Pain in the shoulder is, after low back pain, the most frequent complaint of orthopaedic patients. Despite the frequency of shoulder lesions – and the consequent pain and disability – much confusion still exists as to aetiology, terminology and treatment, in contrast to the statement made by Cyriax:

The shoulder is the most rewarding joint in the whole body. As a rule, one can always come to a clear diagnosis, and, if treated in the proper way, most shoulder lesions seem to be curable. Moreover, it is the most suitable joint for the general practitioner, since almost no technical aids are required. A good history and full clinical examination, together with a detailed knowledge of the anatomy, suffices to solve the majority of the shoulder problems.

Complicated cases that are difficult to diagnose exactly are encountered. If clinical findings are difficult to interpret, the following general points should be of help.

First, it should be realized that double lesions do exist, clouding the diagnosis. For example, it is not uncommon to find supraspinatus tendinosis together with infraspinatus tendinosis or in association with subdeltoid bursitis. In these doubtful cases, a diagnostic infiltration of a local anaesthetic can be most helpful in isolating the second lesion.

On other occasions, patients present with a painful limitation of passive movement together with pain on resisted movements, and the question arises as to whether the problem is in an inert or a contractile structure. If there is capsular limitation on examination, the joint should be treated first. If resisted movements remain painful after the joint has been managed appropriately, then the tendons should be treated. This approach is the best one, because resisted movements very often become negative after arthritis has disappeared. The only explanation for the phenomenon is the close relationship between the capsule of the shoulder and the surrounding tendons. It can easily be understood how tension on the contractile structures may influence the pain originating in arthritis. Therefore pain on resisted movement(s) in association with an articular pattern should not be interpreted as being caused by a simple tendinosis. Of course, a severe tendinosis can limit active movement, because of the pain. But passive movements are of full range with a normal end-feel, even though there might be severe pain at the end of movement.

An arthritis is an arthritis, a tendinosis is a tendinosis and both have to be treated as such. It is a common misbelief that, as long as steroid is injected somewhere in the shoulder area, it will spread and cure the lesion, no matter where the lesion lies or where it was injected. In fact, if there is one region in the body which ought to be diagnosed and treated very specifically it is the shoulder. It is necessary to replace a vague diagnosis such as ‘rotator cuff disease’ or frozen shoulder by a precise one indicating exactly what is wrong.
Referred pain

Pain referred to the shoulder

Pain referred to the shoulder, and possibly further down the arm, can be caused by nerve root compression, mainly as the consequence of a posterolateral cervical disc protrusion. A good history is important; the pain has usually started in the neck, probably interscapularly, and has shifted laterally into the arm and hand. Very often the pain is worst at night and is accompanied by pins and needles and numbness. Most frequently the C7 nerve root is compressed, causing pain at the posterior aspect of the whole arm to the second, third and fourth fingers. Other nerve roots can also be involved in a cervical disc lesion but this is far less frequent. Referral to the appropriate dermatome is usual.

In a posterocentral cervical disc lesion with compression of the dura mater, the pain does not spread beyond the deltoid area. Therefore arm pain is not present.

One rare disorder causing pain down the arm is a cervical neuroma. The condition starts with pain in the arm, which progressively spreads proximally as the tumour increases in size.

Other possible causes of referred pain at the shoulder are visceral disorders. The diaphragm is largely developed from the third and fourth cervical segment, the heart from the eighth cervical to the fourth thoracic. Therefore both can give rise to pain in the shoulder and arm. Irritation of the diaphragm and of the phrenic nerve, for example by blood or air under the diaphragm, is another well-known source of acute shoulder pain.9,10

A pulmonary neoplasm at the base of the lung with involvement of the diaphragm can provoke pain in the shoulder area. The same may also happen with a tumour of the superior sulcus (Pancoast’s tumour). The majority of these patients complain of shoulder pain and are often mistakenly thought to be suffering from a musculoskeletal lesion.11,12

Pain referred from the shoulder

Most structures around the shoulder are derived from the C5 segment. There is one important exception: the acromioclavicular joint, which is of C4 origin (Fig. 12.1). In acromioclavicular joint problems the pain is felt at the tip of the shoulder, with little spread. Exceptionally, when the lesion lies at the inferior acromioclavicular ligament, the pain can spread into the upper arm.

In a lesion of one of the other shoulder structures, such as in all types of tendinosis, arthritis and subdeltoid bursitis, the pain is not so much felt at the tip of the shoulder but rather starts in the deltoid region and may spread further down the radial aspect of the arm to the base of the thumb (C5 dermatome; Fig. 12.2). How far down the arm the pain is referred depends on the severity of the lesion: the more severe the inflammation, the further the pain will spread. In glenohumeral arthritis, the degree of pain reference is of particular interest.
in following the healing process: as the patient improves, the inflammation decreases and the pain spreads less far.

**History**

The first question to be elucidated by the history is whether the pain in the arm is genuinely from a shoulder lesion or whether it is the consequence of a more proximal lesion, arising perhaps from the cervical spine. If the answer to this is not clear from the history, a preliminary examination, including tests of the cervical spine, shoulder and elbow, is necessary.

In arthritis of the shoulder, the history will be important to establish the stage (see Ch. 13). In other disorders it is of less significance.

The answers to a number of questions (summarized in Box 12.1) will be needed.

- **What is your age?** Age can be relevant in several disorders. It can be helpful in defining the exact type of arthritis. Traumatic arthritis will only be met after 40 years of age, arthritis from immobilization after the age of 60. Subdeltoid bursitis might be present between 15 and 65 years of age. Tendinitis can occur at any adult age.
- **What is the pain and does it radiate?** Pain starting in the deltoit area and spreading towards the wrist, along the radial aspect of the arm, is caused by a lesion that originates in C5. Such pain may be felt in the whole dermatome or only in part of it. The majority of the shoulder structures belong to the C5 segment. The acromioclavicular joint, a C4 structure, is the main exception. A patient who indicates the tip of the shoulder only as the site of pain suggests strongly that there is a lesion of the acromioclavicular joint. Whether the pain is caused by arthritis, bursitis or simple tendinitis will make no difference to where or how far distally the pain is felt. The distal spread of referred pain depends only on the degree of inflammation. It is routine to ask if the pain remains above the elbow or radiates below it – a matter of particular importance in arthritis.
- **Is there any pain in the arm at rest?** This gives information about the severity of the lesion: if spontaneous pain is present, there is a greater degree of inflammation than if pain is felt only on movement. Again, the answer to this question is one of the criteria for judging the stage of arthritis.
- **Can you lie on the affected side at night?** Pain when lying on the shoulder indicates more severe inflammation than just pain on exercise. Bursitis, tendinitis or arthritis may make it impossible for the patient to lie on the affected side at night. Consequently, this question is not of much help in defining the exact nature of the structure at fault. However, it is rather important in following the resolution of the disorder: as the condition improves, the pain at night diminishes and finally disappears.
- **Did the pain come on spontaneously or was there any particular reason for it, such as overactivity or an injury?** It is clear that overactivity may provoke tendinitis. In a ruptured tendon, however, one should not necessarily expect recent overuse. Overactivity can also cause arthritis in a joint that is already osteoarthrotic; this is just as true for the acromioclavicular joint as it is for the glenohumeral joint. In haemophilia, haemarthrosis usually comes on spontaneously; it is more common at the knee but may occur at the shoulder as well.
- **For how long have you had the pain?** If the pain has already been present for some months, an acute subdeltoid bursitis can be excluded because the full course of this condition is 6 weeks. In addition, onset is abrupt over a few days, sometimes only hours, as in an attack of gouty arthritis. Arm pain because of root compression by a cervical disc protrusion wears off in about 4 months. Long-standing pain can be the outcome of a chronic subdeltoid bursitis or a simple tendinitis. Both can last for years. Monoarticular steroid-sensitive arthritis can take up to 2 years to disappear spontaneously.
- **Are any other joints affected?** A more generalized inflammatory disorder is expected if other joints have been previously involved or are attacked at the same time. Indeed, the shoulder joint can be the seat of rheumatoid arthritis, lupus erythematosus and ankylosing spondylitis.
- **How is your general condition? Have you had any operations?** Recent unexplained loss of weight can be the first sign of a carcinoma. A primary tumour at the shoulder or metastases can be a local source of shoulder pain. A Pancoast’s tumour of the lung often provokes pain in the shoulder area.

**Box 12.1**

**Summary of history taking**

- Age?
- Where is the pain? Does it radiate?
- Pain at rest or only on use?
- Can you lie on that side at night?
- How did the pain come on: spontaneously/overuse/injury?
- For how long have you had the pain?
- Are other joints affected?
- General condition? Any operations?

**Inspection**

The inspection starts with checking what position the head is held in and whether both shoulders are level. It is important to check for redness, swelling, muscular wasting or any deformity such as scapular winging. A step deformity at the upper lateral aspect of the shoulder is caused by an acromioclavicular dislocation, with the distal end of the clavicle lying superior to the acromion. Atrophy of the upper trapezius may indicate spinal accessory nerve palsy. Atrophy of supraspinatus and/or infraspinatus is caused by either a supraspinous nerve palsy or long-standing rotator cuff lesions. Effusion of more than 10–15 mL arising from the glenohumeral joint is normally
visible on inspection at the anterior centre of the humeral head. Local swelling may also be found in acute, haemorrhagic or chronic subdeltoid bursitis and in acromioclavicular joint cysts, as well as in tumours.

**Functional examination**

The shoulder is an easy joint to examine. The intention is to obtain the maximum information from a minimum number of tests. Recent studies have shown high inter-rater and intra-rater reliability of the examination scheme presented.

**Preliminary examination**

In most cases of shoulder–arm pain the history will reveal whether the pain originates from the shoulder itself or is of cervical origin. Sometimes, however, the examiner is not quite sure and will then use a quick survey of all structures between C1 and T2 to exclude other sources of pain in the upper quadrant. It is good practice to perform a preliminary examination of the upper quadrant in the following situations:

- There is or was neck pain
- There is or was trapezius pain
- The pain is only at the top of the shoulder and/or at the clavpectoral area
- The pain is in the arm but remains quite localized
- The pain in the arm is influenced by movements of the neck
- Coughing, sneezing or taking a deep breath increases the pain
- There is paraesthesia.

The preliminary examination of the upper quadrant is comprised of the following tests (Box 12.2):

1. Six active movements of the cervical spine – range of movement and/or painfulness; quick survey of the cervical spine
2. Active elevation of the shoulder girdle – range of movement and/or painfulness; quick survey of all the structures of the shoulder girdle
3. Resisted rotations of the cervical spine and resisted elevation of the scapulae; quick survey of nerve roots C1–C2–C3–C4
4. Active elevation of both arms – range and pain; quick survey of shoulder and shoulder girdle
5. Resisted movements of the upper limb – strength and pain; this is both a quick test for peripheral lesions at the elbow–arm–wrist and a neurological examination of roots C5–C6–C7–C8–T1 and of the peripheral nerves of the upper limb
6. Passive examination of the elbow; quick test of the elbow joint.

Any influence on the pain or any weakness will guide the examiner approximately towards the affected area, which is then examined thoroughly.

<table>
<thead>
<tr>
<th>Box 12.2</th>
</tr>
</thead>
</table>

**Preliminary examination**

**Neck**

1. Flexion
2. Extension
3. Side flexion to the left
4. Side flexion to the right
5. Rotation to the left
6. Rotation to the right

**Resisted movements**

7. Rotation to the left (C1)
8. Rotation to the right (C1)

**Scapula**

9. Active elevation of both scapulae
10. Resisted elevation of both (C2–C4) scapulae

**Shoulder**

11. Active elevation of both arms
12. Resisted abduction (C5)

**Elbow**

**Passive movements**

13. Flexion
14. Extension

**Resisted movements**

15. Flexion (C5, C6)
16. Extension (C7)

**Wrist**

17. Resisted flexion (C7)
18. Resisted extension (C6)

**Thumb**

19. Resisted extension (C8)

**Finger**

20. Resisted adduction of the little finger (T1)

If the examination reveals that the lesion lies in the shoulder, the examiner will try to define in which particular structure the lesion is situated by carrying out a detailed shoulder examination; this is comprised of 12 basic tests (summarized in Box 12.3).

**Basic functional examination of the shoulder**

Clinical examination should not begin by palpation for local tenderness. This widespread habit is a common cause of misdiagnosis.

The basic shoulder examination consists of 12 tests. It is important always to perform every basic test and not to stop, even if the diagnosis appears clear after a limited number of tests. Stopping too soon can easily lead to an incomplete diagnosis. It is important to realize that, in mixed patterns of pain
on both passive and resisted movement(s), pain on resisted movements does not exclude a disorder in an inert structure, nor pain on passive movements a disorder in a contractile structure. These results may sometimes lead to diagnostic difficulties (see Ch. 4).

Accessory tests may be called for. They will only be performed if, after the basic functional examination, the diagnosis still remains unclear. After the basic examination is complete, at least a differential diagnosis should be in mind. To arrive at the final diagnosis, one or more accessory tests may be useful.

**Elevation of the arm**

**Active elevation**
The patient is asked to raise both arms sideways above the head, as far as possible (Fig. 12.3a). The range of movement and the influences, if any, on pain are noted.

This very unselective and broad test investigates both inert and contractile structures, not only of one single joint, but also of all five ‘joints’ of the shoulder girdle (see online chapter Clinical examination of the shoulder girdle). Therefore, the result should always be interpreted in light of the other tests. As it gives a good idea of the patient’s willingness to cooperate, it will also help in identifying a person who has no genuine lesion but is feigning illness.

**Passive elevation**
The examiner takes the patient’s arm just proximal to the elbow, brings it upwards from the side and pushes it as far as it will go towards the head. At the same time counter-pressure is applied over the contralateral shoulder, preventing the patient from side-flexing to the other side (Fig. 12.3b). Pain, range of motion and end-feel are noted. Because this movement comes to a halt when the axillary portion of the capsule is stretched, the normal end-feel is elastic.

**Painful arc**
The patient raises the arm, actively, in a frontal plane and concentrates on pain likely to occur at mid-range, being asked...
humerus and scapula takes place. If the movement is impaired, the glenohumeral or the subacromial joint is at fault.

**Passive lateral rotation**

The examiner takes the patient’s arm above the wrist, flexes the elbow to a right angle and pulls the arm with gentle pressure into full lateral rotation, meanwhile avoiding extension by holding the patient’s elbow against the side of the abdomen. The trunk is immobilized by bringing the other hand around the patient’s contralateral shoulder (Fig. 12.5b).

This movement comes to a stop by stretching the anterior portion of the capsule. Therefore the end-feel is elastic. The normal range is about 90°. Since individual differences exist, both sides should always be compared.

Besides the anterior portion of the joint capsule, other structures, such as the subcoracoid bursa, the acromioclavicular joint and the subscapularis tendon, are tested as well. Limitation of the movement is mainly found if something is wrong with the scapulohumeral joint itself; in this event, a harder end-feel is usually present. A simple tendinosis of the subscapularis does not cause limitation of the movement but may render it very painful.

**Passive medial rotation**

With one hand still just above the patient’s wrist and flexing the patient’s elbow to 90°, the arm is brought into full medial rotation, without extension. The examiner’s other hand is placed dorsally between the scapulae (Fig. 12.5c). The normal amplitude is about 90°. As before, this movement should be compared on both sides.

Occasionally a painful arc can be present on medial rotation. This has the same diagnostic value as a painful arc on elevation and bears the practical consequence that in order to test for real limitation of movement the examiner must persist to get beyond the painful arc.

**Resisted movements**

**Resisted adduction**

The patient is asked to pull the right arm towards the body as hard as possible. The examiner puts one hand around the elbow, and the other at the patient’s ipsilateral side (Fig. 12.6a).

**Resisted abduction**

The test is performed with the arm hanging down, a few degrees of abduction being permitted. The examiner asks the patient to push his or her arm to the side, meanwhile applying counterpressure at the elbow. The examiner’s other hand stabilizes the patient on the contralateral side (Fig. 12.6b).

**Resisted lateral rotation**

The patient is asked to bend the elbow to a right angle and to push the forearm away from the body. To avoid any movement of the trunk, the other hand is put on the patient’s contralateral shoulder (Fig. 12.7a). Counterpressure is applied just above the wrist and care must be taken to get two details right. First, the patient should keep the elbow against the body, so that there is no element of abduction. Second, extension of the elbow during lateral rotation is avoided. This is easily checked

---

**Three tests for the glenohumeral joint**

**Passive scapulohumeral abduction**

The lower angle of the scapula is immobilized by the thumb and index. With the other hand, the examiner takes the patient’s arm just above the elbow and lifts it up until the scapula starts to move (Fig. 12.5a). It is important for the patient not to assist this movement actively because then the scapula immediately starts to rotate, so making the movement a compound one involving several joints.

The normal range of scapulohumeral abduction is about 90°. Performed in the way described, only movement between
applied to the distal part of the forearm just above the wrist. The other hand is placed on the patient’s ipsilateral shoulder (Fig. 12.8a).

**Resisted medial rotation**
This is tested in the same position as resisted lateral rotation, but the patient’s arm is held at the inner part of the wrist and the forearm is pulled towards the body (Fig. 12.7b).

**Resisted elbow flexion**
With the elbow still bent at a right angle and the forearm supinated, the forearm is pulled up. Counterpressure is applied to the distal part of the forearm just above the wrist. The other hand rests on the patient’s ipsilateral shoulder (Fig. 12.8b).
Fig 12.6 • Resisted movements: (a) adduction; (b) abduction.

Fig 12.7 • Resisted rotation: (a) lateral; (b) medial.
Clinical examination of the shoulder

Passive horizontal adduction
The patient’s arm is brought horizontally in front of the body. At the end of the movement the elbow is pressed gently further towards the contralateral shoulder (Fig. 12.9). Twisting of the patient’s trunk is prevented by the examiner bringing the other hand behind this shoulder.

Palpation
General palpation for heat and swelling is done after the functional examination. These may be present in bacterial arthritis and in primary and secondary tumours of the humeral head, glenoid and acromion, and in acute and chronic subdeltoid bursitis.

Palpation for pain is only performed when the basic examination proves that the lesion lies within the reach of a finger. As already indicated, it always follows the clinical examination and never precedes it. Comparison between the two sides is essential. Palpation for tenderness is mainly done in acute and chronic subdeltoid bursitis and in a sprained superior ligament of the acromioclavicular joint.

Accessory tests
Sometimes the diagnosis is still not clear after the basic examination and a differential diagnosis has to be undertaken. At other times, the exact structure at fault has been identified by this stage of the examination but the precise localization of the lesion within that particular structure remains uncertain. In both cases, one or more accessory tests may be required (Box 12.4). Passive horizontal adduction is the only one which is explained here. The other tests are discussed, together with the corresponding disorders, in the following chapters.

Box 12.4
Summary of accessory tests of the shoulder
- Passive horizontal adduction
- Passive horizontal lateral rotation
- Apprehension test for anterior instability
- Apprehension test for posterior instability
- Load and shift manoeuvre
- Sulcus sign
- Yergason’s test
- Resisted horizontal adduction
- Resisted horizontal extension
- Resisted horizontal adduction with the arm forwards
- Resisted flexion
- Resisted extension
- Pressure against a wall
- Scapular adduction against resistance

Passive horizontal adduction
The patient’s arm is brought horizontally in front of the body. At the end of the movement the elbow is pressed gently further towards the contralateral shoulder (Fig. 12.9). Twisting of the patient’s trunk is prevented by the examiner bringing the other hand behind this shoulder.
such as tumours and metastases, and identification of calcifications in or around tendons. Plain radiographs may also be helpful in the evaluation of anterior and posterior instability. Although ultrasonography is nowadays the most frequently used method to evaluate rotator cuff lesions, plain X-ray examination can be of use in the detection of accompanying appearances, such as changes in the coracocromial arch, an unusual form or a spur off the acromion. Radiography is also still advocated in long-standing massive cuff tears.

Ultrasound scanning

Ultrasound scanning is mainly advocated for the detection of full or partial rotator cuff lesions. In experienced hands it can reveal not only the integrity of the rotator cuff but also the thickness of its various component tendons. Through careful positioning and through knowledge of the dynamic anatomy of the cuff, the experienced ultrasonographer can image selectively the upper and lower subscapularis, the biceps tendon, the anterior and the posterior supraspinatus, the infraspinatus and the teres minor. Ultrasonography has further advantages: it is non-invasive and safe, bilateral examinations are quickly performed, the shoulder can be examined dynamically and, above all, the procedure is inexpensive.

One important disadvantage, however, is that the method has a long learning curve. The results are examiner-dependent and a good outcome can only be expected in experienced hands. Specificity and sensitivity of as high as 98% and 91% respectively in comparison with surgical findings were claimed by Mack et al. Others have found an overall sensitivity of 97% in diagnosing full cuff tears and of 91% in partial thickness tears.

Arthrography

Single-contrast arthrography can be helpful in diagnosing complete tears of the rotator cuff, incomplete deep surface tears and instability problems. It will show loss of axillary-fold space and diminished joint capacity in adhesive capsulitis, but because this disorder is so easy to detect clinically, arthrography should never be required. It is of no assistance in clarifying the differential diagnosis in cases of impingement, in the absence of a rotator cuff tear.

Arthroscopy

Arthroscopy is useful for both diagnosis and treatment. It should be regarded as an adjuvant in those cases where the normal diagnostic aids are insufficient. As it offers an excellent view of the glenoid, labrum and capsule, it is an excellent technique in repair of shoulder instability.

However, confronted with the almost perfect results obtained through examination technique, the physician should never forget that full and partial tears of the rotator cuff exist in a substantial part of a normal asymptomatic population. Both cadaveric studies and imaging studies on asymptomatic individuals have demonstrated that cuff defects become increasingly common after the age of 40 and that most occur without substantial clinical manifestations.
Magnetic resonance imaging

Magnetic resonance imaging (MRI) has rapidly become a commonly used technique for shoulder evaluation, proving its utility in the evaluation of muscle, tendons, hyaline and fibrous cartilage, joint capsule, fat, bursae and bone marrow. Today it is the most accurate non-invasive method available for imaging the rotator cuff. The major advantages of this modality include its non-invasive nature, lack of ionizing radiation, excellent contrast and anatomic resolution, multiplanar imaging capability, and ability as a single imaging modality to evaluate simultaneously for a wide variety of pathologic processes. One disadvantage is that small foci of soft tissue calcification may be missed on MRI. As with all techniques that provide optimal visualization, one should always take into account the high rate of asymptomatic lesions and never rely simply on the outcome of the technique to make a diagnosis and start a treatment.

Computed tomography

Computed tomography (CT) is equally as accurate as MRI for evaluation of the glenoid rim and labrum, the humeral head and the glenohumeral capsule. Nevertheless, MRI is to be preferred because it is more accurate in tendinopathies and no X-ray exposure occurs. In shoulder instability, CT-arthrography seems to be the best diagnostic method.

Bursoscopy

Bursoscopy can be performed under general or local anaesthesia. Although there are almost no indications for bursoscopy, it may be of help in diagnosing lesions of the bursal part of the rotator cuff. At the same time, it offers visualization of the acromial roof.

Access the complete reference list online at www.orthopaedicmedicineonline.com
Clinical examination of the shoulder

References

27. Hirano Y, Sashi R, Izumi J, et al. Comparison of the MR findings on indirect MR arthography in patients with rotator cuff tears with and without...

