Clinical examination of the cervical spine

6

CHAPTER CONTENTS

History

History taking in patients with problems in the neck, trapezius or shoulder region should be as detailed as possible and great care should be taken to define every symptom precisely. Especially when a controversial treatment, such as manipulation, is to be considered, it is vital that nothing has been forgotten that could constitute a contraindication.

Age may be important, because some disorders do not occur before or do typically occur at a certain period of life. For instance, torticollis in a baby is probably congenital. The same clinical picture in a 5-year-old child is more likely to be caused by contracture of the sternocleidomastoid muscle after, for example, glandular swelling or abscess formation. During and after adolescence it is more probably the result of a disc protrusion.

The same argument applies to root pain. Under the age of 35 it is scarcely ever caused by a disc except after trauma, in which it may occur from 30 years upward. Radicular pain in a young person is usually the result of a neurofibroma, while in the elderly it is commonly the result of compression by an osteophyte or invasion from secondary deposits in the spine, rather than a disc protrusion.

Early morning headache is typical in the elderly and is often the result of contracture in upper cervical ligaments. Headache from temporal arteritis also occurs late in life.

Whenever symptoms appear in a patient of the 'wrong' age group, further investigation should be requested in order to exclude more serious disorders.

The patient's *work*, *hobbies* or preferred *sport* may give an idea of postures, movements or strains that may be causative or provocative.

Cervical spine lesions may lead to the following symptoms: pain, paraesthesia, vertigo or symptoms related to the vertebral artery, and incoordination and spasticity.

Pain

Pain is the most common symptom. Its localization may give an idea of the position of the lesion. Details about its evolution and behaviour help to determine the nature of the disorder.

If this is the patient's first presentation with a problem in the cervical spine, questions are asked about the current complaints (see below). In a recurrence, a detailed and chronological reconstruction of the past history should be made.

The patient may present with acute, subacute, chronic or recurrent pain. Acute and subacute episodes are characterized by difficulty in moving the head without exacerbation of the pain. Except in young people with torticollis or after injury, acute lesions are not as common as more chronic complaints. Chronic lesions come and go for months or years without any tendency towards spontaneous recovery. Most problems in the cervical spine, however, are recurrent, which implies that the course is characterized by definite attacks of short duration. The examiner should then find out whether the patient

is totally free from pain in between the attacks, for how long the symptoms last and whether the pain is always felt on the same side.

Onset

Next, the following questions are asked about the onset of the pain.

- Where did it start?
  - Pain of cervical origin very often starts at the cervical spine but frequently spreads or shifts to another region quite quickly, so that the cervical source may pass unnoticed.
  - Interscapular onset of pain is typical of a lower cervical disc lesion that compresses the dura. In contrast, it is very unusual for pain to begin in the arm. Should this occur, the possibility of a neurofibroma, compressing a nerve root, has to be considered in young people. In the elderly, an osteophyte or even a malignant process is more probable.
- When did it start?
  - Pain of cervical origin may occur in discrete attacks, especially when a disc lesion is responsible. It is important to encourage the patient to recall the first episode and to ask for a chronological account. In discal root pain, a normal period of spontaneous relief should be recognizable.
- How did it start?
  - The origin may be spontaneous, either acute or chronic, but may also be the consequence of injury. In the latter case, more details should be sought about the type of injury (e.g. a fall or whiplash). It is then necessary to seek further investigations to exclude fractures or luxations.

Evolution

More detailed information is then obtained about the development of the complaints in relation to localization, duration and intensity.

The *localization* may change, either because the pain shifts to another place or because it spreads. Pain that spreads and gradually expands over a larger area is typical of an expanding lesion and should always arouse suspicion. On the other hand, pain that shifts from the scapular area to the upper limb is highly indicative of a shifting lesion (or disc lesion). The fragment of disc substance first displaces posterocentrally and compresses the dura mater, which results in central, bilateral or unilateral scapular pain; it then moves laterally and impinges on the dural investment of a nerve root. The scapular pain disappears and is replaced by a radicular pain down the upper limb. In order to interpret the distribution and evolution of the pain correctly, the mechanism of dural pain should be understood. Because the anterior aspect of the dura mater is innervated by a dense network of branches of sinuvertebral nerves originating at several levels, extrinsic compression and subsequent irritation of the dura may give rise to pain felt in several dermatomes. This phenomenon is called 'multisegmental pain' and is described in Chapter 1. Because the dural investment of the nerve root is only innervated from its own recurrent nerve, irritation here results in pain strictly felt in the corresponding dermatome, thus strict segmental pain.

Also *the duration of the pain* is informative. Most benign cervical disorders are intermittent. If pain progressively worsens, then the presence of an irreversible lesion such as metastases must be borne in mind, particularly in the elderly. Root pain as the result of a disc protrusion lasts for a variable but limited period and then ceases as spontaneous remission takes place (see Ch. 8). Hence, root pain that lasts longer than 6 months should arouse suspicion of another, possibly progressive cause.

As cervical disorders are frequently episodic, the patient should be asked to describe *previous episodes* in as detailed a way as possible. Often a recurrence can be ascribed to instability of the affected structure. Once an intervertebral disc fragment has displaced, it may do so again, because the cartilage remains unhealed. Further displacement may be in a different direction and it is thus possible for the pain to be variable and not on the same side. Therefore, pain that changes sides from one attack to another very strongly suggests the presence of a disc lesion. Also the duration of the previous bouts may have some prognostic value, as it can give an idea of how long the current symptoms may be expected to last. The patient should be questioned about previous successful treatment because, if the present episode is a recurrence, it is very likely that it will respond to the same treatment. Has the patient been totally free of pain between attacks? Freedom from symptoms indicates that the patient went into complete remission and this result could be obtained again. Failure of complete remission requires a search for the reason: possibly previous treatments have not been completed. Alternatively, age may be a factor in that some conditions have a tendency to become more persistent with advancing years.

Current pain

After the patient has given a thorough description of the onset and evolution, the moment has come to ask for details about the pain experienced at present: its localization, the influence of posture and movements, and how it is affected by cough.

Localization

The localization may vary: headache, pain in the face, neck, scapular area, pectoral area or down the upper limb are all possible.

Headache

If headache is referred from the cervical spine, the patient will usually mention an association between the symptoms and certain postures and/or movements. The pain may be bilateral or unilateral, and can be either segmental or multisegmental. Segmental pain originates from the upper cervical segments (C1 and C2). Disorders at the joints between occiput and atlas, or between atlas and axis, may give rise to pain felt at the centre of the upper neck and spreading to the occiput, the vertex (C1) and/or the temples and forehead. As the pain is

not always felt in the neck, localization to the head only can divert attention from the cervical spine. Multisegmental headache results from irritation of the dura at any cervical level. The pain often radiates from the mid-neck up to the temple, the forehead and behind one or both eyes, but rarely to the bridge of the nose. If, apart from this distribution, there is also downward reference of pain to the scapular area, the dural origin is clear.

Some types of headache can be recognized by paying attention to the history.

Early morning headache in elderly patients is a typical example. The patient wakes every morning with headache and/or occipital pain. After some hours the symptoms ease and have completely disappeared by midday. Symptoms do not recur until the next morning. The sequence is repeated daily without fail and, as the years go by, pain tends to last longer into the day. This type of headache responds spectacularly to manipulative treatment (see p. 201).

Migraine is another typical history. Symptoms usually start during adolescence and may persist for many years. The vascular origin of this disorder has been widely accepted and the following features are well known: an 'aura' which frequently includes visual hallucinations, photophobia, nausea, vomiting and other bizarre experiences, often precedes an attack; pain is severe, unilateral and well localized, though may change sides for each attack and is usually described as throbbing or bursting.

C*luster headache* is very severe, is more common in men, and occurs on a regular basis. The pain is always felt on the same side, mainly above the eye, and may be accompanied by a partial Horner's syndrome.

Pain in the face

This may either have a local origin or be referred. Local causes include sinusitis, dental problems, temporomandibular lesions, lesions of the facial bones, neuralgia and arteritis. Referred pain may be a segmental C2 pain or a multisegmental dural pain. The latter should always be borne in mind because, if a local cause is not found, treatment to the cervical spine may be curative.

Pain in the neck

Local pain in the upper neck is usually the outcome of a local lesion: one of the ligaments of the upper cervical segments or one of the upper facet joints. Rarely, the muscular insertions on the occiput are responsible. However, upper cervical pain may also have a multisegmental dural origin. Mid- or lower cervical pain is most often caused by a mid- or lower cervical discodural conflict, especially if the pain is felt centrally or bilaterally. Unilateral and lower cervical pain that is well localized often originates from a facet joint.

Pain in the trapezioscapular area

This is the most common pain reference for cervical lesions. The majority of pain in the trapezius or scapular area has a cervical origin, and must usually be considered as the multisegmental reference of a discodural conflict (Fig. 6.1). The pain may be unilateral, bilateral or interscapular. Depending on the patient's age, it may be intermittent or constant; the older the patient, the more likely the pain will last over longer periods. Upper scapular pain or pain in the trapezius area may also have a C4 segmental origin. Other sources of trapezioscapular pain are a thoracic lesion, a local scapular lesion or a shoulder girdle problem.

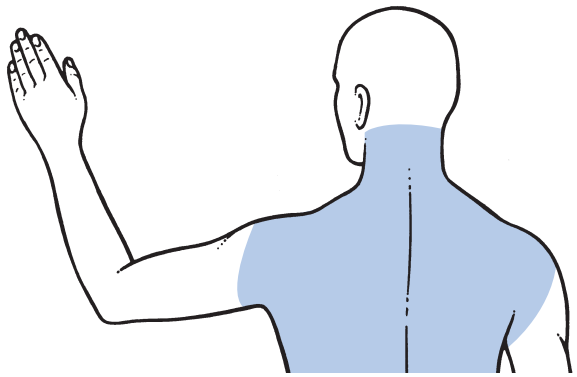


Fig 6.1 • Multisegmental scapular pain.

Pain in the pectoral area

Another rare manifestation of multisegmental dural reference is pain in the pectoral area. Because the pain is usually felt deeply and there is a strong popular association between pectoral (retrosternal) pain and cardiac disease, the pectoral discomfort can be initially misjudged as angina.

Pain down the upper limb

Dural pain never presents down the arms. Therefore, upper limb pain is always segmental in origin and is referred within its dermatomal borders. If the lesion is discoradicular, the normal time sequence of the symptoms must be appreciated: neck pain first, followed by unilateral scapular pain and then finally segmental pain. It is therefore important to ask whether or not the arm pain has been preceded by neck and/or scapular pain. If not, a non-discogenic origin of the pain is to be considered.

Exacerbation of pain by cough

This is uncommon in cervical lesions but may occur in a disc prolapse, when the pain is usually felt in the scapular region. Pain in the arm on coughing is one of the symptoms that draws attention to a neuroma (see Ch. 9).

Paraesthesia

Paraesthesia is a very common symptom which may originate from any nerve fibre in the cervicoscapular area or in the arm (Table 6.1). Paraesthesia is often experienced as a 'pins and needles' sensation. In other instances, the patient may describe the feeling as 'numbness'. The moment the patient mentions the presence of such symptoms, the examiner should carefully determine how proximal they are because, as has been explained in Chapter 2, the point of compression always lies proximal to that of the paraesthesia. The lesion may lie at any one of a number of different levels but the vaguer the distribution of the pins and needles, the more proximally the lesion needs to be sought.

Table 6.1 Paraesthesia

Level	Cause/site of cause	Symptoms
Cervical	Myelopathy:	No pain
	Intrinsic	Multisegmental paraesthesia on neck flexion
	Extrinsic	Lhermitte's sign
	Nerve root	Pain Segmental paraesthesia Compression phenomenon
Shoulder girdle	Brachial plexus	Vague paraesthesia Release phenomenon
Arm	Nerve trunk	Defined area of paraesthesia Specific tests
	Nerve ending	Cutaneous analgesia (Paraesthesia)

At the cervical spine

Spinal cord

External pressure on the spinal cord is characterized by painless paraesthesia in the upper and/or lower limbs felt distally and in a multisegmental distribution. The paraesthesia comes and goes in a wholly irregular way, most marked by day. Neck flexion usually increases the symptoms, or Lhermitte's sign may be present: an electric shock sensation in the trunk and/or upper limbs following forceful passive flexion of the cervical spine. Differential diagnosis has to be made from pernicious anaemia, diabetes and peripheral neuritis.

Nerve root

When a nerve root is affected, paraesthesia appears distally in the corresponding dermatome. The pins and needles come and go in an erratic fashion and do not last for more than an hour at a time. Pain resulting from external pressure on the dural sleeve may precede or accompany the paraesthesia.

At the shoulder girdle

Lesions of the brachial plexus at the thoracic outlet give rise to paraesthesia in one or both hands and affect all digits. When there is external pressure and because of the release phenomenon, pins and needles are only felt after the compression has ceased (see Ch. 2). They are often nocturnal, waking the patient after some hours' sleep.

In the arm

When one of the peripheral nerves in the upper limb is involved, paraesthesia (and sometimes pain) is felt in the territory of that nerve (radial, median or ulnar). The well-known distribution of paraesthesia (three and a half radial, or one and a half ulnar fingers) often gives a clue. Differentiation from radicular paraesthesia is generally not difficult. In case of doubt, specific tests to elicit the pins and needles can be performed (e.g. Tinel's test). The pins and needles are often accompanied by cutaneous analgesia, which may be marked, especially in distal lesions.

Vertigo or symptoms related to the vertebral artery

It is well known that vertigo may be the consequence of vertebrobasilar vascular insufficiency. However, cervical disorders without any impairment of the vertebral artery can also give rise to vertigo. The explanation is that the cervical spine, together with the eyes and the labyrinths of the ear, is an important source of proprioceptive information that influences the sense of balance. When vertigo is a dominant symptom, the examiner must carefully look for its origin, especially if a manipulative treatment is considered (see Ch. 11).

Incoordination and spasticity

These complaints are indications that something is amiss with either deep (proprioceptive) sensibility, or the vestibular system or the cerebellum.

Medication

Current medication may have a bearing on both diagnosis and management, and should be carefully ascertained, especially because anticoagulants are contraindications to manipulative therapy (see Ch. 5).

A summary of history taking is given in Box 6.1.

Inspection

Inspection and examination are performed on the standing patient. The examiner stands behind the patient and looks at the neck and scapular region. First the posture of neck and head is observed. The head should be in the midline, with the chin above the manubrium. A normal neck shows a slight lordotic curve. Loss of the lordotic curve, with the head fixed in flexion, suggests a block at the back of an intervertebral joint and is most common after whiplash injuries. Next, neck length is ascertained. A short neck is present in Klippel–Feil syndrome (due to fusion of several vertebrae)[1] and a webbed neck in a girl is typical of Turner's syndrome.[2] Then the examiner notices if the head is tilted or rotated in one direction, which indicates torticollis. A careful analysis of the torticollis is then made. The neck may be held in lateral deviation or in a combined position of lateral deviation and rotation. The lateral tilt as well as the rotation can be towards or away from the painful side. In acute discodural torticollis, the head is usually deviated in lateral flexion away from the painful side. There is usually no fixation in rotation. Shortening of the sternocleidomastoid muscle (congenital or acquired) leads to a deviation of the head in lateral flexion towards the pain combined with rotation to the other side (see Ch. 8).

Box 6.1

Summary of history

Age

Work, hobbies, sport

Pain

Onset

1 Where?
2 When?
3 How?

Evolution

1 Localization
2 Duration

Current pain

1 Localization
   a Headache
      i Segmental/multisegmental
      ii Typical histories
         ◦ early morning headache
         ◦ migraine
         ◦ cluster headache
   b Pain in the face
      i Local lesions
      ii Referred pain
         ◦ segmental
         ◦ multisegmental
   c Pain in the neck
      i Upper neck
         ◦ local lesion
         ◦ multisegmental
      ii Mid- or lower neck
   d Scapular pain
      i Segmental
      ii Multisegmental
      iii Thoracic lesion
      iv Scapular lesion
   e Pectoral pain: multisegmental
   f Arm pain: segmental
      i Spinal origin
      ii Non-spinal origin
2 Influence of coughing

Paraesthesia

Lesion at the cervical spine

1 Spinal cord
2 Nerve root

Lesion at the shoulder girdle (brachial plexus)

Lesion in the arm (peripheral nerve)

Vertigo or symptoms related to vertebral artery

Incoordination and spasticity

Medication

The scapular and deltoid areas are surveyed. Deviations are noted in the position of the scapulae and in the muscular contours of neck, trapezius and shoulder muscles.

Functional examination

A complete examination of the cervical spine is comprised not only of neck movements but also of shoulder and upper limb tests. Many of the symptoms that occur in the upper limb originate from the neck. Hence an upper limb scanning examination must always be performed to distinguish them from local lesions. The examination includes articular tests, root tests, cord tests and tests for the peripheral joints. Before the examination starts, the examiner asks the patient if anything can be felt at that moment. If the answer is affirmative, the next questions will be: what is felt, and where? During the subsequent test session the examiner will find out if the movements have any influence on these symptoms or evoke other symptoms.

Neck movements

The movements are first performed actively and then repeated passively; after this, resisted movements are tested.

Active movements

The patient is asked to flex and extend the head and to rotate and tilt it in both directions (Fig. 6.2). The amplitude of each movement is noted and the patient indicates whether it is painful and, if so, where. Neck flexion must be considered not only as an articular test for the cervical spine but also as a dural test for the thoracic spine in that it stretches both the cervical and the thoracic dura. Hence, if pain is elicited in the upper thoracic region, it may be the consequence of a dural impingement at either a cervical or a thoracic level. The relation of the movements shows either a symmetrical (full articular) pattern (Fig. 6.3) or an asymmetrical (partial articular) pattern (Fig. 6.4). The full articular pattern of the cervical spine is: some or great limitation of extension, equal degree of limitation of both rotations and both lateral flexions and no limitation of flexion. All other combinations of pain (and limitation) are classified as partial articular patterns.

Passive movements

Next, the same movements are performed passively. However, it is not always necessary to carry these out. Flexion and both lateral flexions are done in doubtful cases only, but passive extension and both passive rotations are always executed with great care. Pain, limitation and the end-feel are assessed. The normal end-feel is capsular. Abnormal end-feels are muscle spasm, bone-to-bone, crisp, empty, soggy and elastic rebound. They point towards particular pathological entities (see Ch. 4).

Passive extension

The examiner asks the patient to extend the neck. Both forearms are then placed against the patient's scapulae with the fingers on the patient's forehead. Simultaneous radial deviation of both hands tests the end-feel in extension. By executing the test very gently, hard axial pressure is avoided.

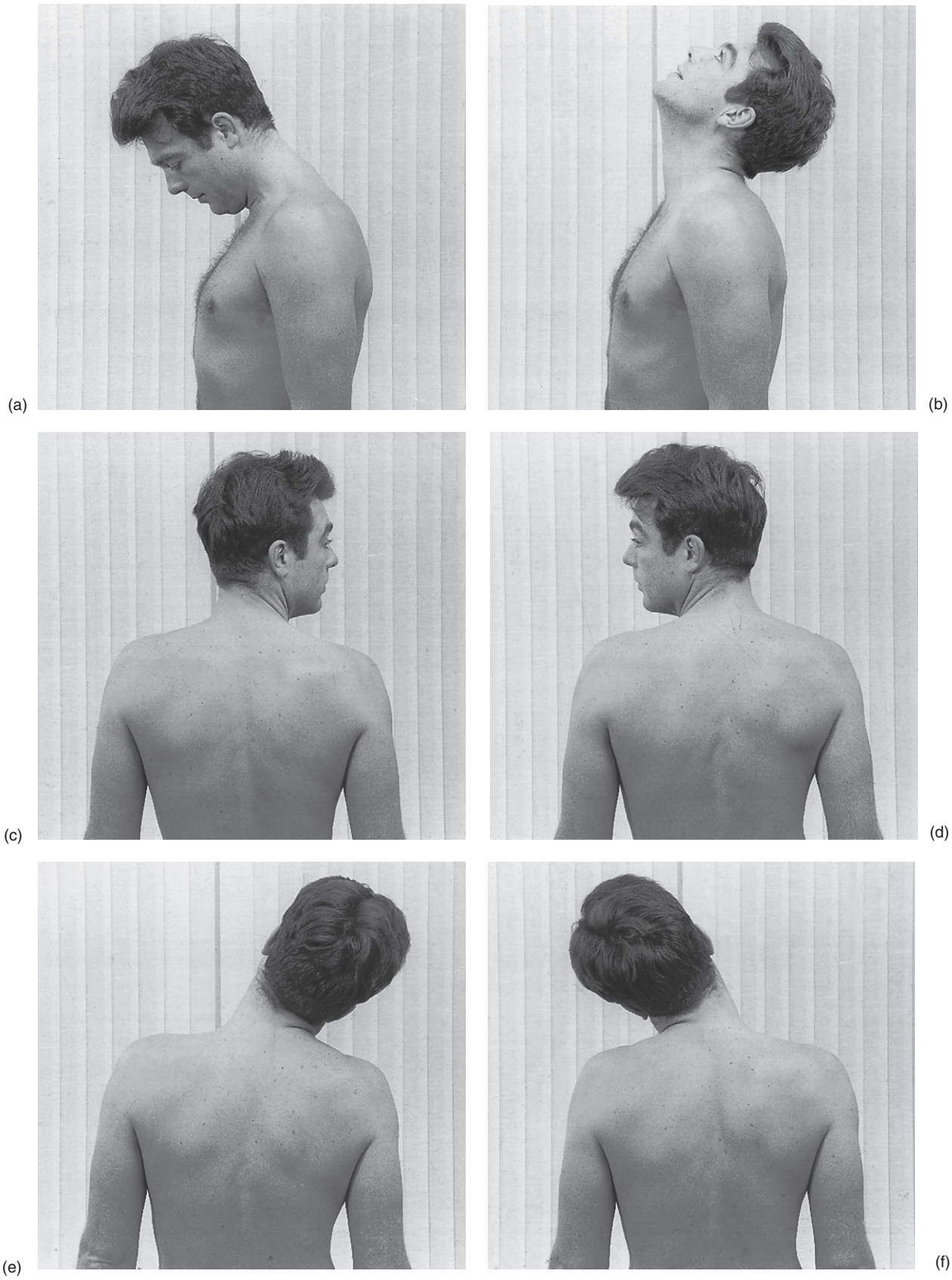


Fig 6.2 • Active movements: flexion (a), extension (b), rotation (c, d) and lateral flexion (e, f) of the head.

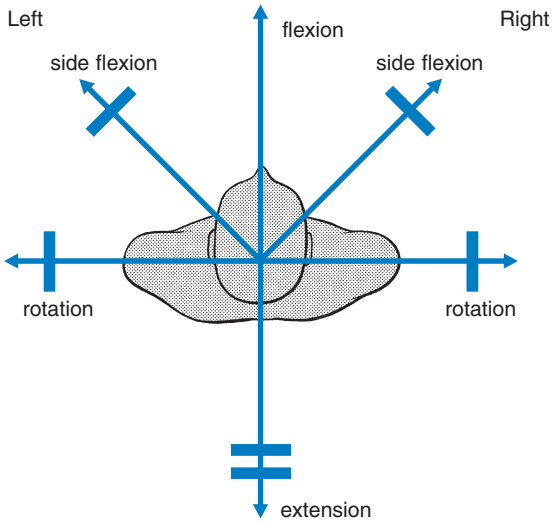


Fig 6.3 • The full articular pattern.

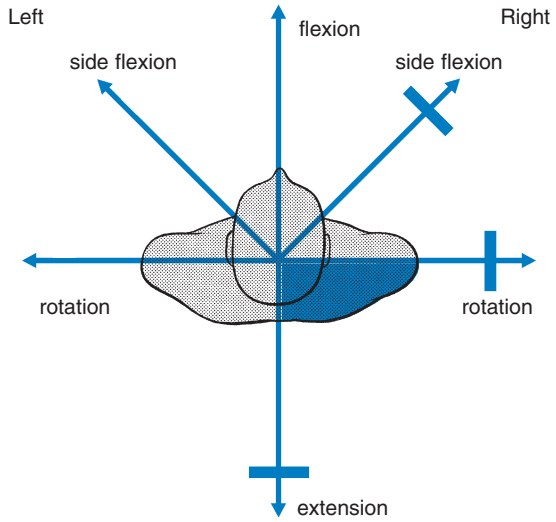


Fig 6.4 • Example of a partial articular pattern (colour indicates pain).

Rotation

The patient turns the head in rotation, first to one side, then the other. To avoid trunk movements, the examiner stabilizes the patient's body using the forearms. One is placed against the patient's scapula at the side towards which the patient turns the head and the other at the anterior aspect of the other shoulder. The hand of the arm that overlies the scapula moves into ulnar deviation and grasps the patient's forehead on the contralateral side. The other hand moves into radial deviation and grasps the patient's occiput on the side facing the examiner. Movement is performed by a simultaneous action of both hands. As the head turns, end-feel is again noted.

Lateral flexion

The examiner places the ipsilateral hand laterally against the patient's shoulder. With the other hand placed above the ear at the opposite side, gentle side flexion is undertaken.

Flexion

The patient bends the head and the examiner gently assists it into greater flexion. Excessive pressure should be avoided.

Resisted movements

After active and passive tests, resisted movements are performed. Conduction of both rotations suffices. The other movements are only carried out in case of doubt and for the purpose of differential diagnosis. Pain and/or weakness are ascertained. Interpretation of positive resisted movements must be done in the light of the overall clinical picture. The response can be obscured in acute lesions, where the slightest effort augments the pain as the result of transmitted stress. Muscular and tendinous lesions are extremely uncommon at the cervical spine. The movement also gives information on motor conduction of the first cervical nerve root.

Primary test: rotation

The patient holds the head in the neutral position. The examiner places the forearms against both scapulae with the fingers just above the patient's ears and the fingertips pointing forwards so that they lie on the temples (Fig. 6.5). The patient is asked to rotate the head and the movement is resisted with the fingertips.

Secondary tests: extension, flexion and lateral flexion

These are illustrated in Figure 6.6.

Flexion

The examiner stands beside the patient and places one hand on the upper interscapular area and the other hand on the forehead. The patient is asked to push the head forwards and resistance is provided.

Extension

The examiner stands beside the patient. One hand is placed laterally on the sternum and the other on the occiput. The patient is asked to pull the head backwards and resistance is provided.

Lateral flexion

The examiner stands behind the patient. One hand is placed laterally on the opposite shoulder and the other above the ear. The patient is asked to push the head against the hand. Resistance is exerted.

Scapular movements

Scapular movements are performed to establish the mobility of the scapula in relation to the thorax. They also test the shoulder girdle and the thoracic part of the dura mater.

Active movement

The patient is asked to elevate the shoulders (Fig. 6.7). Pain and/or limitation are checked.

The mobility of the scapula on the thoracic cage, together with the integrity of the acromioclavicular joints, the sternoclavicular joints and the joints between the first ribs and the vertebral column, is assessed. Any pain and/or limitation

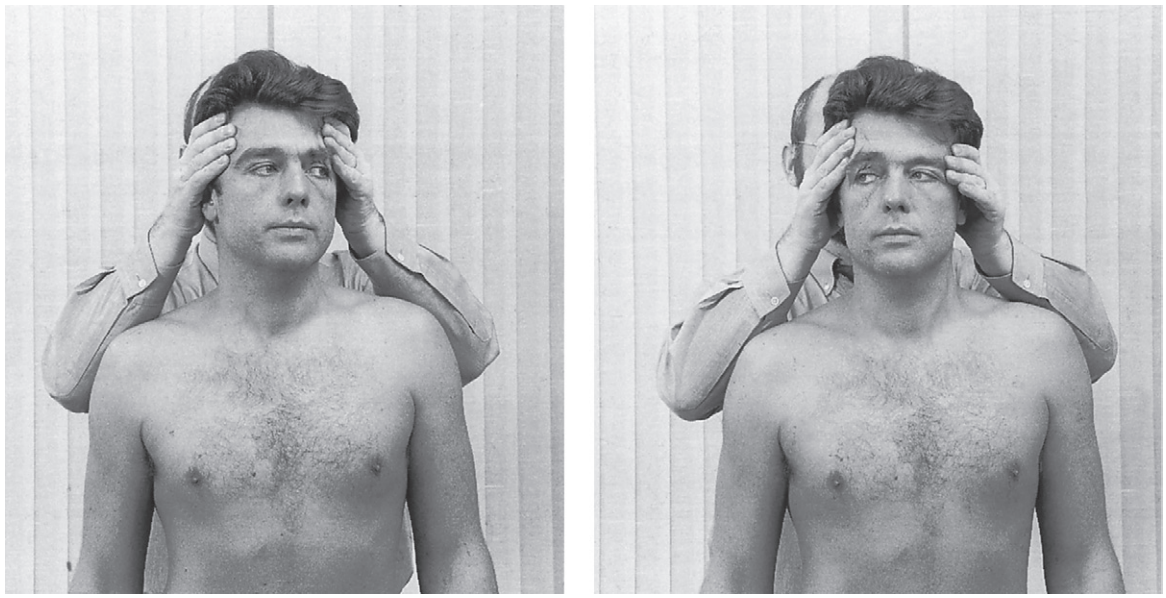


Fig 6.5 • Primary resisted movement: rotation.

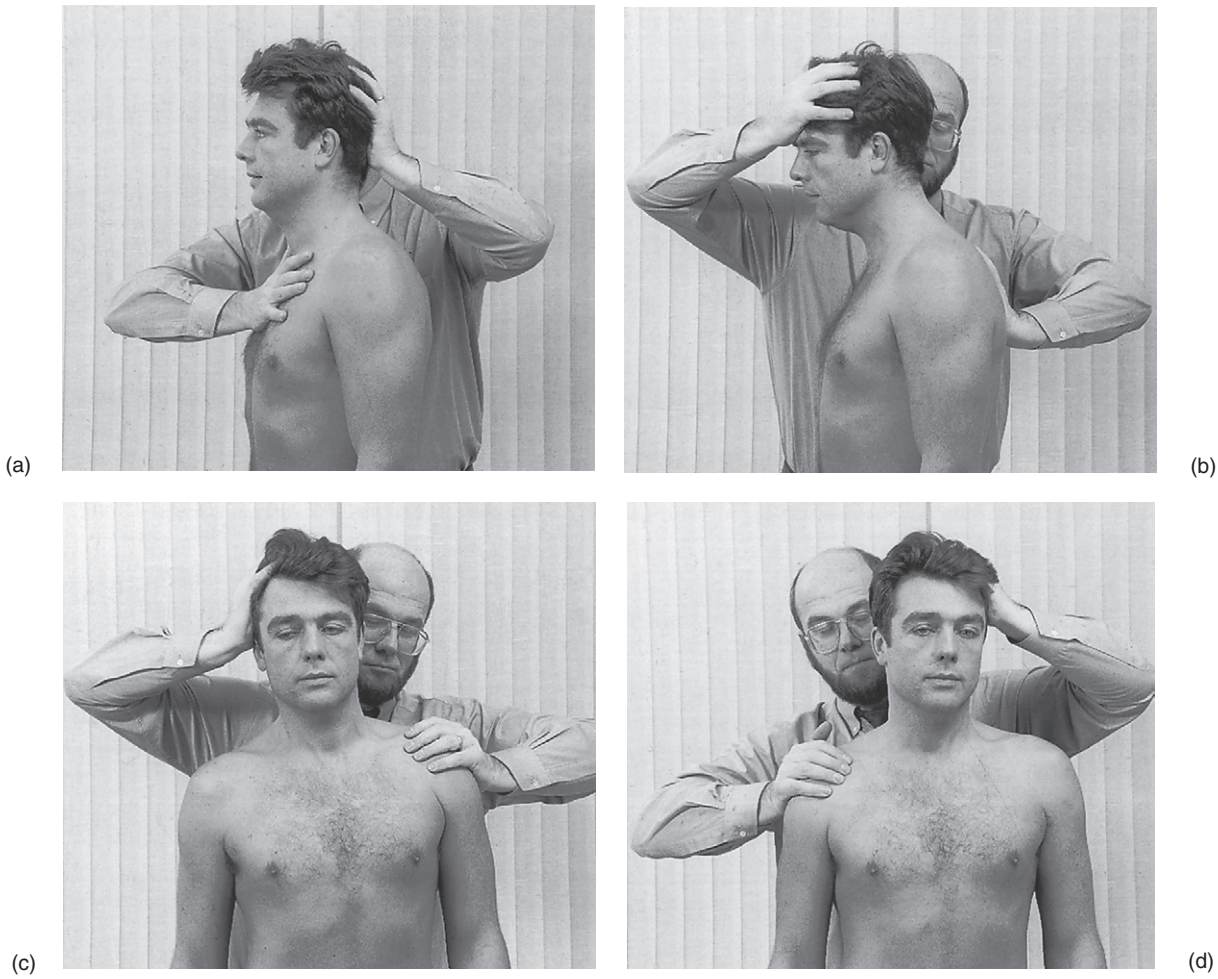


Fig 6.6 • Secondary resisted movements: extension (a), flexion (b) and lateral flexion (c, d).

Fig 6.7 • Active elevation of the shoulders.

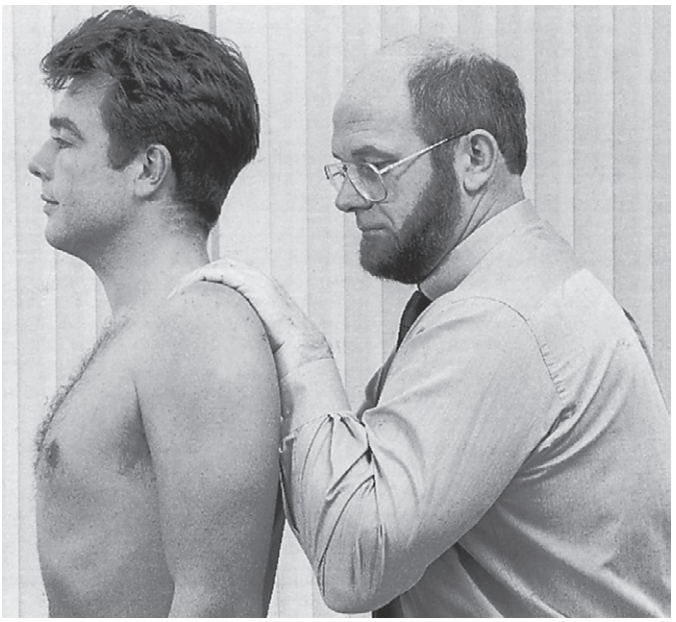


Fig 6.8 • Resisted elevation of the shoulders.

suggest the need for a full shoulder girdle examination (see p. 210).

Resisted movement

The patient is asked to keep the shoulders elevated while the examiner applies a downward force on them (Fig. 6.8). This tests the trapezii muscles and the motor conduction in C2–C4. Normally the trapezii are stronger than the downward pressure.

Arm tests

Arm movements test the integrity of the muscular system.

If pain is elicited, alternative causes of pain down the upper limb should be sought. When one or more movements are weak a neurological problem is responsible. The pattern presented will indicate the possible level.

Active elevation

The patient is asked to elevate both arms sideways, as high as possible (Fig. 6.9). This is a swift scan for shoulder and shoulder girdle problems. If there is pain and/or limitation, a complete shoulder examination should follow (see Ch. 12).

Resisted movements

Isometric resisted tests are done bilaterally, so that strength may be compared. These are mainly tests for motor conduction and so strength is noted, but, if the test elicits pain, the possibility of a local lesion should be considered.

The tests are illustrated in Figures 6.10–6.13. Detailed execution of the different tests is discussed in the relevant chapters on the shoulders, elbow and wrist.

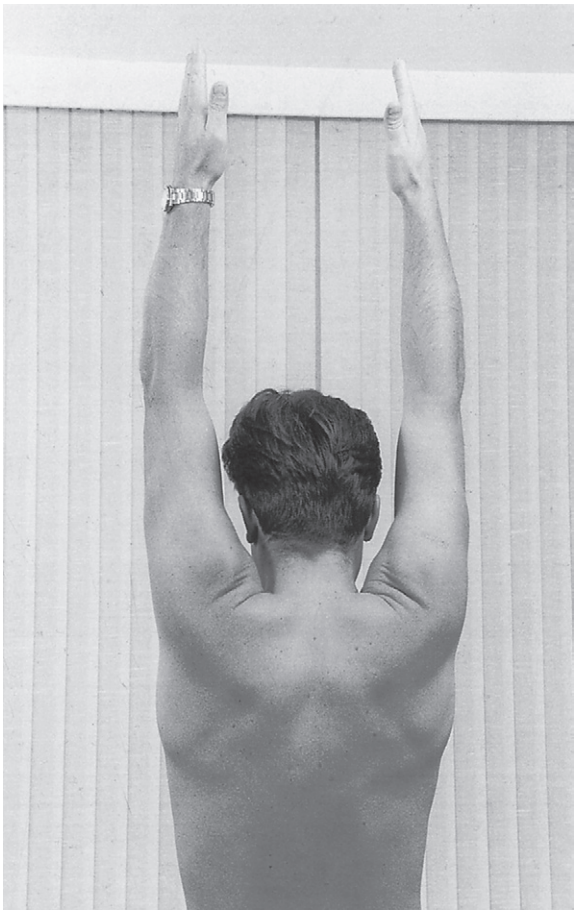
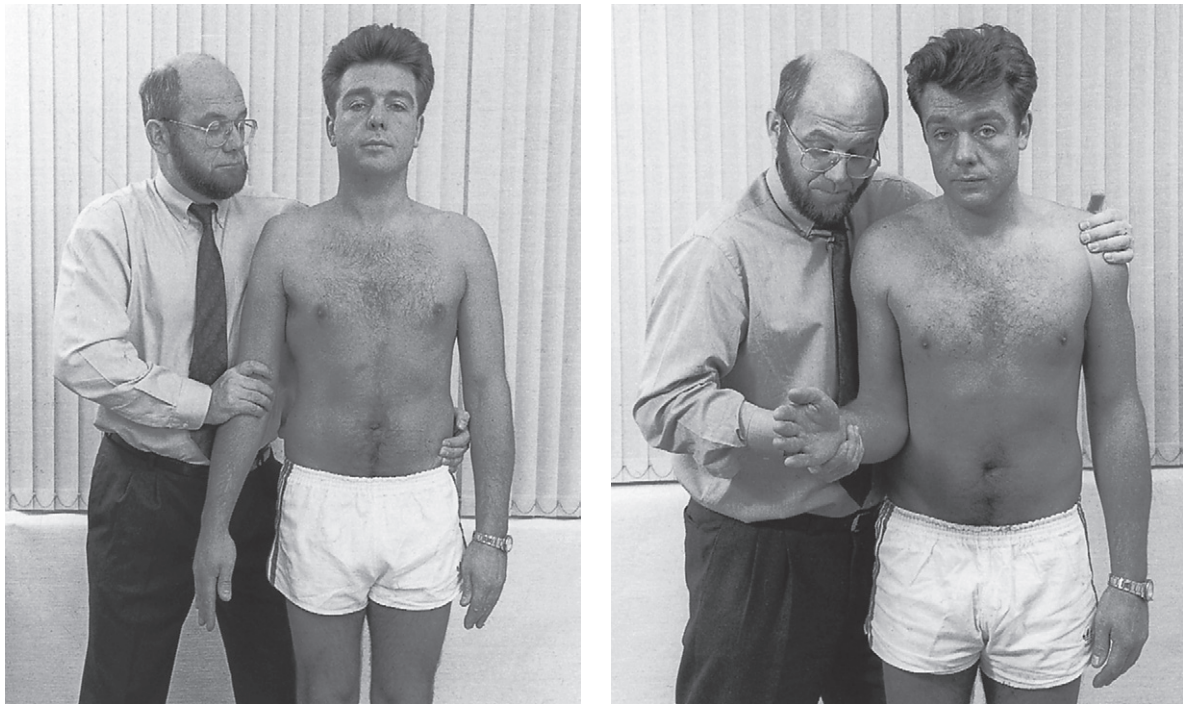
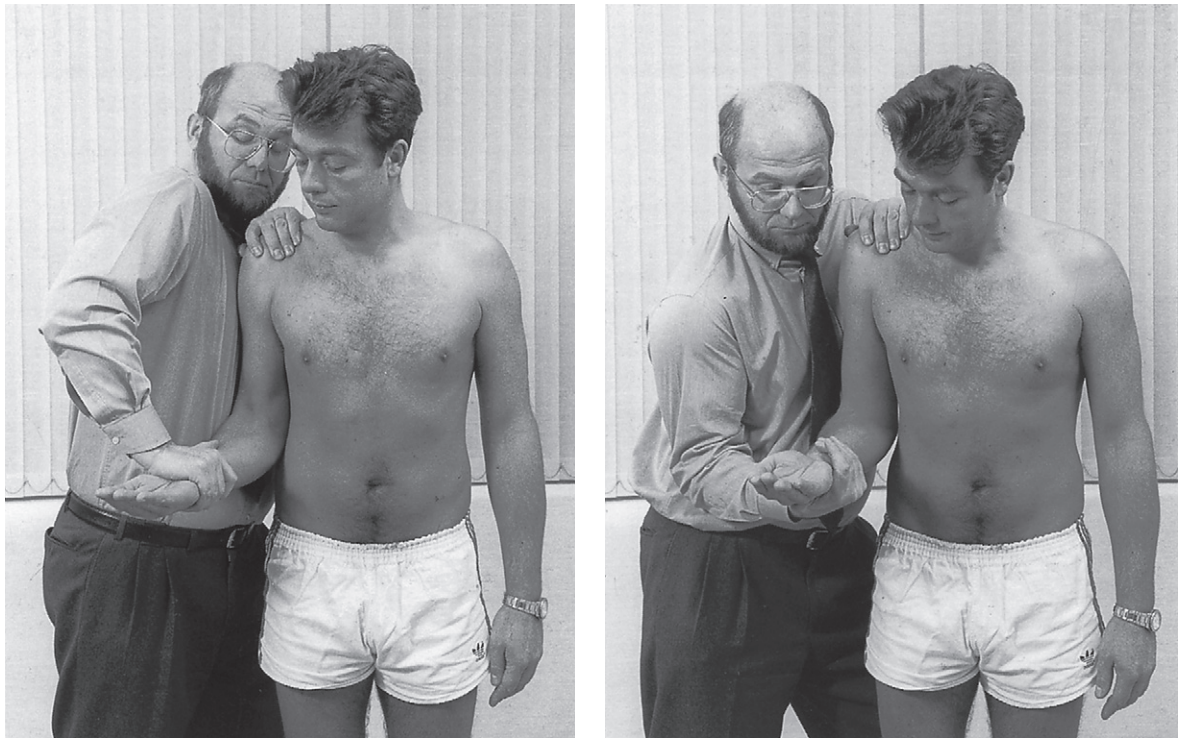


Fig 6.9 • Active elevation of the arms.



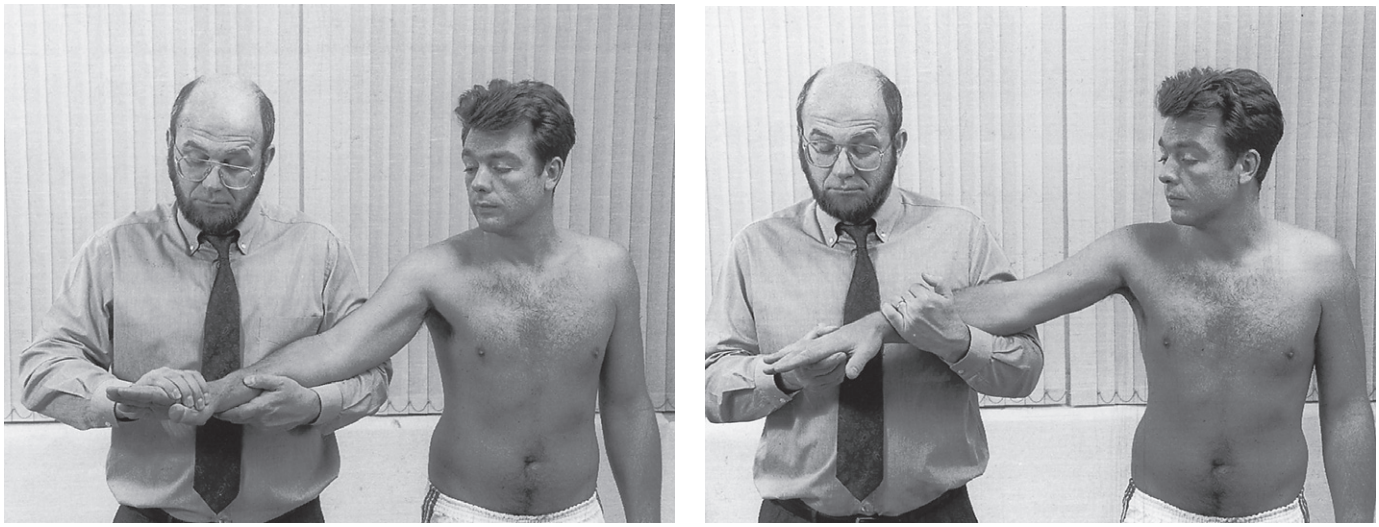
(a) (b)

Fig 6.10 • (a) Resisted abduction of the shoulder tests the C5 nerve root and the abductor muscles. (b) Resisted external (or lateral) rotation of the shoulder tests the C5 nerve root and the external (or lateral) rotators.



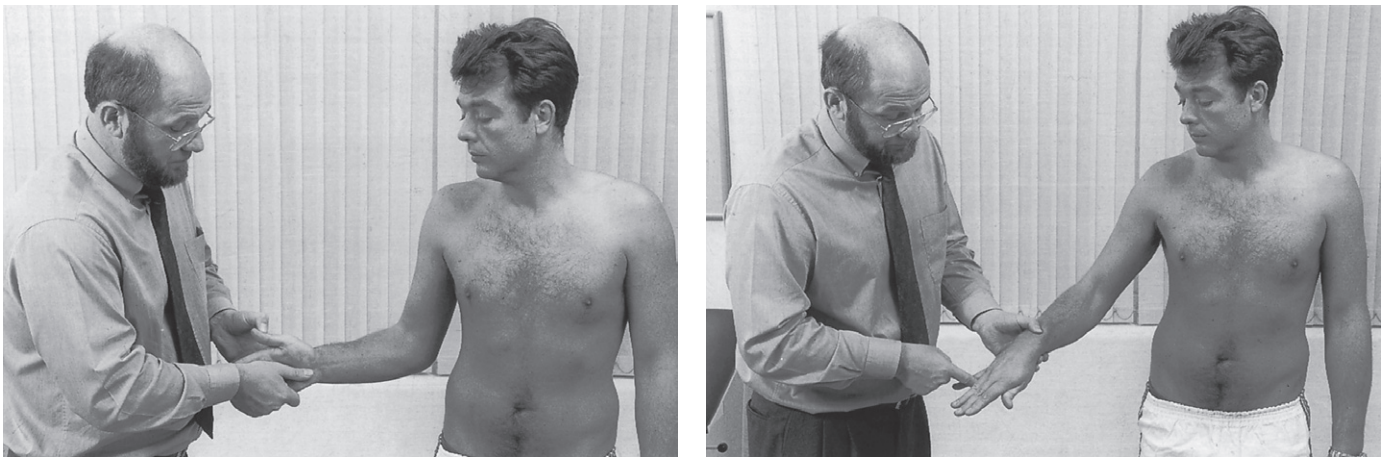
(a) (b)

Fig 6.11 • (a) Resisted flexion of the elbow tests the C5 and C6 nerve roots and the elbow flexors. (b) Resisted extension of the elbow tests the C7 nerve root and the elbow extensors.



(a) (b)

Fig 6.12 • (a) Resisted extension of the wrist tests the C6 nerve root and the wrist and finger extensors. (b) Resisted flexion of the wrist tests the C7 nerve root and the wrist and finger flexors.



(a) (b)

Fig 6.13 • (a) Resisted extension of the thumb tests the C8 nerve root and the thumb extensors. (b) Resisted adduction of the fifth finger tests the T1 nerve root and the intrinsic muscles of the hand.

Resisted abduction of the shoulder

This tests the C5 nerve root and the abductor muscles of the shoulder (deltoid and supraspinatus). The test is performed with the arm hanging down, a few degrees of abduction being permitted. The patient is asked to resist the examiner's attempt to push the arm inwards.

Resisted external rotation of the shoulder

The C5 nerve root is tested as well as the external rotators of the shoulder (infraspinatus and teres minor). The patient is asked to bend the elbow to a right angle and to hold it firmly into the side. The examiner's attempt to push the forearm medially should be resisted.

Resisted flexion of the elbow

This test examines nerve roots C5 and C6 and, at the same time, the flexors of the elbow (biceps, brachialis and brachioradialis). The patient holds the elbow in 90° flexion and supination, and resists the examiner's attempt to extend the elbow.

Resisted extension of the elbow

This tests nerve root C7 and the extensor of the elbow (triceps). The elbow is again held at a right angle and the examiner's attempt to bend the patient's elbow is resisted.

Resisted extension of the wrist

The C6 nerve root is tested, as well as the extensors of the wrist (extensores carpi) and fingers (extensor digitorum

communis). The elbow is held in extension. The patient resists the examiner's attempt to flex the wrist.

Resisted flexion of the wrist

This test examines nerve root C7 and the flexors of the wrist (flexores carpi) and fingers (flexores digitorum). The elbow is held in extension. The examiner's attempt to extend the wrist is resisted.

Resisted extension of the thumb

The C8 nerve root is tested, as well as the extensors of the thumb (extensores pollicis). The examiner's attempt to flex the thumb is resisted.

Resisted adduction of the fifth finger

This tests the T1 nerve root and the intrinsic muscles of the hand, i.e. the adductors of the little finger. The patient squeezes the examiner's finger between the fourth and fifth fingers. The examiner assesses the strength.

Sensory conduction

The examiner passes his fingers over the patient's skin in the different dermatomes (Fig. 6.14). The patient is asked if the sensation is the same over all areas.

One arm is compared with the other, and each dermatome is compared with the others in the same limb.

Testing reflexes

The main reflexes are tested and note is taken of whether they are normal, diminished, absent or inverted. Each side is always compared with the other.

Biceps reflex

The patient's elbow is held at a right angle and is well relaxed. The tendon is stretched by the pressure of the examiner's thumb on which the hammer is tapped. The C5 and C6 nerve roots are tested. The reaction is elbow flexion (Fig. 6.15).

Brachioradialis reflex

The patient's elbow is held at a right angle and is well relaxed. The hammer taps on the distal end of the radius. This tests the C5 nerve root. The reaction is elbow flexion (Fig. 6.16).

Triceps reflex

The patient's elbow is 90° flexed and well relaxed. The hammer strikes the triceps tendon, just proximal to the olecranon. The C7 nerve root is tested. The reaction is elbow extension (Fig. 6.17).

Plantar reflex

To test the plantar reflex, the examiner uses the sharp end of the reflex hammer to stroke the sole of the patient's foot, starting at the lateral aspect of the heel and moving along the

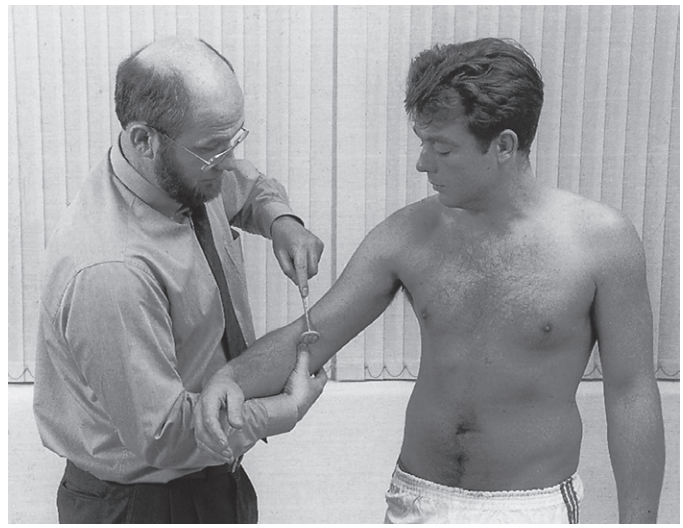


Fig 6.15 • Testing the biceps reflex: C5 and C6 nerve roots. The reaction is elbow flexion.

Fig 6.14 • Testing sensory conduction.

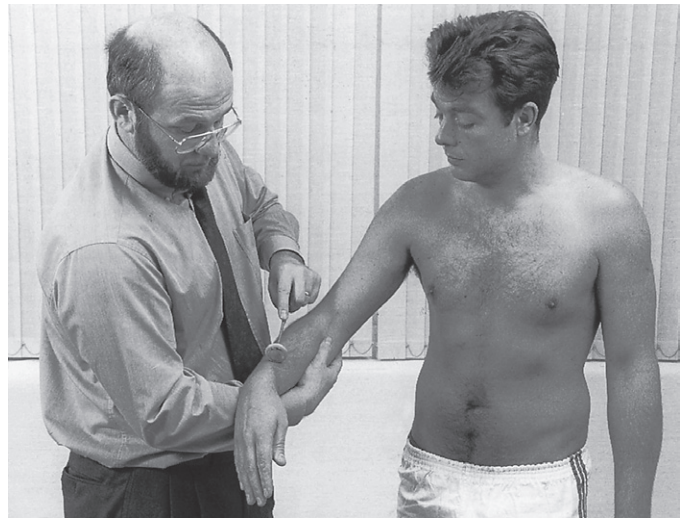


Fig 6.16 • Testing the brachioradialis reflex: C5 nerve root. The reaction is elbow flexion.

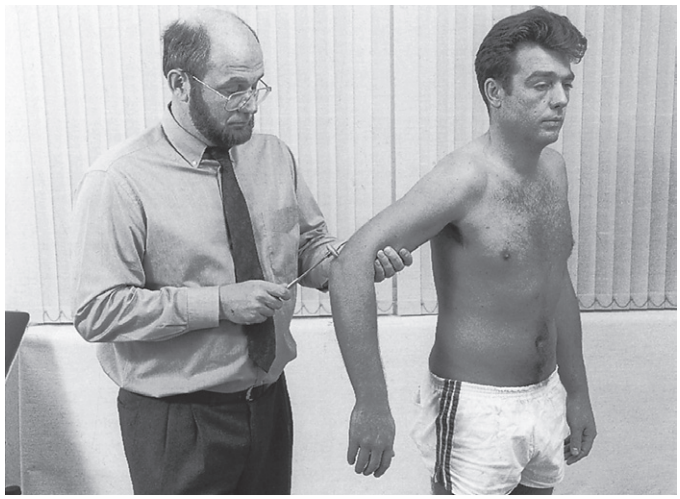


Fig 6.17 • Testing the triceps reflex: C7 nerve root. The reaction is elbow extension.

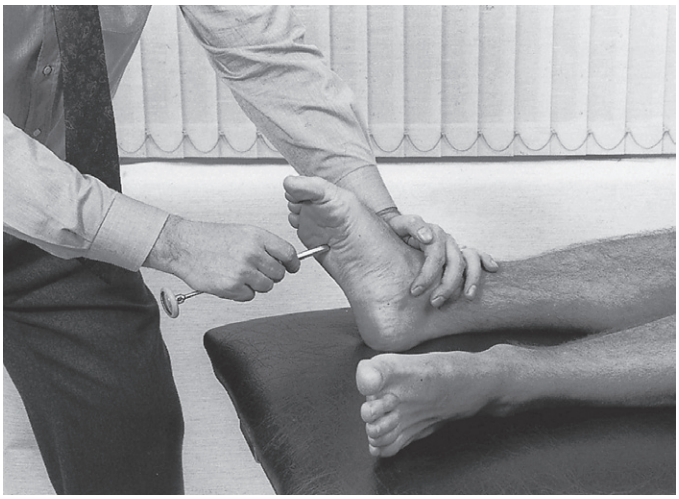


Fig 6.18 • Testing the plantar reflex: central nervous system. The reaction is flexion of the toes.

lateral border of the foot to the base of the fifth metatarsal bone and then onwards to the base of the big toe at the medial aspect of the foot. The normal reaction, as described by Strümpell, is flexion of the toes and withdrawal of the foot (Fig. 6.18). The pathological reflex – Babinski's sign – is a slow extension of the big toe, combined with spreading of the other toes and flexion of knee and hip. The presence of Babinski's sign indicates a (severe) central disorder.

Hoffmann's sign

The hand is supported and pronated so that wrist and fingers fall into slight flexion. The middle finger is firmly grasped and partially extended. The nail is then flicked by the examiner's thumbnail. This flicking should be done with considerable force. The sign is considered to be positive when quick flexion of both the thumb and the index finger results.[3] A positive sign is indicative of possible pyramidal tract pathology (Fig. 6.19).[4]

A summary of the neurological deficit at each level is given in Table 6.2.

A summary of the functional examination is given in Box 6.2.

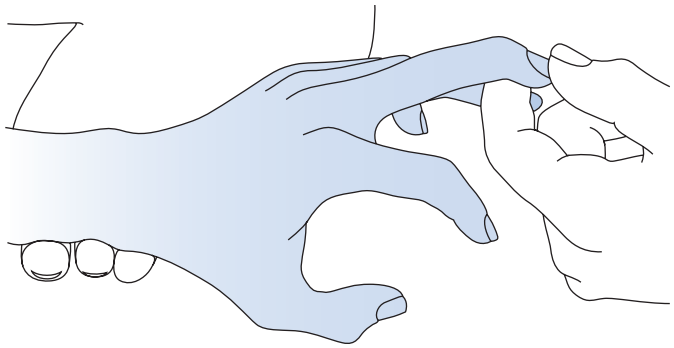


Fig 6.19 • Hoffmann's sign is elicited by flicking the distal phalanx of the long finger. Flexion of the thumb at the interphalangeal joint is a positive response.

Technical investigations

Technical investigations have become a routine measure in the evaluation of patients with neck pain for several reasons: to assist diagnosis, to complement the clinical diagnosis, to meet the patient's request for 'radiography', or for medicolegal reasons.

During recent decades there has been a tendency to reduce the time spent on history taking and clinical examination and to proceed immediately with technical investigations in order to detect the anatomical changes that are held to be responsible for a patient's condition. This trend not only has serious financial consequences but also leads to diagnostic errors. It is important to realize that imaging, whether it is X-ray, computed tomography (CT) or magnetic resonance imaging (MRI), does not reveal the source of the pain but only shows anatomical changes that may or may not be consistent with the patient's description of the pain. Most of these anatomical alterations reflect painless degenerative changes that are normal at certain ages and which may also be present in asymptomatic individuals. The examiner should constantly keep in mind the fact that the presence of anatomical and morphological changes does not automatically imply causality. For example: CT and MRI are widely used to demonstrate the existence of discal disorders, which also exist in a large number of asymptomatic people. Boden[5] cites a figure between 14 and 28% and Teresi[6] a figure of 23%. According to Matsumoto *et al*, degeneration is present in 86% of the discs of asymptomatic individuals of over 60 years of age. Posterior disc protrusion is observed in 7.6% of asymptomatic subjects.[7]

However, technical procedures may be of great help in complementing the clinical findings, i.e. to confirm a tentative diagnosis or to exclude serious disorders. The examiner should always remember, however, that a clinical diagnosis is a basic requirement and that imaging techniques should never be used

Table 6.2 Neurological deficit at each level

Level	Deficit
C1–C2	Tingling in the occipitoparietal region. Muscular weakness is rare
C3	Paraesthesia or numbness at the lower pinna, the posterior part of the cheek, the temporal area and the lateral aspect of the neck. Weakness is clinically not detectable. Cutaneous analgesia is uncommon (the lateral aspect of the neck)
C4	A horizontal band of cutaneous analgesia along the spine of the scapula, the mid-deltoid area and the clavicle. Slight weakness of the trapezii. Paraesthesia does not occur
C5	Weakness of the supraspinatus, infraspinatus, deltoid and brachial biceps muscles. The biceps and brachioradialis jerks are sluggish or absent. Paraesthesia and sensory deficit do not occur
C6	Paraesthesia in thumb and index fingers. Analgesia at the tips of thumb and index fingers. Weakness of the biceps, brachialis, supinator brevis and the extensores carpi radiales muscles. The biceps jerk is sluggish or absent
C7	Paraesthesia in index, middle and ring fingers. Cutaneous analgesia at the dorsal aspect of the index and middle fingers. The weak muscles are the triceps and the flexor carpi radialis. The triceps jerk may be affected
C8	Paraesthesia in the middle, ring and little fingers. Cutaneous analgesia at the little finger. The weak muscles are both extensors of the thumb, the extensor and flexor carpi ulnaris, the adductor pollicis, the common extensor of the fingers and the abductor indicis
T1	Paraesthesia and cutaneous analgesia at the ulnar aspect of the hand, and weakness of the intrinsic muscles of the hand
T2	Paraesthesia and motor and sensory deficit are very uncommon

Box 6.2

Summary of the functional examination

Neck movements

6 active movements:
pain/limitation

3 (or 6) passive movements:
pain/limitation/end-feel

2 (or 6) resisted movements:
pain/weakness – C1

Scapular movements

Active elevation
pain/limitation → Shoulder girdle examination?

Resisted elevation
C2–C3–C4

Arm tests

Tests for neurogenic integrity and alternative causes of arm pain

Active elevation:
pain/limitation → Shoulder examination?

Resisted movements?
(tests for motor conduction):

shoulder:
- abduction – C5
- external rotation – C5

elbow:
- flexion – C5/C6
- extension – C7

wrist:
- flexion – C7
- extension – C6

thumb extension – C8
little finger adduction – T1

Sensory conduction

Reflexes:
Biceps – C5/C6
Brachioradialis – C5
Triceps – C7
Plantar – CNS
Hoffmann's – CNS

as screening tests. Also, decisions about treatment procedures should be made on clinical grounds but may be influenced by specific findings on imaging.

Radiography may show congenital anomalies but quite often these are not clinically significant. Another reason for obtaining plain films is to exclude fractures and luxations.[8] Plain radiography has a specificity of 100% in low-risk patients.[9,10] However, in high-risk patients, helical CT scan seems to be the preferred initial screening test for detection of cervical spine fractures.[11,12] The most important consideration with cervical X-rays is perhaps the risk of missing tumours and infections. It is important to remember, however, that bony disorders are not always visible on plain X-rays in their initial stages, and a negative examination may give a false feeling of security.

Computed tomography is a good diagnostic tool for bony disorders, such as fractures and luxations, where it is often more effective than plain radiography and MRI.[13] It is useful to demonstrate osseous neural foraminal stenosis, bone destruction or bone proliferation and ossification of the posterior longitudinal ligament. It is also effective for detecting cranial migration of the odontoid process in rheumatoid arthritis patients.[14]

Magnetic resonance imaging – because of its superior depiction of soft tissue anatomy – is a preferred tool for the diagnosis of soft tissue disorders such as pre- or paravertebral haemorrhage or oedema, ligamentous lesions and disc herniations.[15] It is also excellent for demonstrating cord compression and nerve root injuries.[16] It appears to be the most reliable imaging study for diagnosing spinal infections[17] and tumours.[18] Dynamic functional MRI may provide additional information in patients with rheumatoid arthritis.[19]

Scintigraphy is most useful for the detection of quantitative changes in the skeleton in bone metastases and inflammatory and metabolic bone diseases.

Electromyography has a low sensitivity and specificity, and is therefore only secondary in the diagnosis of cervical nerve

root palsies, which can easily be detected by clinical testing. It can have a certain importance in cases with medicolegal implications.

Conclusions

- Technical investigation should not replace clinical examination.
- It may be used to clarify the clinical picture or to exclude a serious disorder.
- The results must be evaluated with great care and only in the light of the clinical picture.
- In doubtful cases, clinical evaluation will be more important than technical investigations.
- Treatment decisions should never be taken on the outcome of imaging studies alone.

 Access the complete reference list online at **www.orthopaedicmedicineonline.com**

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