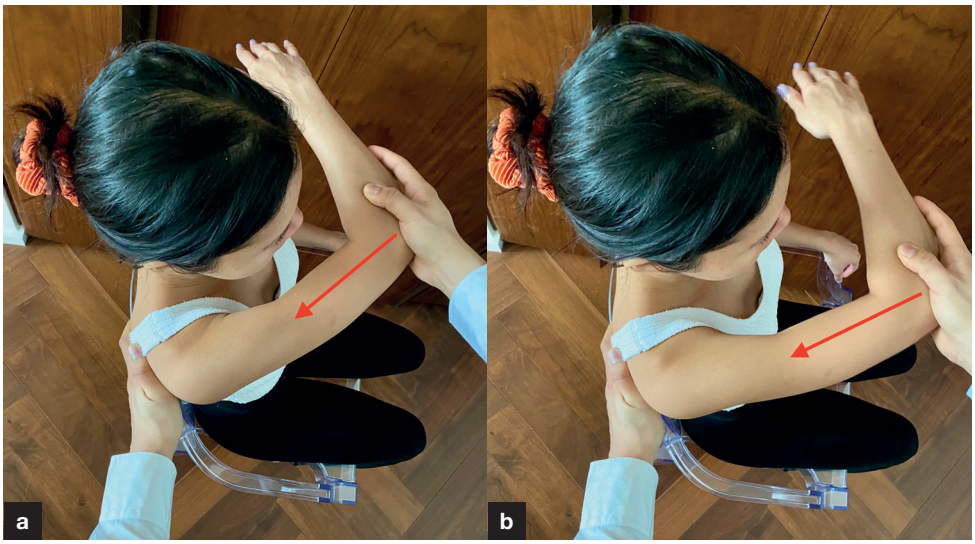

Figure 15. a. Posterior apprehension test. b. Posterior apprehension test repeated with increased abduction.

Hyperabduction test

Laxity of the inferior glenohumeral ligament may be tested with the hyperabduction test (Figure 16) (Gagey and Gagey, 2001). The shoulder is abducted with the scapula stabilised (Figure 16a). A positive hyperabduction test is above 105° indicating laxity of the inferior glenohumeral ligament (Figure 16b). A negative test is between 85° and 90°.

Subacromial impingement

Neer's sign suggests impingement of the rotator cuff beneath the coraco-acromial arch (Figure 17) (Neer, 1972). With one hand fixing the scapula, the shoulder is internally rotated and flexed. It is positive if the patient experiences pain.

The Hawkins–Kennedy test recreates pain when the rotator cuff impinges against the coracoacromial ligament (Hawkins and Kennedy, 1980) (Figure 18). From a position of shoulder flexion to 90° and elbow flexion to 90°, the arm is internally rotated and the test is considered positive if pain is elicited.

Long head of the biceps

Common conditions affecting the intra-articular portion of the biceps include tendinopathy and SLAP (superior labral lesion, anterior to posterior) lesions. Intra-articular instability or tears of the biceps may occur when associated with rotator cuff tears around the rotator

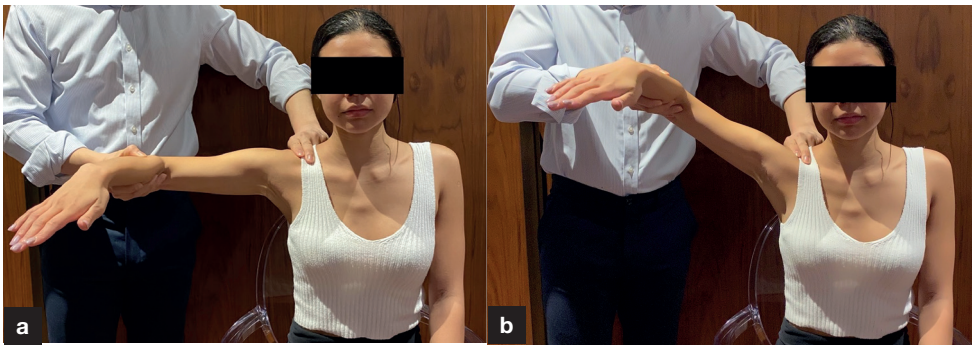

Figure 16. Hyperabduction test. a. Negative test. b. Positive test.

Figure 17. Neer's test for impingement.

interval. This will present as pain along the bicipital groove of the humerus and can be recreated during palpation. The Speed's (Figure 19), Yergason's (Figure 20) and O'Brien's (Figure 21) tests should be considered.

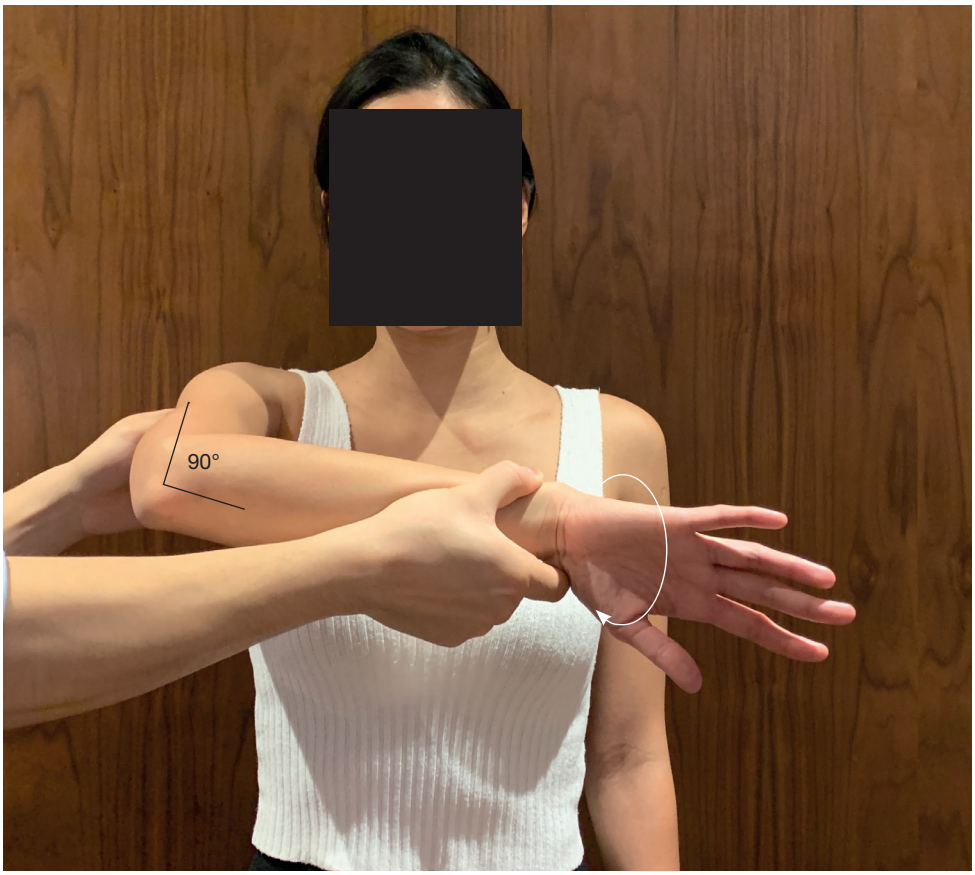

Figure 18. Hawkins–Kennedy test for impingement.

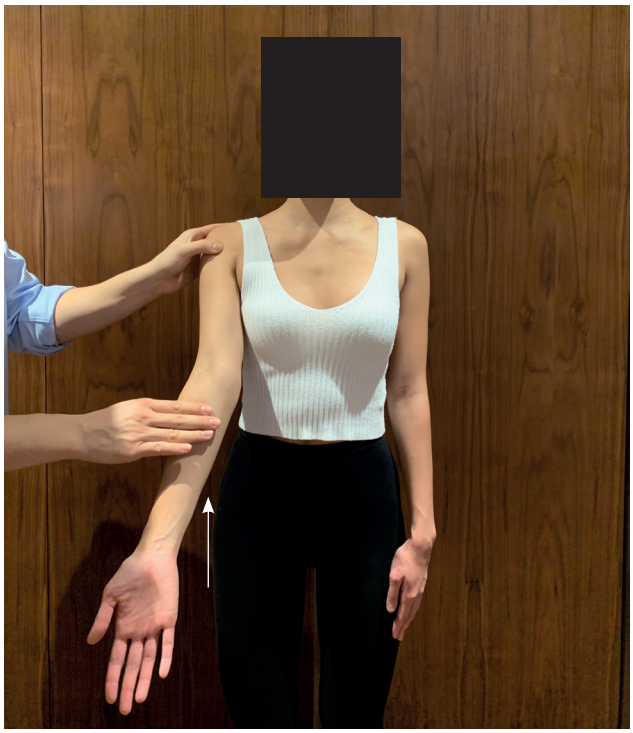

Figure 19. Speed's test.

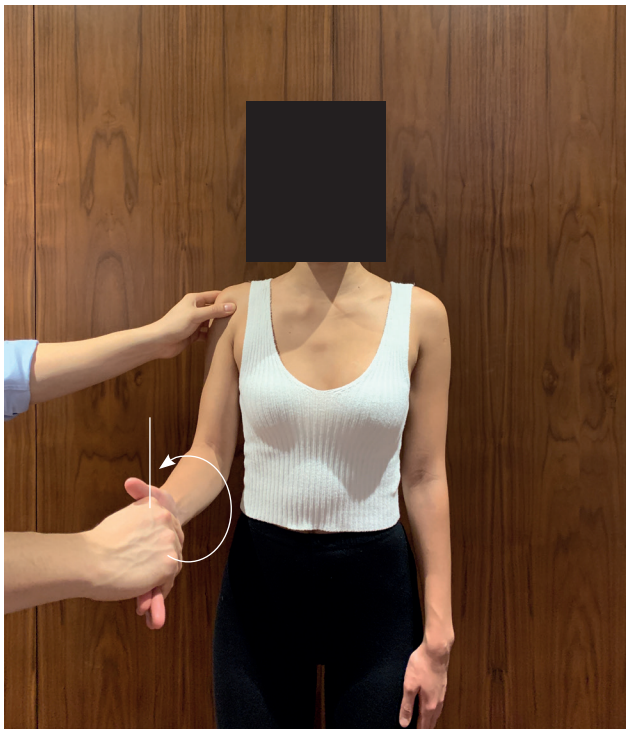

Figure 20. Yergason's test.

Figure 21. a. O'Brien's test. a. Hand in pronation. b. Hand in supination.

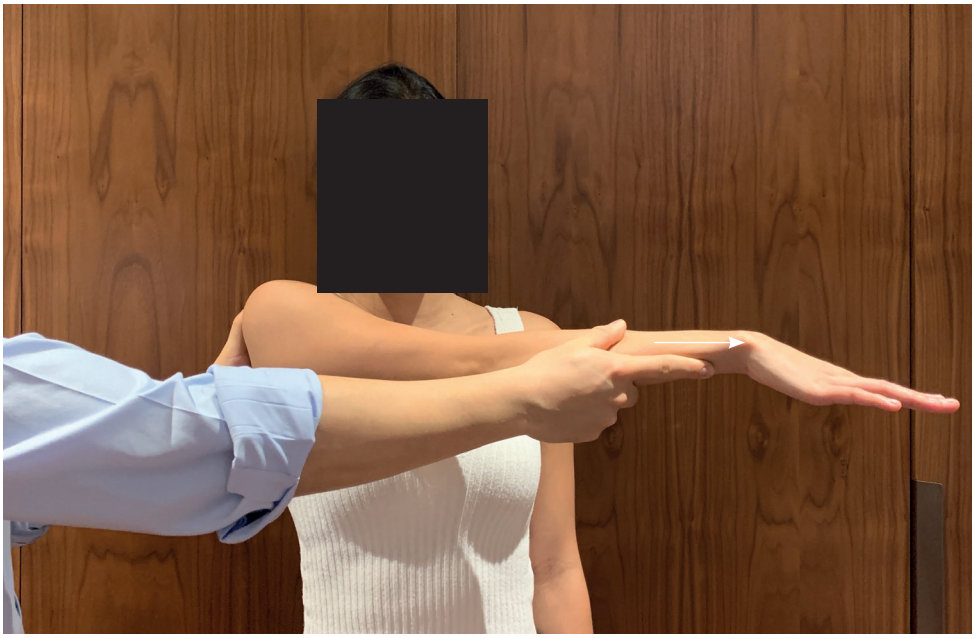

Figure 22. Scarf test.

To perform Speed's test, place the patient's forearm in supination with the elbow in 20° of flexion. Ask the patient to flex their shoulder against resistance while palpating the bicipital groove. Pain indicates a positive test (Crenshaw and Kilgore, 1966).

In Yergason's test, resisted supination from a starting position of forearm pronation may elicit pain along the long head of biceps tendon or the bicipital groove. This suggests tendinopathy of the long head of biceps tendon (Magee, 1987).

O'Brien's test is performed by applying downward pressure on the outstretched arm at 10° of adduction from the medial sagittal plane. It is performed with the hand in pronation (Figure 21a) followed by the hand in supination (Figure 21b). Pain in pronation and no pain in supination indicates a positive test (O'Brien et al, 1998).

Acromioclavicular degenerative disease

Scarf test (cross-arm adduction test) can be performed (Figure 22). From a position of 90° of abduction in the scapular plane and with the elbow extended, the arm is passively adducted across the chest. Pain indicates acromioclavicular joint pathology (Silliman and

Key points

- An adequate history is key to focusing clinical examination.
- Using the 'look, feel, move and special tests' sequence will help ensure a comprehensive examination is conducted.
- Special tests can be subdivided into the pathology that the examiner is focusing on, including rotator cuff disease, instability and impingement.
- The examiner should always remember to complete an examination with a brief assessment of the joint above and joint below. In the context of the shoulder, the joint above is the cervical spine and the joint below is the elbow joint.
- The examiner should always remain vigilant to avoid causing discomfort to the patient, or even a dislocation when examining a patient with instability.

Hawkins, 1994). The examiner may also observe pain at the end of the abduction arc, localising specifically to the acromioclavicular joint.

O'Brien's test can be performed as well (Figure 21) but this may also be positive in cases of superior labral and long head of biceps anchor lesions.

Conclusions

Examination of the shoulder should always start with observing the joint followed by movement (active, passive and resisted) and special tests, used to diagnose certain conditions. The special tests can be subdivided into the pathology for which they are testing, such as rotator cuff pathology, instability and subacromial impingement. Note that not all tests need to be performed in all patients. The patient's age and presenting history will always direct the examiner to possible pathology and allow appropriate refinement of examination.

This article is a comprehensive guide for those who are preparing for exams or would like to improve on their clinical examination skills and offers a systematic approach of examining the shoulder joint.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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Curriculum checklist

This article addresses the following requirements from the general internal medicine training curriculum:

- Managing an acute unselected take
- Managing an acute specialty-related take
- Managing patients in an outpatient clinic, ambulatory or community setting, including management of long-term conditions.

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