Interpretation of the clinical examination of the cervical spine

A standardized clinical examination enables the examiner to recognize clinical patterns. He/she will easily distinguish common patterns from uncommon ones and recognize so-called ‘warning signs’ (see Ch. 9). Neck, shoulder girdle and shoulder problems are differentiated and a distinction is made between ‘mechanical’ conditions, such as disc lesions or capsuloligamentous lesions, and ‘non-mechanical’ conditions, such as rheumatological, neurological or infectious disorders.

Interpretation of the history

Most symptoms (elements taken from the history) are purely subjective. They are: pain, paraesthesia, numbness and dizziness. Others, such as diminished mobility and weakness, are more objective and can be checked during the functional examination.

Pain

Pain is usually the leading symptom. Pain behaviour is extremely important and is defined by the following elements: localization, onset, evolution, influencing factors, duration and accompanying symptoms.

Localization

The actual site of the pain is a first rough pointer. Pain may be localized or vague, and is felt either in the neighbourhood of the lesion or at a distance (see Referred pain, Ch. 1).

Very localized pain, accurately indicated by the patient, is often a ligamentous or facet joint problem. Bony lesions also give rise to localized pain. Pain that is vaguely defined and spreads over a larger area is usually referred. It is then distal to the lesion (see Rules of referred pain, Ch. 1). Referred pain that is felt in a particular dermatome (segmentally referred) is often radicular in origin but may also result from any soft tissue lesion in the region of the neck. The source is usually an inflammation and/or compression of a mid- or lower cervical nerve root, giving rise to pain in the shoulder area (C4) or in the upper limb (C5–T2). It often indicates a discoradicular interaction, but other causes of root pain should also be considered, such as degenerative conditions or a space-occupying lesion in the radicular canal.

Pain that is felt in several adjacent dermatomes at the same time is quite common and indicates a multisegmental type of reference (see Fig. 7.1). Multisegmental pain reference may be either the result of multiradicular involvement – which is extremely uncommon in the cervical spine and should immediately arouse suspicion (see Warning signs, Ch. 9) – or the result of a discodural interaction. In the latter case other dural symptoms may also be found and the functional examination shows a clinical picture of internal derangement (see Ch. 8). It should be stressed that dural symptoms are mostly discogenic in origin but may also occur in any space-occupying lesion in the spinal canal interfering with the sensitivity or the mobility of the dura mater. Dural pain is usually felt at the lower neck, in the trapezius area and the upper scapular and interscapular region, either centrally or unilaterally. The pain may spread further, upwards to the head, face and upper neck or the mid-scapular, pectoral and axillary regions.
Onset (Fig. 7.2)

Pain may come on suddenly, gradually or as the result of an injury. Pain that starts suddenly is activity-related. It is a manifestation of sudden internal derangement of an intervertebral joint, mostly the result of the displacement of a discal fragment. It is then usually accompanied by sudden twinges when moving. It comes and goes in an irregular way and tends to recur. Functional examination shows the articular involvement. Pain that comes on gradually is not very informative because many different conditions begin in that way. If the pain is related to specific activities, a mechanical condition (see Ch. 8) is probable; if such a relation between symptoms and movements or postures is not found, a non-mechanical condition should be considered (see Ch. 9). If an injury is responsible for the development of the patient’s symptoms, further technical investigation will be necessary to exclude serious disorders such as fractures and luxations.

Evolution (Fig. 7.3)

Pain may shift from one place to another, mostly from the centre of the neck to one side or from the cervicotrapezi scapular area to the upper limb. The meaning of pain that moves is important: the pain shifts because the lesion shifts. There are not that many lesions that may change their position; a loose fragment of disc is one of the few possibilities. Since discodural or discoradicular interactions occur in episodes, pain may switch sides from one attack to another. Pain may also expand, which means that it increases in extent and in intensity. Expanding pain is always a serious warning sign in that it indicates an expanding lesion: for example, a tumour. In most cases of discoradicular interactions, pain has started proximally in the neck, trapezius and/or scapular area before it shifts to the upper limb. However, in younger patients, discoradicular pain may be felt in the arm from the very beginning. The lesion is then called a primary posterolateral disc protrusion. Other instances that start with pain in the arm without previous neck or cervical pain are neurofibromas and root compressions by osteophytic outcrops or metastases.
Factors influencing pain

The questions: What brings the pain on? and What makes the pain disappear? are necessary to find out whether or not the condition is related to activity or posture. Most disorders are activity-related: discodural or discoradicular interactions, degenerative conditions, muscular and capsuloligamentous lesions. The type of activity that has an influence on symptoms may help in determining the possible type of lesion. Disc lesions are affected by certain movements, especially towards kyphosis, as well as by certain postures, whereas ligamentous conditions are mostly purely postural. In the latter case, maintenance of positions will aggravate pain and altering the position relieves the pain. When the condition is non-activity-related it is of the non-mechanical type and suggests bony lesions, rheumatoid-type conditions, infections, intraspinal or neurological disorders, or visceral pathologies.

Accompanying symptoms

Coughing or sneezing that causes pain in the trapezius or scapular region is a common symptom in discodural or discoradicular interactions, although any space-occupying lesion in the spinal canal may elicit such symptoms. Pain in the arm on coughing is considered unusual and mandates a closer look: the patient could be suffering from a neurofibroma. Twinges – sudden bouts of pain resulting from movement of the head – are a typical articular symptom. They very much suggest internal derangement in the intervertebral joint – a disc protrusion. Morning pain is typical of arthritic and rheumatoid-type conditions such as ankylosing spondylitis. It also occurs in capsuloligamentous contracture following degeneration (‘the elderly man’s morning headache’ – see Ch. 8). Nocturnal pain is generally accepted as being of the inflammatory type, although mechanical pain may occur when the patient has a poor sleeping posture in which the head is put into a painful position.

Duration of pain

Except in acute torticollis, which recovers spontaneously within a maximum of 10 days, neck pain has no tendency to spontaneous recovery. It may improve after some time but it may also persist. If the cause is internal derangement it usually does improve but tends to recur, certainly in young people. In the elderly the tendency to spontaneous remission is inclined to diminish. Neck pain that not only continues but also increases in intensity is very suggestive of malignancy. Root pain that is the result of a discoradicular interaction has a spontaneous remission over a period of 3–4 months reckoned from the moment of the ‘shift’: the pain appears in the arm and the scapular pain disappears. Root pain that has not diminished after several weeks is probably the result of another condition, either degenerative or malignant.

Paraesthesia

Paraesthesia is the major differential diagnostic feature distinguishing lesions in nervous tissue and other structures. This may vary from real ‘pins and needles’ to ‘numbness’ and may evolve towards a sensory deficit. If paraesthesia is mentioned and is clearly related to the lesion, a nervous disorder or a lesion affecting a nervous structure is present. The problem may be intrinsic (‘neuritis’) or extrinsic (‘entrapment’) (see Fig. 7.4).

Intrinsic neuritis may result from infectious (mononucleosis), toxic (ethyl alcohol or lead poisoning), metabolic (diabetes mellitus) or vascular conditions (arteriosclerosis), may have an iatrogenic cause (injection) or may follow vitamin B12 absorption deficiency.

When the lesion is the result of external pressure on the nerve, the cause must be sought in the intervertebral disc (discoradicular interaction), degenerative conditions (lateral recess stenosis), injury (fractures or luxations), space-occupying disorders (tumour, abscess, haematoma, aneurysm) or other soft tissue compression (fibrous bands, scars).

In nerve tissue compression three major features have to be interpreted: proximal extent, localization and behaviour. The patient has to understand clearly the difference between pain and paraesthesia because both behave differently. The lesion responsible for the development of pins and needles always lies proximal to their proximal extent; in other words, the area of paraesthesia is always felt distally to the site of compression. The localization of the paraesthesia is defined to a multi-segmental area (spinal cord), a segmental area (nerve root) – dermatome – or the territory of a peripheral plexus or nerve. The behaviour of the symptoms depends on which part of the nervous system is involved and subsequently on which mechanism is active: spinal cord, nerve root, nerve trunk or nerve ending (see Complete information on pressure on nerves in Ch. 2).

Interpretation of the functional examination

The functional examination of the cervical spine does not cause technical problems. Active, passive and resisted movements

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**Fig 7.4 • Paraesthesia.**
a serious articular problem. Passive movements that cover the full range and are painful indicate that the inert structures are being stretched or compressed. Negative isometric tests show that the contractile tissues are also functioning well and that there is nothing wrong with the bone to which they are attached. Pain in the absence of any positive test must therefore be referred or at least of the non-mechanical type: for example, inflammatory.

Positive scapular movements usually point towards a lesion in the shoulder girdle, although it is possible to find slight positive signs in a disorder of the cervical spine; elevation and/or approximation of the scapulae also act as a dural sign. If a shoulder girdle problem is suspected, a complete shoulder girdle examination should follow (see online chapter Clinical examination of the shoulder girdle).

Positive arm tests may occur in cervical disorders such as spinal cord or nerve root palsy, but if they provoke pain felt in the arm, they usually indicate a local lesion in the upper limb – shoulder arthritis, subdeltoid bursitis or tendinitis. Elevation of the arm is thus also used to detect alternative causes of pain down the upper limb. Peripheral nervous lesions will also be detected during routine arm tests. In all these instances, an appropriate and full examination of shoulder, elbow or wrist must follow.

**Interpretation of neck movements**

(Fig. 7.6)

Neck movements are usually disturbed in two ways: either both active and passive movements, or active and resisted movements are positive. If all three sets of tests are positive, the examiner should be careful: a serious condition could be present.

**Active and passive movements are positive**

Painless active limitation is not usually a reason for consultation unless it interferes with certain activities: for example, reversing a car. Painful limitation will disclose a certain pattern, which can be confirmed by passive testing; the same limitation will be found but the end-feel will add some information about the structure that causes the restriction. Two main ‘patterns of limitation’ may be recognized: the full articular pattern or any other pattern that deviates from the full pattern.

**Limited movement: the full articular pattern**

The full articular pattern at the cervical spine is no limitation of flexion, equal degree of limitation of side flexion and rotation, and some or serious limitation of extension (see Fig. 7.7).

Painless limitation with a hard end-feel in an elderly person indicates that the patient has arthrosis of the cervical spine. Apart from some stiffness and a vague ache, this condition does not really cause serious problems.

Painful limitation in a full articular pattern, however, points towards a more serious condition, such as ankylosing spondylitis, rheumatoid arthritis, recent fracture or luxation, postconcuSSIONal syndrome, bone disease or a lesion of the upper cervical complex. The history and the end-feel can add more information about the aetiology, but usually further paraclinical investigations are required.

**Limited movement: partial articular patterns**

A partial articular pattern is a clear asymmetrical presentation of pain and/or limitation. This common finding usually indicates internal derangement (displacement of a disc fragment with discodural or discocardicular interaction). The complete clinical picture must, of course, be compatible with history and end-feel – see Chapter 8.

Specific types of partial articular pattern – the convergent type and the divergent type – may indicate a lesion of a facet joint (see Ch. 7), although it is not impossible for the same pattern to arise in an ordinary disc lesion too.

**Full range: partial articular patterns**

The same asymmetric pain patterns may occur in the absence of any clinically detectable limitation. This usually has the same significance, although the examiner has to be even more careful because a non-activity-related condition could easily be responsible.
Limited movement: a suspicious partial articular pattern

Warning

The partial articular pattern in which side flexion away from the painful side is the only painful movement is an important warning sign (Fig. 7.8).

A displaced fragment of disc is very unlikely to disturb side flexion while leaving all other movements free. Often, the reason for this particular limitation of movement lies outside the cervical column (neck, mediastinum or apex of the lung).
**Active and resisted movements are positive**

Isometric testing – movements performed against maximal resistance – may cause pain, weakness or a combination of both. The muscular contraction augments the pressure in the intervertebral joints. It is therefore not totally impossible to find positive resisted movements in an articular lesion, especially when the condition is in an acute or subacute stage – for example, acute torticollis – or when there is a high degree of inflammation. The passive tests, however, should still dominate.

When a clear *contractile tissue pattern* is found – pain on isometric testing in one direction, but also on active and passive stretching in the opposite direction – the possibility of a lesion of a musculotendinous structure, although not so common, should be considered. When resisted movements are clearly more positive than active and passive ones, or when the pattern includes weak movement(s), this has to be considered as a warning sign. Vertebral metastases, fracture of the first rib, glandular fever, wedge fracture of a vertebral body, postconcussional syndrome and retropharyngeal tendinitis or abscess should be excluded.

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**Warning**

- Isometric contraction that is more painful than active or passive movements warrants a closer look.
- Weakness of one or more neck movements indicates a serious disorder. Further investigations are required.

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When no clear pattern of pain and/or weakness is detected or when the pattern is inconsistent, diagnosis on clinical grounds is extremely difficult, and the patient should be sent for further investigations.

**Interpretation of shoulder girdle movements** (Fig. 7.9)

Shrugging the shoulders involves quite a number of different structures: acromioclavicular joint, sternoclavicular joint, upper rib joints, costo- and coracoclavicular ligaments, costocoracoid fascia, upper lung, brachial plexus and muscular structures – elevators are at work, while depressors become stretched.

*Pain* when the shoulders are shrugged may occur in a lesion of the shoulder girdle that becomes painfully stretched: for example, sternoclavicular arthritis, healed apical tuberculosis, and lesions of the first or second thoracic nerve root, subclavius, costocoracoid fascia or first costotransverse joint. It is important to remember that this test also stretches the thoracic dura mater and thus provokes pain in a thoracic discodural interaction.

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**Fig 7.8** • A suspicious partial articular pattern (colour indicates pain).

**Fig 7.9** • Shoulder girdle movements.
Painless limitation shows that the mobility of the scapula in relation to the thorax is impaired, either by contracture of soft tissue at the shoulder girdle or by gross lesions at the sternoclavicular or acromioclavicular joint.

Painful limitation is rare and is indicative of a lesion, such as a haematoma in contact with the costocoracoid fascia, an apical pulmonary neoplasm or a severe sternoclavicular lesion.

Pins and needles in one or both hands on sustained movement suggests the thoracic outlet syndrome. Crepitus indicates roughening of the posterior thoracic wall (see online chapter Disorders of the inert structures).

**Interpretation of arm movements** (Fig. 7.10)

**Active elevation of the arm is positive**

When active elevation is painful but not limited, the examiner should ascertain where the pain is felt. If positive neck signs have been found and the shoulder movement hurts in the neck region, this is probably the result of ‘transmitted stress’ and thus irrelevant. If the movement hurts in the shoulder and/or down the arm, the problem is local and full examination of shoulder, elbow or wrist should follow.

Active elevation that is painful and limited is probably the result of a local condition in the shoulder girdle or in the shoulder. A proper examination of shoulder girdle and arm should follow and disclose the lesion.

A number of conditions limit active but not passive elevation of the arm. Apart from more generalized disorders, the following neurological lesions can be responsible: mononeuritis of the long thoracic or spinal accessory nerves, osteophytic or traumatic root palsy of C5. Tendinous ruptures, especially of the supraspinatus tendon, may also limit arm elevation, as does fracture of the first rib or of the spinous process of C7 or T1. Psychogenic pain is another possibility.

**Resisted arm movements are positive**

When one or more isometric tests of the arm are painful and/or weak, the lesion must be sought in shoulder, elbow or wrist. The appropriate local examination then leads to a diagnosis.

Painless weakness is sometimes difficult to detect. The patient is asked to perform a maximal contraction and the examiner assesses the strength. Weakness may vary from a subtle paresis, typical of nerve root compression by a fragment of disc, to complete paralysis, as found in more serious neurological disorders or in complete tendinous rupture.

The examiner should be able to establish whether the condition is myogenic or neurogenic. Neurological weakness either has a central cause – upper motor neurone lesion – or is the result of a peripheral nerve lesion – lower motor neurone, nerve root, plexus or local peripheral nerve. When the weakness is segmentally distributed, the problem must lie in the cervical spine. In more generalized neurological conditions (e.g. diseases of the central nervous system and cerebrovascular accidents), the weakness is more extensive. Painless myogenic weakness is probably the result of a complete rupture of a tendon.

The most common condition causing weakness down the arm is nerve root compression – usually C7 – by a displaced fragment of disc. In orthopaedic medicine the most important non-mechanical causes of weakness down the arm are mononeuritis of the suprascapular nerve, vertebral metastases, T1 nerve root lesion, neuralgic amyotrophy, traction palsy of C5 and neurofibroma.