Mechanical disorders

CHAPTER CONTENTS

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Mechanical disorders of the cervical spine affect the structures of the locomotor system. They are often related to the consequences of the ageing spine. Degenerative changes at the level of the intervertebral discs may lead to disc displacements and also to anatomical and biomechanical changes in ligaments, capsules, nervous tissue and vascular structures. In addition to this degeneration being responsible for the development of certain disorders, injuries and overuse may also lead to soft tissue lesions in the region of the neck (Box 8.1).

Degeneration and anatomical changes

Degenerative changes in the cervical spine are part of the normal ageing process and are almost ubiquitous in older people.1,2 Very often they remain asymptomatic.3,4 Therefore diagnoses such as ‘degeneration’, ‘arthrosis’, ‘osteophytosis’, ‘spondylosis’ or ‘spondylarthrosis’ based on incidental radiological findings are still too easily made. Throughout the literature, a discrepancy between the discovery of structural changes and the presence of symptoms is a consistent finding.5

Ageing of the cervical spine

As a result of weight bearing in bipedal humans, the axial spine is submitted to increased forces acting on the different structures. The disc, being entirely avascular, suffers most from this situation; degeneration starts quite early in life and progresses with age. The degenerative process in the intervertebral disc is followed by other structures of the spine, such as bone, ligaments, capsules and zygapophyseal joints.

Ageing of the cervical disc

In healthy individuals the cervical intervertebral disc has a structure which is very similar to that of the lumbar disc: an annulus fibrosus which contains a nucleus pulposus. As long as the disc is not submitted to excessive asymmetrical forces, the hydraulic mechanism within the disc functions perfectly. It becomes deficient as the result of excessive forces occurring during everyday activities, or following absence of movement. The annular fibres become strained and sprained, and the nucleus starts to dry out. This is a characteristic sign of disc degeneration.

It has been shown that, in the first two decades of life, lateral tears occur in the annulus fibrosus. They tend to develop joint-like structures – the uncovertebral joints – that then begin to undergo transformation.6 In the second and third decades, the lateral tears enlarge towards the medial part of the disc, often ending in a complete transverse splitting of the disc into equal halves. These anatomical changes cause instability of the
Mechanical disorders of the cervical spine

Disc disorders
- Disco-dural interactions
- Disco-radicular interactions

Degenerative disorders
- With localized pain
  - Arthritis at the upper two cervical joints, leading to ligamentous contracture: morning headache in the elderly
  - Subacute arthritis of the atlantoaxial joint
  - Arthritis at a facet joint
- With radicular pain: osteophytic root compression
- Cervical spondylotic myelopathy

Capsuloligamentous disorders
Musculotendinous lesions
- Lesions of the semispinalis or splenius capitis muscle
- Lesions of the longus colli muscle (retropharyngeal tendinitis)

Consequences of disc ageing for surrounding structures

Effects on the ligaments
Instability of the intervertebral joints results in instability of the entire segment. The excessive and irregular movements of the related vertebrae lead to traction at the site of osseous attachments of the annulus fibrosus to the vertebral body. Lifting of the anterior and posterior ligaments results in spur formation at the anterior and posterior borders of the vertebral body, and subsequently to the formation of osteophytes. In addition, the ligamentum flavum is submitted to traction forces. It becomes deformed and enlarged, and will buckle into the spinal canal during extension.

Effects on the facet joints
The prevalence of cervical facet joint degeneration is very high in individuals aged 50 years and more, with a tendency to increase in severity with age. Diminution of the height of the disc and the subsequent reversal from lordosis to kyphosis result in a greater transmission of shearing forces to the facet joints. They start to bear weight and this furthers the degenerative process. This is characterized by fibrillation and erosion of the articular cartilage, partial or complete denudation of the cartilage, and new bone formation. Later in life, subperiosteal osteophytes with periarthritis fibrosis develop, resulting in a gross decrease in mobility.

All levels of the middle and lower cervical spine are affected to almost the same degree, whereas in the lumbar spine there is an increase in degeneration towards the lower levels.

Effects on the uncovertebral joints
With progressive diminution of disc height, the bony protruberances about the uncovertebral articulations degenerate, leading to osteophytes that enlarge the joint surfaces and project from the posterior edge of the vertebral body into the disc space and the intervertebral foramina. Compromise of adjacent neurovascular structures (nerve root and vertebral artery) is a potential complication.

Effects on the spinal canal
Circular disc displacement, as is seen when the disc has degenerated entirely, may further the development of osteophytic outcrops on all sides, and thus also into the spinal canal, threatening the spinal cord. Once the bony parts formed by the uncovertebral joints touch each other, further loss of height can only happen anteriorly. Because of the decrease in height in the anterior column of the cervical spine, cervical lordosis may diminish and even disappear, resulting in the typical position of the degenerated neck – the chin projected forwards. Retrolisthesis in the mid-cervical area (C3–C6) is a common finding in spondylarthrosis. Also, buckling of an enlarged ligamentum flavum narrows the spinal canal, especially during extension of the neck.

Effects on the intervertebral foramen
The association of diminished intervertebral space, osteophyte formation at both the uncovertebral and zygapophyseal joints, and hypertrophy of the facet joint capsules causes diminution of the intervertebral foramen and eventual neural foraminal encroachment. Further diminution of the foraminal space is caused by the backwards slip of the upper vertebra during extension.

Radiological changes
Degenerative changes of the cervical spine are common in both asymptomatic and asymptomatic adults. At the age of 50, spondylosis is visible on plain X-rays in more than 50% of asymptomatic people. A magnetic resonance imaging (MRI) study on 500 asymptomatic subjects could detect disc...
Posterolateral displacement

If the extruded disc material runs into the nerve root canal, discoradicular interaction occurs. This posterolateral migration of disc tissue causes pressure on the nerve root, which results in a series of symptoms: first segmental pain following compression of the dural sheath (root pain), then segmental paraesthesia and/or neurological deficit as the result of the parenchyma becoming pinched. The disc displacement may be primary or secondary.

Secondary posterolateral displacement

This is the most common situation. The patient has suffered from a few posterocentral displacements with neck, trapezius and/or scapular pain in the past. During the most recent attack, as the disc fragment moves from the centre to one side, the pain shifts from the neck to the upper limb. Segmental root pain builds up while the multisegmental neck pain disappears.

Primary posterolateral displacement

From the outset the pain is felt in the forearm. There has been no previous neck pain because originally there was no compression of the dura mater but rather of the nerve root directly. The segmental pain can be accompanied by paraesthesia and/or neurological deficit. Because this condition is rather uncommon, differential diagnosis should be made with non-discal nerve root compression or with intrinsic conditions of the nervous system.

Stages of disc displacement

Disc displacements also behave according to their actual status of degeneration. Cyriax described seven stages of disc lesions, each one typical of a certain age group and characterized by a typical history (Fig. 8.1).

Stage 1

Acute torticollis in adolescents or young adults: acute neck pain, with total immobilization and gross deviation. This is
the result of a large discodural interaction, usually of the nuclear type. The lesion undergoes spontaneous cure within 10 days.

**Stage 2**
Intermittent scapular pain, mostly unilateral but not always on the same side. The patient is in his/her late 20s or older. The symptoms may last several weeks.

**Stage 3**
Constant scapular pain in a patient over 50. Due to developed spondylosis and stiffness of the neck, there is no spontaneous reduction of disc material.

**Stage 4**
Pain in the upper limb after initial scapular pain. The patient is between 35 and 65. The pain typically increases during the first 2 weeks then remains unchanged over the next 4–8 weeks, recovering spontaneously after 8–12 weeks. There may be paraesthesia and neurological deficit.

**Stage 5**
In elderly patients, a bilateral protrusion may cause aching in both upper limbs and paraesthesia in all the fingers.

**Stage 6**
Constant bilateral aching in head, neck and scapulae may be experienced in elderly patients as the result of a fixed postero-central protrusion that leads to constant discodural interaction.

**Stage 7**
The disc compresses the spinal cord. This results in paraesthesia in the hands and/or feet.

Osteophytes may obliterate the anterior spinal artery, leading to progressive paraplegia.

**Findings on examination**
It is believed that disc degeneration and disc displacements are of themselves painless events. It is only when pain-sensitive structures in the neighbourhood pick up on the disc abnormality and translate mechanical pressure and inflammatory changes into pain that signs and symptoms originate. The reader is referred to Chapter 33 – the ‘dural concept’ – for a thorough description of this dural hypothesis.

Disc displacements in the cervical spine will give rise to the same set of signs and symptoms as in the lumbar spine. However, in contrast to the lumbar spine, disc lesions at the cervical spine may threaten the spinal cord. Therefore, not only the usual dural, articular and root signs and symptoms, but also cord signs and symptoms may be present here and must be sought.

**Dural symptoms**
When a fragment of disc (at any level) protrudes postero-centrally, it may compress the dura mater either in the midline, which results in central or bilateral pain, or slightly to one side, leading to pain felt unilaterally. The dura mater, being a multi-segmentally innervated tissue, translates this compression into multisegmental pain (see Ch. 1). Pain reference from the cervical dural mater may thus spread up to the head and down to the mid-thoracic region, and may be felt anywhere in this area (Fig. 8.2). However, the pain is most commonly experienced in the region of neck, trapezius and scapula (Fig. 8.3a). Occasionally it is felt in the clavipectoral area or in the axilla (Fig. 8.3b).

Patients often mention a tender spot, usually somewhere at the superior border of the trapezius, which they identify as the source of their pain. On palpation the examiner indeed finds localized tenderness. However, during the examination, movements designed to test the trapezius muscle are found to be negative. Furthermore, the tender spot may shift during neck manipulation and disappears when a full and painless range is
obtained. This confirms that the tenderness is clearly a referred phenomenon (see Ch. 1) without localizing or diagnostic value. This multisegmental tenderness is one of the dural symptoms and results from dural compression at any level.

In contrast to a lumbar discodural problem, a cough seldom hurts. Very exceptionally, swallowing may be uncomfortable, although the mechanism causing this symptom is unclear.

**Dural signs**

Dural signs are not found on examination. Although neck flexion stretches the dura mater, the pain very often experienced during this movement must be regarded as an articular sign rather than a dural one. Neck flexion can only be regarded as being a dural test if it stretches the dura from a distance, which is not the case here. There is also no equivalent to the straight-leg raising test in the lumbar examination where a simple movement (hip flexion with an extended knee) allows differentiation between dural pain, root pain and muscular tightness. Some nerve roots (C4–C6) are tethered to the gutter of their respective transverse process, but apparently not to the foramen. Some authors have developed and discussed ‘upper limb tension tests’ (ULTT) as a valuable examination procedure for patients with neck problems with or without radiation down the upper limb. The aim would be to create stress, transmitted to the structures in the spinal canal via the peripheral nerves (median–radial–ulnar). The peripheral nerves in the upper limb however, have, unlike those in the lower limb, a more complex course. It is therefore more difficult to carry out ‘pure’ movements and, although these tests stress the neurological tissues, they also stress some contractile and inert tissues in neck, shoulder girdle and arm. Because of their low specificity, they are not integrated into the standard functional examination of the cervical spine.

**Articular symptoms and signs**

The symptoms are activity-related: pain is elicited or influenced by movements, activity and posture. Sometimes there are twinges during movement of the neck.

On examination, a partial articular pattern of internal derangement is found: some active movements are painful and limited or cause pain at the end of range, while others are negative or clearly less positive. The asymmetrical pattern that occurs may vary from very subtle, with hardly any limitation, to very pronounced with some movements completely blocked, forcing the head in a deviated position. A minimal partial articular pattern (Fig. 8.4a) emerges when the internal derangement is minor and the discodural interaction slight. It is hypothesized that pronounced signs result from a severe discodural interaction (Fig. 8.4b). Passive movements usually hurt more than active ones, though cases may be encountered in which passive movements ease the pain. Resisted movements are negative, except perhaps resisted flexion. The latter may slightly increase the pain in more acute cases, presumably as a result of the consequent compression strain on the affected joint.

When neck flexion elicits pain in the upper thoracic area, further examination of neck, shoulder girdle and thorax must differentiate between a cervical lesion with pain reference to the upper thorax and a lesion in the shoulder girdle or upper thoracic spine. The movement is an articular sign for the cervical spine but is also regarded as a dural sign for the thoracic spine. During neck flexion the dura mater is stretched and drawn forward against an eventual upper thoracic protrusion (see Ch. 25).

A painful arc may be found on active or passive testing. This sign sometimes occurs during rotation movement in patients with unilateral symptoms and during extension in patients with central or bilateral pain, and is pathognomonic of a disc lesion.

If only one movement proves positive, it is usually rotation towards the painful side. Caution must be taken when the only painful movement seems to be side flexion away from the painful side. This sign may occur in any costoscapuloclavicular lesion, but may also suggest a lesion at the apex of the lung. Further investigations are necessary.

In discodural problems either the normal leathery end-feel is expected or, in more severe cases, the more typical end-feel of muscle guarding (‘crisp’). This is clearly unlike the hard end-feel of arthrosis or the muscle spasm end-feel of more serious disorders.

**Root symptoms and signs**

By analogy with the lumbar spine, where backache may evolve into sciatica, cervicoscapular pain may be replaced by brachial pain. The original multisegmental cervicoscapular pain disappears and severe and strictly segmental pain down the arm supervenes. The examiner must be aware that patients sometimes omit to mention the original pain in the trapezius or scapular area but concentrate only on the severe symptoms at
The Cervical Spine

This is called the ‘maximal cervical compression test’. Great care is needed while performing this test as it also compresses the vertebral artery.

Cord symptoms and signs

In posterocentral disc protrusion, the spinal cord may also become compressed. Pressure on the cord itself is not painful. It leads to multisegmental paraesthesia, usually felt in both hands and/or feet and very often provoked or influenced by active or passive neck flexion. Sensory disturbance soon supervenes. In more severe cases, the gait will become disturbed, the plantar reflex may become positive (Babinski’s sign) and the patient may develop spasticity, incoordination and extensive weakness in the lower extremities.

Findings on examination are summarized in Table 8.1.

Common syndromes

The following clinical pictures are all caused by cervical disc protrusions. Symptoms and signs are determined by size, localization and degree of degeneration of the displaced discal fragment and the nature of the involved structures.

Acute torticollis: unilateral pain with asymmetrical picture

Unilateral acute torticollis is caused by a discodural interaction that is quite common between the ages of 15 and 30. An acute torticollis under the age of 12 is rarely caused by a disc (see Differential diagnosis).

History

Most patients wake in the morning with a stiff neck. Pain and stiffness increase as soon as they adopt an upright position. Any attempt to move the neck results in unilateral pain, radiating to trapezius and/or upper scapular area. Occasionally the symptoms come on suddenly as the result of a certain

<table>
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<th>Table 8.1 Findings on examination</th>
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<td><strong>Symptoms</strong></td>
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Fig 8.5 • Pressure on the dura mater (a) ceases when the disc moves laterally and compresses the nerve root (b).
movement (e.g. bending over a washbasin), trivial trauma (e.g. a blow to the head\textsuperscript{30}) or coughing.

Neck movements make matters worse, and even arm movements may cause considerable pain. The pain diminishes when lying down with the neck supported but it is very difficult to change position and the patient has to hold the head firmly between the hands to do so.

Previous attacks, not necessarily with symptoms on the same side, may be mentioned. Many patients also feel giddy during an attack of acute torticollis.

Inspection
The patient holds the head in an asymmetrical position. In acute torticollis that results from a disc lesion, the deviation is usually purely lateral, in most cases away from the painful side and without any rotatory component. Slight deviation in flexion occasionally occurs.

Examination
On examination, gross and obvious articular signs are found: a striking and extremely painful limitation of one rotation and one lateral flexion towards the same side, usually the painful side. Often no movement is possible in either of these directions (Fig. 8.6). The other movements are much less painful and are scarcely limited, except possibly extension. The end-feel is empty or one of severe muscle guarding.

Resisted movements may be painful and even weak. The patient stops the contraction because muscular action causes a momentary change of pressure in the intervertebral disc and intensification of pain.

Arm movements may also be impaired. On active elevation of the ipsilateral arm, a false painful arc may be present and in very acute cases the patient may even be unable to bring the arm up voluntarily above the horizontal. These secondary signs are clearly the result of transmitted stress: when the arm reaches the horizontal, the muscular effort is at its greatest and secondary tautening of the cervical muscles takes place, leading to such pain that the arm falters and a false shoulder sign appears. There are no root or cord signs.

Diagnosis
The pattern of limitation is diagnostic. Acute torticollis is the most striking example of a partial articular pattern, which indicates that part of the joint is blocked by an intra-articular displacement. In most instances the displacement is nuclear: the nucleus has oozed out slowly during the night, while the patient has been lying for some hours with the neck in side flexion or rotation. The dura mater becomes compressed and irritated, which causes the cervicoscapular pain. A sudden onset suggests an annular displacement. It usually occurs in patients over 30. This mechanism was hypothesized by Cyriax more than 50 years ago and was recently proven by two MRI studies. Maigne et al performed MRI in a 15-year-old male adolescent, a few hours after the onset of torticollis. Increased signal intensity compatible with a fluid collection was seen in the right uncovertebral region at C2–C3, causing excessive lateral pressure and pushing C2 outwards. A new MRI taken 3 weeks after resolution of symptoms was unremarkable.\textsuperscript{31}

Another MRI study performed by Gubin et al in ten children and adolescents with acute torticollis showed similar findings: high-intensity zones were seen near uncovertebral zones C2–C3 or C3–C4. The zones were always on the side where the patients felt pain and disappeared spontaneously after a few days.\textsuperscript{32}

The characteristics of acute unilateral torticollis are listed in Box 8.2.

\begin{figure}[h]
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\includegraphics[width=\textwidth]{fig8.6.png}
\caption{The partial articular pattern in acute torticollis (colour indicates pain).}
\end{figure}

\begin{box}
\section*{Box 8.2}
\textbf{Summary of unilateral acute torticollis}

\textbf{Definition}
- Acute torticollis is a sudden attack of severe cervicoscapular pain, owing to a large posterior shift of disc material, compressing the dura mater and resulting in a discodural interaction

\textbf{Onset}
- Sudden: annular (age > 30)
- Slow: nuclear (age < 30)

\textbf{Symptoms}
- Articular
  - (Twinges)
  - Pain on active movements
- Dural
  - Dural pain: large reference

\textbf{Signs}
- Deviation in side flexion (or flexion)
- Gross partial articular pattern

\textbf{Treatment}
- > 30 years: manipulation under traction
- < 30 years: progressive sustained movements

\textbf{Spontaneous recovery}
- Takes 7–10 days
\end{box}
Differential diagnosis
Discogenic torticollis is the most common form of twisted neck or ‘wry neck’ and should be differentiated from many other types of torticollis.

Torticollis in infancy and childhood
This can be congenital or acquired. Congenital types include those resulting from osseous, muscular or neurogenic factors. Osseous lesions are mostly anomalies of the atlas, such as hemiatlas, partial atlantic aplasia or partial atlanto-occipital fusion, and Klippel–Feil syndrome. Klippel–Feil syndrome is congenital fusion of two or more cervical vertebrae. The classic clinical triad is: lower neck, short neck, and restriction of head and neck movements. In patients with moderate involvement, this classic triad may not be seen and sometimes there is only some scoliosis deformity or moderate torticollis.

Congenital muscular torticollis (CMT) is caused by shortening of the sternocleidomastoid muscle. This leads the head to bend toward the affected side and the chin to turn to the opposite side, the so-called cock robin position of the neck. CMT is the third most common congenital musculoskeletal anomaly after dislocation of the hip and clubfoot, with a reported incidence of 0.3–1.9%. Various theories have been proposed but the true aetiology of torticollis remains uncertain. As a result of fibrotic changes of the sternocleidomastoid muscle, the unilateral contracture may subsequently result in plagiocephaly, skull and facial asymmetry. When diagnosed early, CMT can be managed conservatively and seldom requires surgery. In fact, a simple stretching programme leads to spontaneous resolution in most patients. In children older than 1 year, corrective surgery has both cosmetic and functional benefits, the best outcomes being obtained between the ages of 1 and 4. After the age of 5, the form and efficacy of treatment are controversial.

Acquired torticollis in children should always be taken seriously, as it may result from a number of underlying causes, some of which are severe and life-threatening. Spontaneous subluxation of the atlantoaxial joint following peripharyngeal inflammation is known as Grisel’s syndrome. Children between 5 and 12 years are most frequently affected. However, the condition has been reported in patients ranging from infancy to the seventh decade of life. Torticollis may occur shortly after the onset of the underlying infection or it may follow mild trauma to the neck. The syndrome has been reported in association with rhinopharyngitis, cervical osteomyelitis, rheumatic conditions, and following surgical procedures such as tonsillectomy or adenoidectomy, choanal atresia repair and mastoidectomy. It is hypothesized that distension and abnormal laxity of the ligaments surrounding the atlantoaxial articulation result from direct spread of inflammation from the pharynx and nasopharynx. This leads to C1–C2 instability with subluxation and (sometimes) devastating neurological sequelae (between 10 and 15% of patients have neurological signs or symptoms, with serious consequences including quadriplegia and sudden death). The condition begins with a spasm of the irritated sternocleidomastoid muscle. This contraction leads to a typical position of the head, which is easily differentiated from the position in acute discogenic torticollis. In a disc lesion, the deviation is purely in lateral flexion or flexion or a combination of both. When a spasm of the sternocleidomastoid muscle is responsible, the neck is held in flexion, side flexion towards and rotation away from the painful side.

Fig 8.7 • (a) Discogenic torticollis – the deviation is pure in lateral flexion. (b) Grisel’s syndrome: spasm of the sternocleidomastoid muscle forces the head in side flexion towards and rotation away from the painful side.

Spasmodic torticollis
Spasmodic torticollis or cervical dystonia is the most frequently occurring focal dystonia, with an incidence of 8.9 per 100,000 people. Dystonia is defined as sustained, involuntary muscle contractions, which often cause twisting or repetitive movements or abnormal postures. The origin of the symptoms is still unclear. The condition often results in cervical pain and disability as well as impairments affecting postural control.

The inspection is diagnostic. The patient is seen to rotate the head suddenly, always in the same direction, by an apparently irresistible active movement. This involuntary movement can be prevented by manual pressure, which can also be used to overcome the muscles and rotate the head back into the neutral position. The muscles give way in a manner that suggests neurological hypertonus.

Therapy of spasmodic torticollis includes behaviour modification, such as training the patient to readjust the position of the head, and biofeedback, hypnosis and anticholinergic drugs. When these procedures are not successful, local application of botulinum toxin A offers a highly effective treatment.
Unilateral cervicoscapular pain

This is the most common neck complaint. Symptoms may start from the late 20s on and can occur at all ages. The pain has a recurrent character with varying localization and eventually becomes more or less chronic.

History

The patient describes periods of unilateral cervicoscapular pain, which may come on spontaneously or after a minor trauma. The pain may be localized, usually at the mid- or lower neck, or refers to the trapezius area, scapular area, shoulder region or head. The multisegmental character of the reference shows the pain to be of dural origin. The pain is aggravated by certain movements – a common complaint is difficulty in twisting the head to one side so as to reverse a car. Certain postures, especially flexion maintained for a certain time (e.g. when reading), may increase the pain. There is usually no pain at night, except on turning in bed. The painful episode lasts a few days to several weeks and disappears spontaneously. There is no pain between the bouts. A new attack is not always felt on the same side. Over the age of 50, pain may not disappear completely between two episodes of aggravation.

Examination

A mild partial articular pattern is found (Fig. 8.8). As a rule, two, three or four movements out of the six are painful, and four, three or two prove painless. Passive movements are usually more painful than active ones. There may be minor limitation, or a painful arc is found. The end-feel is rather crisp, indicating the muscle guarding typical of a disc lesion, but it is not uncommon to find a normal, capsular end-feel. Root and cord signs are absent. It is not easy to determine the level at which the pain originates.

Psychogenic torticollis

The patient keeps the head and scapula fixed in an impossible position, which immediately demonstrates its non-organic nature: the head is held in side flexion towards the alleged painful side and the scapula at the same side is kept hunched. No organic lesion exists which leads to fixation of the head in side flexion and whereby the patient is obliged to keep the scapula elevated.

On examination, all active and passive movements are very painful and limited. Resisted movements are painful and weak. This again is very suspect. Finally, the end-feel discloses active muscular contraction but sustained passive pressure during persuasion soon leads to a full range of movement and a normal end-feel, which confirms the diagnosis.

Parkinsonism

The neck may gradually become stiff and painful because of muscle rigidity that is the result of increased extrapyramidal tone. The passive range being much larger than the active one affords a clue, and inspection of the face is confirmatory, as are other typical findings (e.g. tremor, gait).

Cervical scoliosis

The presence of a compensatory thoracic curve following cervical scoliosis indicates the possibility of adolescent scoliosis, unilateral cervical rib, Klippel–Feil deformity or previous thoracoplasty.

Meningitis

The differential diagnosis is not very difficult. In meningitis, the patient develops acute pain in the neck with headache. There is nausea and sometimes vomiting and fever. The neck is fixed in extension. On examination very pronounced dural symptoms and signs are found: even straight-leg raising is positive (Kernig’s sign and Brudzinski’s sign).

Natural history

Untreated, the pain is constant and severe for 2 or 3 days; the condition recovers spontaneously over the course of the following week.

Treatment

Treatment is by manipulation. The technique is adapted according to the clinical picture. Acute torticollis in patients under 30 often behaves in a nuclear manner; these patients should be treated with ‘nuclear’ techniques – progressive sustained rotation and/or lateral flexion, whereby an attempt is made to push the displaced nuclear material slowly back. The less common annular cases should be treated with the usual ‘annular’ manipulation techniques (see Ch. 11).

Fig 8.8 • Examples of partial articular patterns in unilateral cervicoscapular pain (colour indicates pain).
protrusion lies, because any disc at any level gives rise to the same symptoms (multisegmental pain) and signs (partial articular pattern). Oscillatory techniques on a sitting or prone lying patient or anteroposterior gliding movements with the patient lying supine may sometimes provoke the pain and give an idea as to the level but this cannot always be relied upon.

**Diagnosis**

The diagnosis is based on the typical history, together with a partial pattern on examination. The history is that of pain, coming and going in episodes and influenced by particular movements and postures. The pain is of the multisegmental type and spreads over several dermatomes. The asymmetrical pattern of painful movements shows that part of the intervertebral joint is blocked by a displaced fragment of disc, usually annular.

**Differential diagnosis**

The differential diagnosis includes lesions in the shoulder girdle (e.g. posterior sternoclavicular syndrome, see online chapter Interpretation of the clinical examination of the shoulder girdle), in the upper thoracic area (see Ch. 26), internal disorders (e.g. in the heart, lungs or diaphragm, see Ch. 28) and neurological conditions (e.g. long thoracic or spinal accessory neuritis, see online chapter Nerve lesions and entrapment neuropathies of the upper limb).

**Natural history**

In patients under 50, there is a tendency to spontaneous cure in a few weeks. Nevertheless a number of patients are not completely cured and are left with a minor ache between the periods of aggravation.

**Treatment**

Unilateral pain in the cervicoscapular area is highly suitable for manipulation. Usually a few sessions suffice to restore a full and painless range of movement. The patient must be informed that the disc may move again, however, and that recurrences are not uncommon. Each new attack should be treated in a similar way. However, when there is a tendency to recurrence, prophylactic measures should be taken (i.e. position at work, sleeping position, collar, exercises – see Ch. 13).

See Box 8.3 for a summary of unilateral pain in the neck, trapezius or scapular area.

**Unilateral root pain**

Root pain as the result of a disc protrusion pressing on the dural investment of a cervical nerve root is quite common. It has an incidence rate of 1/1000 per year with a peak age between 45 and 54. The lesion very seldom occurs in adolescence. In younger patients suffering from cervical root pain, other disorders must be excluded before a disc lesion is considered. Over the age of 60, root pain caused by a discoradicular interaction is also rare, whereas an osteophytic or metastatic compression becomes more likely (Box 8.4).

**History**

As a rule, the patient has had a history of recurrent bouts of unilateral cervicoscapular pain over the past years. The present symptoms start with the usual scapular pain, but this time they do not resolve spontaneously. On the contrary, one day the scapular pain may have become much worse and strictly unilateral, subsequently shifting to shoulder and arm (Box 8.5). The scapular pain then disappears or diminishes to a degree that it is no longer worthy of mention, whereas pain in the arm increases and remains severe for 1–2 months. The ache is sharp and permanent, and prevents the patient from sleeping. Sometimes the patient can only achieve rest by bringing the arm above the head – a position that relieves tension on the roots but also widens the intervertebral foramen and diminishes the pressure. This sign is highly suggestive of a discoradicular conflict, but is unlikely to be present in radiculopathy caused by spondylosis. The arm pain may be accompanied by pins and needles in some fingers, later followed by numbness. In order to make the differential diagnosis with other lesions that provoke paraesthesia, it is vital to collect more information...
about its behaviour: how far proximally does the paraesthesia spread, which fingers and what parts of them are involved, and when precisely are the pins and needles felt? A typical feature is that the paraesthesia has neither edge nor aspect within the fingers. Stroking the skin may provoke or increase pins and needles but moving the digits has no influence. Paraesthesia comes and goes, day or night, in an erratic fashion, appears without any definite reason and does not last for more than an hour at a time. In difficult cases, diagnostic traction may help: if the paraesthesia disappears during manual traction at the head and comes back when traction is released, the cause is clearly cervical. In most cases pain and paraesthesia disappear spontaneously, 6–10 weeks after the onset of the brachial pain. It may take months for the numbness to disappear completely.

**Inspection**

In very acute cases a pain-avoiding posture may be present: the head is held in side flexion, mostly away from the painful side. Severe root pain may force the patient to keep the arm at the side, well supported by the other hand.

**Examination**

The patient is asked about the precise location of the pain, which will enable the examiner to determine the dermatome and affected root. However, it is important to mention that the localization of the arm pain is not always a reliable localizing sign. Due to the high incidence of intradural connections between the dorsal rootlets of C5, C6 and C7 segments, there can be overlap between dermatomes, with one dermatome encompassing one or two adjacent segments. It may therefore be possible for an individual to have a dermatomal distribution that fails to match the classic pattern precisely. A better pointer to the level of compression is paraesthesia, and therefore, if the patient mentions pins and needles, more details should be sought about their localization.

Articular signs may be present but are not paramount. Usually only a slight partial articular pattern of internal derangement is seen; as the protrusion lies more outside the joint and the articular movements no longer interfere with it, articular signs are less important than root signs. Some active and passive movements may provoke or increase pain in the scapular area. The end-feel is crisp. It is possible, although not at all common, for neck movements to influence the pain and/or the pins and needles down the arm. The Spurling manoeuvre (a downwards pressure on an extended and rotated neck) may also elicit radicular pain and paraesthesia. Resisted movements of the head are negative.

At the end of the normal course of the disorder, neck movements become completely painless but the arm still hurts considerably. At this point the best diagnostic clue (apart from the history) is the characteristic pattern of root palsy on examination of the upper limb.

Weakness indicates which nerve root has become compressed. The degree of motor deficit can be very subtle. The examiner should therefore compare both sides carefully. Gross weakness (3 or 4) is a warning sign, indicating that the lesion is very probably non-discogenic in nature. Cutaneous analgesia is sought at the fingers and the reflexes are tested. An uncomplicated discoradicular interaction does not cause cord signs.

**Diagnosis**

The history shows the typical evolution of a posterolateral disc displacement: initial attacks of multisegmental cervicospinal pain, shifting to segmental pain, down the upper limb. As the pain increases, the accompanying symptoms follow a strict chronology:

- pain → paraesthesia → numbness → weakness

The examination confirms the history: the combination of a partial articular pattern and positive root signs.

**Different root syndromes and their differential diagnosis**

The nerve roots most frequently compressed by a disc are, in order of frequency, C7 (56–70%), C6 (19–25%), C5 (2–14%) and C8 (4–10%). Each nerve root lesion, whatever its cause may be, gives rise to pain felt in the skin area corresponding with the segment to which the nerve root belongs. The pain is the result of involvement of the dural sheath surrounding the nerve fibres. When the nerve parenchyma becomes affected too, paraesthesia will be felt down the nerve distribution in the arm. However, variations in the nerve distribution may occur, and pain and paraesthesia may be felt in areas which do not totally correspond to one specific dermatome. More involvement of the nerve fibres causes weakness of the muscles belonging to the same segment and cutaneous analgesia in some (mostly the distal) part of the dermatome. One should bear in mind that other (non-neural) soft tissue lesions may lead to exactly the same segmental pain. Therefore resisted tests, undertaken to examine nerve root conduction, also serve to test for alternative causes of pain down the limb.

**C1 and C2 nerve roots**

The absence of discs at the first two cervical levels implies that nerve root compression by discs cannot occur. Reference of pain to the C1 or C2 dermatomes (headache; Fig. 8.9) does not always mean that C1 or C2 nerve roots are involved; the pain may be multisegmental and the result of compression of the lower cervical dura by a posterocentral disc protrusion.

True segmental C1–C2 pain may be found in elderly people and is usually bilateral. It is hypothesized to be the result of arthrosis at the upper cervical joints involving the capsular and ligamentous structures.
The Cervical Spine

possibility is a trigeminal neuritis, which is characterized by paroxysms of severe, lancinating, electric bouts of pain restricted to the distribution of the trigeminal nerve. Ch 4 nerve root

Discogenic lesions of the fourth cervical nerve root are rare. Pain spreads from the lower half of the neck towards the point of the shoulder (Fig. 8.11). Paraesthesia seems not to occur at this level. In theory, weakness of the trapezius muscle should be found but in practice muscular weakness is not detectable. A horizontal band of cutaneous analgesia may be found along the spine of the scapula, the mid-deltoid area and the clavicle.

Differential diagnosis. It is important to remember that the upper scapular area is very often the site of multisegmental dural pain, resulting from a discodural interaction at any level. Upper scapular pain also occurs in: (a) disorders within the shoulder girdle, e.g. posterior sternoclavicular syndrome or a lesion of the first costotransverse joint; (b) some neurological conditions, e.g. mononeuritis of the long thoracic, spinal accessory or suprascapular nerves; and (c) some pulmonary or visceral disorders, e.g. inflammation of the gallbladder. Pain felt at the shoulder on deep breathing is typical in diaphragmatic pleurisy.
C5 nerve root
A C5 nerve root involvement is usually not the result of a disc lesion but is often the outcome of either a traction injury or compression by an osteophyte. Traction palsy of the C5 nerve root occurs after an injury that depresses the shoulder girdle and osteophytic palsy caused by encroachment into the fourth intervertebral foramen. Both result in gross weakness of the C5 muscles without pain.

Pain is felt along the lateral aspect of the arm and forearm as far as the base of the thumb (Fig. 8.12). Pins and needles do not seem to occur in C5 nerve root compression. Weakness may be found in supraspinatus, infraspinatus, deltoid and brachial biceps. A C5 sensory palsy from a disc is rare. The C5 dermatome provides the clue (see online chapter Nerve lesions and entrapment neuropathies of the upper limb).

Differential diagnosis. The differential diagnosis (see online chapter Nerve lesions and entrapment neuropathies of the upper limb) includes some peripheral nerve lesions and all pathology of the shoulder (see Chapters 14 and 15):

• Axillary nerve palsy after dislocation of the shoulder: this results in painless weakness and atrophy of the deltoid muscle and consequent weakness of abduction of the shoulder. Rotation movements remain strong.
• Mononeuritis of the spinal accessory nerve: there is painless weakness of the trapezius muscle which results in slight limitation of active elevation of the arm.
• Mononeuritis of the long thoracic nerve: this presents with painless weakness of the serratus anterior muscle. Active elevation of the arm is grossly limited.
• Mononeuritis or traumatic palsy of the suprascapular nerve: there is painless weakness of the infraspinatus (and supraspinatus) muscles.
• Neuralgic amyotrophy: this leads to gross weakness in several muscles.
• Herpes zoster: there is pain and a typical skin eruption in the C5 dermatome.
• Shoulder arthritis, supraspinatus tendinitis or infraspinatus tendinitis: pain down the C5 dermatome can be referred from the joint capsule or from a rotator cuff tendon.
• Rupture of the supraspinatus muscle: partial rupture leads to painful weakness and complete rupture to painless weakness of abduction at the shoulder.

C6 nerve root
The sixth cervical nerve root can become compressed by the C5 disc or by osteophytic outcrops originating from the uncovertebral joint or from the facet joint.

Pain runs along the anterior aspect of the arm, the volar aspect of the forearm and the radial side of the hand as far as the thumb and index finger (Fig. 8.13). Pins and needles are felt in the thumb and index finger. There is weakness of the biceps, brachialis, supinator brevis and the extensors of the wrist. Sometimes the subscapularis muscle is affected too.

Differential diagnosis. The differential diagnosis is from the following disorders:

• Rupture of the infraspinatus muscle: lateral rotation is painful and weak in partial rupture, and weak only in complete rupture.
• Metastases or fracture in the scapula: passive mobility of the scapula is limited and the muscles attached to it are weak.
• Myopathy: bilateral wasting of the supraspinatus and infraspinatus muscles is suggestive of myopathy. Arthritis from immobilization of the shoulder is then a painful complication.

Mechanical disorders

Fig 8.12 • The C5 dermatome.

Fig 8.13 • The C6 dermatome.
Fig 8.14 • The C7 dermatome.

Fig 8.15 • The C8 dermatome.

- **Tennis elbow**: tendinitis at the origin of the extensor carpi radialis brevis may be so acute that the patient often winces and lets the hand go when asked to extend it against resistance (see Ch. 19).

**C7 nerve root**

Compression of the seventh cervical nerve root by the C6 disc is far more common than compression at any other level.\(^{66}\)

Pain is felt at the posterior aspect of the arm and the dorsal aspect of the forearm as far as the second, third and fourth fingers (Fig. 8.14). Rarely, pain is experienced at the anterior and upper aspect of the chest and not in the arm. Pins and needles are mostly felt in the index, middle and ring fingers. The most conspicuous feature is weakness of extension of the elbow (triceps muscle). Flexion of the wrist may also be weak (flexor carpi radialis). In severe cases, resisted adduction of the arm is slightly weak and there may even be some visible wasting of the mid-portion of the pectoralis major. The examiner also notices that voluntary elevation of the arm is lacking over the final 5°. In the unusual circumstance of a larger part than usual of the serratus anterior muscle being derived over the final 5°. In the unusual circumstance of a larger part than usual of the serratus anterior muscle being derived from the C7 segment, winging of the scapula may be seen.\(^{78}\)

Cutaneous analgesia is sought at the dorsal aspect of the index and middle fingers. The triceps jerk is seldom affected, even in quite severe cases.

**Differential diagnosis.** The differential diagnosis is from the following disorders:

- **Lead poisoning**: one of the first signs is often bilateral weakness of extension of the wrist (see online chapter Nerve lesions and entrapment neuropathies of the upper limb).
- **Carcinoma of the bronchus**: this may also lead to bilateral weakness of extension of the wrist.
- **Tennis elbow**: a painful twinge with weakness of extension of the wrist may be found in acute cases (see C6 root).
- **Golfer’s elbow**: pain on resisted flexion of the wrist is the primary sign (see Ch. 19).
- **Tendinitis of the triceps muscle**: there is pain on resisted extension of the elbow (see Ch. 19).
- **Fracture of the olecranon**: resisted extension of the elbow is painful and weak but this picture is complicated by articular signs at the elbow joint (see Ch. 18).

**C8 nerve root**

The eighth cervical nerve root emerges between the seventh cervical and first thoracic vertebrae and can be compressed by the C7 disc.

Pain is felt at the inferior part of the scapular region and the ulnar aspect of the hand, over the middle, ring and little fingers and the ulnar and distal aspect of the forearm (Fig. 8.15). Pins and needles are experienced in the middle, ring and little fingers. The condition is easily confused with ulnar nerve problems (‘pseudo ulnar palsy’).\(^{79}\)

Both extensors of the thumb are weak. Other muscles affected are the ulnar deviators of the wrist, the adductor pollicis, the common extensor of the fingers and the abductor indicis. Occasionally the triceps muscle is also slightly weak. Cutaneous analgesia is found at the little finger.

**Differential diagnosis.** The differential diagnosis includes:

- **Thoracic outlet syndrome**: this may result in pins and needles in the ulnar fingers and sometimes in weakness of the intrinsic muscles of the hand too (see online chapter Nerve lesions and entrapment neuropathies of the upper limb).
- **Metastases in the C1 or T1 vertebra**: involvement of the C7 and C8 nerve roots at the same time is very suggestive of malignant disease.
- **Angina pectoris**: heart disease should always be considered when pain radiates to the left arm, especially to the ulnar aspect of the hand and forearm.
- **Traction palsy of the lower trunk of the brachial plexus**: this also affects the fibres derived from the C8 nerve root (see online chapter Nerve lesions and entrapment neuropathies of the upper limb).
- **Frictional neuritis of the ulnar nerve at the elbow or pressure on the ulnar nerve at the wrist**: (see online chapter Nerve lesions and entrapment neuropathies of the upper limb).
- **Thrombosis of the subclavian artery**: there is pain in the upper limb and an absent radial pulse.

**T1 nerve root**

This segment includes the upper limb and is therefore examined with the neck. Compression of the first thoracic nerve root by a T1 disc protrusion is very uncommon and never leads to a palsy.
Mechanical disorders

T1 pain is felt in two distinct sites: the pectoroscapular area and the ulnar aspect of the forearm (Fig. 8.16). The thoracic pain may be influenced by coughing and neck flexion. The T1 root is stretched by a forward movement of the scapulae, and by abducting the arm and flexing the elbow so that the hand comes to lie behind the neck. Pins and needles are felt at the ulnar side of the hand. A T1 palsy is characterized by weakness of the intrinsic hand muscles, but is never caused by a disc lesion. Also, numbness in the T1 area is always the result of a non-discal condition. A first thoracic palsy, together with Horner’s syndrome, is one of the main symptoms in Pancoast’s tumour and also vertebral metastases may involve the T1 nerve root.

**Differential diagnosis.** Differential diagnosis of a T1 lesion should be made from the following conditions (see online chapter *Nerve lesions and entrapment neuropathies of the upper limb*):

- **Cervical rib:** this may compress the lower trunk of the brachial plexus, which is partly derived from the T1 nerve root.
- **Compression of the median nerve:** in carpal tunnel syndrome, pain may sometimes spread to the forearm. Most of the muscles in the hand that are supplied by the median nerve are also partly derived from the T1 nerve root.
- **Compression of the ulnar nerve:** this may cause pins and needles in the ulnar border of the hand. All the small muscles of the hand that are innervated by the ulnar nerve are also partly derived from the T1 nerve root.
- **Amyotrophic lateral sclerosis:** weakness and atrophy of the small intrinsic muscles of the hand is often one of the first signs of amyotrophic lateral sclerosis.

**T2 nerve root**

The second thoracic nerve root is examined with the neck because it gives rise to symptoms felt in the upper limb. A disc lesion at this level is extremely rare. If it does occur, it gives rise to pectoroscapular pain radiating down the inner aspect of the arm as far as the elbow (Fig. 8.17). The pain is influenced by neck flexion, approximation of the scapulae and sometimes stretching of T1.

**Natural history**

In discoradicular interactions, spontaneous cure is the rule for both pain and neurological deficit. Patients with neurological deficit usually recover in about 3 months, and those without in 4 months, reckoned from the onset of the pain down the arm. The more marked the palsy, the more quickly the pain abates. Muscle strength will almost certainly have returned to normal 3–6 months after the pain ceased. The only exception is the C8 root, which may take 6 months or more to recover. The sensory disturbance recovers very gradually over a year.

Mochida et al performed follow-up studies, both clinical and with MRI, on 38 patients with lateral cervical disc herniations. All of them were treated with conservative therapy. The authors’ conclusion was: ‘migrating, lateral-type herniations regress so frequently that conservative treatment should be chosen not only for patients with radicular pain, but also for those with upper limb amyotrophy.’

**Treatment**

There are a number of approaches to treatment of nerve root problems.

**Prophylaxis**

Root pain can be avoided when the original cervicoscapular pain is recognized as the early stage of a disc protrusion and treated with manipulative reduction.

**Manipulation**

This can be tried in patients without neurological deficit and with favourable articular signs (neck movements hurt in the scapular area). Reduction in a few sessions is possible in the first 2 months after the onset of the brachial pain. After this period, the results are poor. Manipulation is almost impossible in patients with unfavourable signs (neck movements hurt down the arm or provoke pins and needles in the hand).

When the root pain has been present for some time or neurological deficit has set in, it is better to explain the mechanism of spontaneous cure to the patient and to wait for it. In the meantime, nerve root blocks are given to control the pain. Unilateral scapular pain and root pain of more than 6 months’ standing can often be helped with two or three manipulation sessions. The scapular pain ceases and the mechanism of spontaneous cures is restarted.

**Infiltration**

In those patients in whom manipulation fails or is no longer indicated, 1–6 infiltrations with 2 mL of a steroid solution at the nerve root may afford considerable relief. Pain and
Summary

These three clinical syndromes are most common (Box 8.6) and may be compared to the three pictures found at the lumbar spine (see chapter 33).

Less common syndromes

The syndromes described in this section are also based on disc lesions that, in contrast to the lumbar spine, may imperil the spinal cord. Cyriax believed that posterocentral disc protrusions may form the first step in the evolution towards spinal stenosis. An unreduced central disc displacement exerts continuous pressure on the posterior longitudinal ligament. The latter draws the periosteum away from the vertebral bone. Bone grows towards the periosteum and osteophytes form. These diminish the anteroposterior diameter of the spinal canal and spinal stenosis syndrome develops (see p. 164).

The clinical pictures that appear during the first stage of this development are still reversible by simple manual techniques. Once bony narrowing of the spinal canal has started, however, reduction is impossible.

Acute torticollis with central pain and a symmetrical picture

History

A young or middle-aged person develops severe central neck pain, either spontaneously or as the result of trauma, usually a whiplash injury. The pain fixes the head in a flexed position. Shortly afterwards, both upper limbs may also become painful with a feeling of weakness. Paraesthesia appears distally in both arms or in all four limbs.

Examination

In acute cases, the neck is usually fixed in flexion, which may be so extreme that the chin touches the sternum, extension being totally impossible. The movement pattern is symmetrical, with both rotations and both lateral flexions equally limited. Active elevation of both arms is painful and sometimes limited. There are no root signs. Cord signs are usually absent, except in extreme cases where pyramidal tract signs may be found.

Diagnosis

Diagnosis rests on the history (sudden onset) and on the clinical examination, which shows an extreme limitation of extension.

Differential diagnosis

Differential diagnosis includes conditions that present with a full articular pattern: for example, fracture of a vertebral body and other bony disorders. A similar pattern with gross limitation of extension is also seen in severe ankylosing spondylitis.

Natural history

This type of torticollis tends to recover spontaneously, although very slowly.
### Root Syndromes in Neck and Upper Limb

<table>
<thead>
<tr>
<th>ROOT</th>
<th>SHEATH</th>
<th>NERVE FIBRES</th>
<th>DIFFERENTIAL DIAGNOSIS</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td>Dural reference</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Osteophyte at the atlanto-axial joint</td>
</tr>
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<td>C3</td>
<td></td>
<td>None</td>
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</tr>
<tr>
<td>C4</td>
<td></td>
<td>None (trapezius muscle?)</td>
<td>Dural reference</td>
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**Fig 8.19** Root syndromes in neck and upper limb.
### Differential Diagnosis

<table>
<thead>
<tr>
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<th>Sheath</th>
<th>Nerve Fibres</th>
<th>Sensory Deficit</th>
<th>Motor Deficit</th>
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<tr>
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<td></td>
<td>Infraspinatus</td>
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<td></td>
<td>Biceps</td>
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<td>Triceps Flexor carpi radialis (Extensor carpi radialis) (Serratus anterior)</td>
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<td>Brachioradialis</td>
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<td>Major</td>
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<td>Triceps Flexor carpi radialis (Extensor carpi radialis) (Serratus anterior)</td>
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</table>

**Continued**

[Fig 8.19](#) - Root syndromes in neck and upper limb (cont'd).
### Mechanical disorders

#### Pain

- Pressure on the brachial plexus by a cervical rib
- Pressure on the brachial plexus by the first rib
- C7 or T1 neoplasm
- Pancoast's tumour (apex of the lung)
- Angina
- Traction on the inferior trunks of the brachial plexus with neurological deficit
- Frictional neuritis of the ulnar nerve at the elbow
- Pressure on the ulnar nerve at the wrist
- Thrombosis of the subclavian artery

#### Paraesthesia

- Extensor and flexor carpi ulnaris
- Extensors and adductores pollicis
- Extensor digitorum communis (Triceps)

#### Motor deficit

- Palsy = not a disc

#### Sensory deficit

- Palsy = not a disc

#### SHEATH

- None

#### NERVE FIBRES

- None

#### DIFFERENTIAL DIAGNOSIS

- C8

#### Root syndromes in neck and upper limb (cont’d).

<table>
<thead>
<tr>
<th>ROOT</th>
<th>SHEATH</th>
<th>NERVE FIBRES</th>
<th>DIFFERENTIAL DIAGNOSIS</th>
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<td>C7 or T1 neoplasm</td>
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<td>Pancoast’s tumour (apex of the lung)</td>
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<td>Traction on the inferior trunks of the brachial plexus with neurological deficit</td>
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<td></td>
<td></td>
<td>Thrombosis of the subclavian artery</td>
</tr>
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<td>Palsy = not a disc</td>
<td>Cervical rib</td>
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<td></td>
<td></td>
<td></td>
<td>Pulmonary sulcus tumour</td>
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<td>Pressure on the median nerve</td>
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<tr>
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</table>
The Cervical Spine

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painful, these are usually flexion and extension. As long as the pressure on the spinal cord is not considerable, symptoms alone dominate the presentation and there are no root or cord signs.

Increased compression leads to the manifestation of the clinical syndrome of cervical myelopathy (see p. 165): a positive plantar reflex, incoordination and spasticity of the lower limbs and weakness of the upper limbs. 87

Diagnosis

The history is very important, especially at the beginning of the process, before cord signs and symptoms have supervened. The patient will probably have had attacks of torticollis or of unilateral cervicoscapular pain in the past. Centralization of the pain as age advances, together with a painless full articular pattern on examination, suggests this type of disc lesion. When involvement of the spinal cord is suggested (multisegmental paraesthesia, gait disturbance), examination becomes decisive.

Differential diagnosis

When central or bilateral pain is present, great care should be taken to make a differential diagnosis from other lesions that may cause similar symptoms: arthrosis, ankylosing spondylitis, rheumatoid arthritis, recent fracture, postconcussional syndrome, and bone disease. In the presence of bilateral paraesthesia, differential diagnosis must be made from sensory stroke and disseminated sclerosis.

Natural history

There is a tendency towards spontaneous cure but regression of the disc protrusion is slow.88

Treatment

Manipulative reduction is the treatment of choice but rotation manoeuvres are avoided. The therapist should choose the techniques with great care and perform them very cautiously to avoid further displacement towards the spinal cord or stretching of the posterior longitudinal ligament.

Central or bilateral pain in the neck, trapezius or scapular area

The condition causes central neck pain, with or without bilateral radiation to occiput, trapezius and scapulae, although slow painless development also occurs. Pain is the result of the pressure exerted on the dura mater (Fig. 8.20). Cord symptoms indicate involvement of the spinal cord. Cord signs point to irreversible impairment of conduction. The evolution from pain, through cord symptoms to irreversible cord signs may take several years to develop.

History

Patients are usually middle-aged. They start complaining of central neck ache, which later spreads bilaterally from the occiput to both trapezius. Gradually the pain expands, radiating down to the interscapular area and both scapulae. There may come a time when both upper limbs start to ache. Pain in the arms may alternate: if it is more severe on one side, it is correspondingly less so on the other. By the time the pain has become constant, pins and needles may start, first in both hands, some time later in both feet too. Neck flexion may bring on or increase the pins and needles.

In the middle-aged or elderly patient, the whole process may be entirely painless. It starts with pins and needles in all four limbs: first in both hands, later radiating into the lower limbs, from the front of both knees to the feet. Gradually the gait may become disturbed and weakness appears in both hands.

Examination

Articular signs may be quite inconspicuous. Pain is constant but is not very much influenced by articular movements. If the patient is elderly, a full articular pattern of limitation may be found with a hard, arthrotic end-feel. If any movements are painful, these are usually flexion and extension. As long as the pressure on the spinal cord is not considerable, symptoms alone dominate the presentation and there are no root or cord signs.

Increased compression leads to the manifestation of the clinical syndrome of cervical myelopathy (see p. 165): a positive plantar reflex, incoordination and spasticity of the lower limbs and weakness of the upper limbs.87

Diagnosis

The history is very important, especially at the beginning of the process, before cord signs and symptoms have supervened. The patient will probably have had attacks of torticollis or of unilateral cervicoscapular pain in the past. Centralization of the pain as age advances, together with a painless full articular pattern on examination, suggests this type of disc lesion. When involvement of the spinal cord is suggested (multisegmental paraesthesia, gait disturbance), examination becomes decisive.

Differential diagnosis

When central or bilateral pain is present, great care should be taken to make a differential diagnosis from other lesions that may cause similar symptoms: arthrosis, ankylosing spondylitis, rheumatoid arthritis, recent fracture, postconcussional syndrome, and bone disease. In the presence of bilateral paraesthesia, differential diagnosis must be made from sensory stroke and disseminated sclerosis.

Natural history

There is a tendency towards spontaneous cure but regression of the disc protrusion is slow.88

Treatment

Manipulative reduction is the treatment of choice but rotation manoeuvres are avoided. The therapist should choose the techniques with great care and perform them very cautiously to avoid further displacement towards the spinal cord or stretching of the posterior longitudinal ligament.

Central or bilateral pain in the neck, trapezius or scapular area

The condition causes central neck pain, with or without bilateral radiation to occiput, trapezius and scapulae, although slow painless development also occurs. Pain is the result of the pressure exerted on the dura mater (Fig. 8.20). Cord symptoms indicate involvement of the spinal cord. Cord signs point to irreversible impairment of conduction. The evolution from pain, through cord symptoms to irreversible cord signs may take several years to develop.

History

Patients are usually middle-aged. They start complaining of central neck ache, which later spreads bilaterally from the occiput to both trapezius. Gradually the pain expands, radiating down to the interscapular area and both scapulae. There may come a time when both upper limbs start to ache. Pain in the arms may alternate: if it is more severe on one side, it is correspondingly less so on the other. By the time the pain has become constant, pins and needles may start, first in both hands, some time later in both feet too. Neck flexion may bring on or increase the pins and needles.

In the middle-aged or elderly patient, the whole process may be entirely painless. It starts with pins and needles in all four limbs: first in both hands, later radiating into the lower limbs, from the front of both knees to the feet. Gradually the gait may become disturbed and weakness appears in both hands.

Examination

Articular signs may be quite inconspicuous. Pain is constant but is not very much influenced by articular movements. If the patient is elderly, a full articular pattern of limitation may be found with a hard, arthrotic end-feel. If any movements are
the degenerative condition is not painful in itself and leads only to some stiffness. It is the clinician’s task to determine the possible relationship between the degenerative changes and the patient’s symptoms. Non-symptomatic arthrosis at the cervical spine shows painless limitation of movement in the capsular proportions whereby the movements are merely uncomfortable at the end of range. The end-feel is hard.

Symptomatic cervical spondylitis should be diagnosed purely on clinical grounds, through history and clinical examination. When cervical movements influence the patient’s symptoms, the problem clearly lies within the spine but this does not necessarily imply that arthrosis is responsible. Although degeneration is not painful of itself, it can lead to symptomatic conditions such as: ligamentous contracture, overstretching of a facet joint, radicular compression by osteophytes or cervical spinal stenosis. The diagnosis of these lesions should be made on clinical grounds and not on imaging.

Local pain

Pain in the neck, either unilateral or bilateral, and with or without radiation to the head, occurs in degenerative conditions affecting the upper cervical ligamentous complex or the facet joints. This takes place in arthrosis of the upper two cervical joints, in subacute arthritis of the atlantoaxial joint, in facet joint arthrosis or in traumatic osteoarthrosis.

Morning headache in the elderly

‘Morning headache’ in the elderly is believed to stem from ligamentous contracture at the atlanto-occipital and atlantoaxial complexes. The hypothesis relies on the typical distribution of pain in the C1–C2 dermatomes, the leathery end-feel on clinical examination and the uniformly good results with mobilization.

As age advances, increasing pain develops in the C1–C2 dermatomes: the middle of the upper neck and the occiput, the temples and the forehead (C2). Local pain may be totally absent, so that the patient complains of occipitofrontal headache only. The headache is only on waking and happens without fail every morning. After some hours the pain begins to diminish and by midday all symptoms have ceased, only to return the next morning. Later in the course, the pain may last longer into the day.

On examination a full articular pattern is found. The movements are not very painful but merely stiff and uncomfortable. The end-feel is hard but not bone-to-bone; rather it is leathery, showing capsular contracture. Radiography demonstrates a certain degree of arthrosis, normal for the patient’s age.

The differential diagnosis is between traumatic arthrosis and postconcussional headache. In both, the history is distinctive (see pp. 164 and 168).

The condition is very easily cured by manipulation: 1–4 sessions of slow capsular stretching make all symptoms disappear. Age is not a contraindication to manipulation but the older the patient, the more gradually the therapist must work: fewer manoeuvres are carried out in one session and the interval between the sessions is longer (see Ch. 11 and summary in Box 8.7).

Subacute arthritis of the atlantoaxial joint

Subacute arthritis of the atlantoaxial joint is rare. The patient, aged between 25 and 40, develops stiffness and discomfort in the middle of the upper neck, and over the following weeks these symptoms gradually increase. On clinical examination, extension, both side flexions and flexion movements are full and painless. Both rotations are equally painful and very limited – only 10–20% is possible. Even in a supine position, the range remains unchanged. The end-feel is soft. This combination of symptoms and signs is clearly a warning sign but further investigations, such as blood tests and imaging, remain negative. The aetiology remains unclear but the disorder recovers in a couple of months with anti-inflammatory therapy.

Arthrosis of a facet joint

The prevalence of cervical facet joint degeneration is very high in individuals aged 50 years and more, with a tendency to increase in severity with age. Contrary to the lumbar spine, where there is an increase in degeneration towards the lower segments, in the cervical spine all levels of the middle and lower cervical spine are affected to almost the same degree. However, the relation between the high prevalence of radiographic zygapophyseal arthrosis and neck pain is not clear. It is not well understood why arthrosis at a facet joint becomes symptomatic in one person and not in another. Cyriax hypothesized that pain results from the formation of adhesions and a ‘self-perpetuating inflammation’, which follows overstretching of the arthrotic joint capsule.

Diagnosis of a facet joint lesion is not easy and is always tentative. Some elements from the history and clinical examination may help in differentiating a facet joint lesion from a discodural conflict. In doubtful cases, local infiltration with lidocaine may prove diagnostic. The pain has a spontaneous onset, is unilateral and does not spread. When the facets are bilaterally affected, the pain is bilateral, sparing the centre of the neck. Dural symptoms are absent. Pain is felt when certain positions have to be maintained for a period of time.

On examination, a partial articular pattern is found: some movements become unobtainable, especially passive ones, hurt. The end-feel is rather hard. The fact that the pain is quite localized and does not radiate indicates the possibility of a facet joint lesion. Troisier distinguishes a ‘convergent’ and a ‘divergent’ pattern of painful movements (Figs 8.21 and 8.22). In the first, there is pain on extension and on lateral flexion and rotation towards...
Radicular complaints: osteophytic root compression

A nerve root can become compressed by osteophytes and bony spurs in the neural foramen. The root normally occupies about one-third of the space in the foramen and is accompanied by radicular arteries and veins. The spinal nerve root is vulnerable to compression, anteriorly by an osteophyte derived from the uncovertebral joint and posteriorly by one originating from the facet joints, or from both (Fig. 8.23). These phenomena are secondary to degeneration of the intervertebral disc, with subsequent dehydration and collapse. This disintegration causes increased mechanical stress at the uncovertebral joints and the facet joints, leading to the formation of subperiosteal bone and osteophytic outgrowth, and finally resulting in narrowing of the intervertebral foramen and encroachment of the nerve.\textsuperscript{103,104}

Symptoms of osteophytic radiculopathy usually develop insidiously, but are sometimes triggered by trauma. The patient is over 50 and complains of paraesthesia and weakness in the arm, sometimes pain. Contrary to a disc that causes radicular pain, in osteophytic root compression there is or was not much pain in the neck or scapular area, merely some stiffness. Also the root pain is very moderate, though it may be present for several months. The main complaints are paraesthesia in the arm or fingers and a gradually increasing weakness of the arm. On examination, a full but painless articular pattern with a hard end-feel is found, indicating arthrosis. If any movement does hurt, it is usually side flexion towards the affected side, and a twinge may travel down the arm. Alternatively, waves of paraesthesia may be felt in the distal part of the relevant dermatome and are clearly the result of the osteophyte being pushed against the nerve root. The Spurling manoeuvre (a downward pressure on an extended and rotated neck) may also elicit radicular pain and paraesthesia.\textsuperscript{28} Isometric testing of the upper limb shows segmental weakness. The most frequent localization is C4–C5. A combination of higher uncinate process, smaller anteroposterior diameter of the intervertebral foramen, and a longer course of the nerve root in close proximity to the uncovertebral joint may explain the predilection of

the painful side. In the second, the opposite is found: flexion, lateral flexion and rotation away from the painful side hurt. Such a pattern is compatible with facet joint involvement but does not exclude a discodural interaction. Differentiation between these lesions is always difficult.

This condition responds to deep transverse massage at the joint capsule and slow stretching manipulation. Infiltration with a steroid suspension is an alternative (Box 8.8).
nerve root compression at this level. The C5 nerve root thus becomes compressed, identified by the difficulty or sometimes even inability to bring the arm up. In severe cases, the deltoid may become wasted.

The differential diagnosis is from root compression by a disc protrusion or by a neura or metastases, and can usually be made on a clinical basis (Table 8.2). The osteophyte grows slowly and lies quite far laterally so that it does not exert pressure on the dural investment of the nerve root. Therefore intense pain, as would occur in a discoradicular interaction, is seldom present. The patient complains mainly of paraesthesia first, followed by pain that starts distally and spreads to both arms and hands. All symptoms disappear when the anatomical situation has not changed. When there is gross muscular weakness or weakness has a tendency to increase, surgical treatment is indicated. During the last few decades, a minimally invasive posterior cervical foraminotomy technique has been developed that is highly effective and results in long-lasting pain relief.

**Box 8.9**

**The mushroom phenomenon**

- Elderly patient
- Increasing pain in any position, except lying
- Diminution of symptoms under traction
- Full articular pattern
- Radiographic evidence

This phenomenon is extensively described in later chapters on the thoracic and lumbar spine (see Chs 27 and 35) and is summarized in Box 8.9. A cervical mushroom phenomenon is very rare. It occurs in advanced degeneration of the disc, which displaces mainly in the anterior and anterolateral directions. The intervertebral space becomes so narrow that the vertebral bodies lie in apposition. This phenomenon, together with folding of the posterior longitudinal ligament and enlargement of the arthrotic facet joints, can cause considerable narrowing of the spinal canal and the lateral recess, which may result in compression of dura or nerve root during axial loading.

An elderly patient will state that there are no symptoms as long as recumbency is maintained: in that position the head can be moved easily in every direction without any problems. However, on standing or sitting for a certain amount of time, vague, central and bilateral pain in the neck develops and spreads to both arms and hands. All symptoms disappear when traction is applied or the head lifted upwards with the hands. On examination, a full articular pattern is found: painless limitation of movement with a hard end-feel. There are no radicular signs and no cord signs; consequently the diagnosis rests mainly on the history. A radiograph shows severe arthrosis with gross narrowing of the intervertebral space.

The patient can be helped either by a weight-relieving collar or by surgery (arthrodesis).

**Cervical spondylotic myelopathy**

Cervical spinal myelopathy (CSM) is defined as spinal cord dysfunction, secondary to intrinsic compression from degenerative disease of the cervical spine. It is the most common cause of spinal cord dysfunction in patients who are aged over 55. The presence of a congenitally narrow spinal canal is a critical predisposing factor in patients with spondylotic...
myelopathy.114 The anteroposterior diameter of the cervical spinal cord is 10 mm on average and normally the sagittal diameter of the spinal canal averages ± 18 mm. It is therefore generally accepted that a spinal canal with a diameter between 10 and 13 mm is at risk and can only sustain a narrowing of 2–4 mm before developing myelopathy.115,116

Pathogenesis
Symptoms of myelopathy occur in a wide variety of combinations. In its most severe form the clinical presentation is a spastic gait. There may be atrophy, sensory disturbance and spasticity in the hands. Sometimes impairment of sphincter function also occurs.117 The variable clinical picture reflects the many complex factors that may affect the spinal cord. The primary pathophysiological abnormality is a reduced sagittal diameter of the spinal canal. In that narrowed canal, two different mechanisms – a mechanical and a vascular one – can cause pathological changes in the spinal cord. White and Panjabi118 divide the mechanical factors involved in the pathogenesis of CSM into two groups: static and dynamic. Static factors include the well-known arthritic changes that narrow the canal: a spondylotic bar anteriorly, degenerative osteophytosis of the uncovertebral joints and facet joints laterally, and hypertrophic ligamenta flava posteriorly (Fig. 8.24).119,120 Dynamic factors are abnormal forces placed on the spinal column and spinal cord during flexion and extension. Diminution of the diameter of the spinal canal occurs during extension (because of folding of the posterior longitudinal ligament and of the yellow ligament121) and during flexion (the spinal cord is pulled against the osteophytes).122 Also degenerative cervical spondylolisthesis may cause excessive movement.123,124 During extension, backward gliding of the vertebrae, in combination with folding of the posterior ligaments, may result in cervical cord encroachment (the pincer effect) (see Fig. 8.24).125

Another mechanical theory is that CSM is caused by tensile stresses transmitted to the spinal cord from the dura via the dentate ligaments.126 A spondylotic bar pushes the spinal cord posteriorly, but this displacement is resisted by the dentate ligaments that are anchored by the dural root sleeves in the lateral foramen.127 This theory could explain the neuropathological findings in CSM where damage to the spinal cord is most severe at the lateral columns, and in them the involved areas are often wedge-shaped, with the apex medial and the base lateral.128

Other authors consider spinal cord ischaemia to be a major cause of CSM, either through compression of the anterior spinal artery and its branches in the spinal cord, or through the radicular arteries in the intervertebral foramina. This vascular theory is not widely accepted and most believe that a combination of both mechanical and vascular causes has to be considered (Box 8.10).129,130

Diagnosis
CSM usually develops insidiously, although episodes of abrupt deterioration can occur.

Symptoms
A subtle gait disturbance is usually the first and most common presentation.131 Although CSM can cause a variety of signs and symptoms, spastic gait occurs first, followed by upper extremity numbness and clumsiness. There is loss of fine motor control of the hands and difficulty in writing. Surprisingly, neck pain is not as common a symptom as one might expect, maybe because some pain and stiffness is accepted as normal for the person’s age.

After some years, when the situation gets worse, patients develop a typical ‘spastic gait’ that is broad-based, hesitant and jerky. This gait is one of the main characteristics of cervical myelopathy. Nurick has classified CSM largely on the basis of gait abnormality – typically the most common clinical concern of the patient (Table 8.3).132

There are also sensory changes in the lower extremities, which the patient typically describes as ‘walking on cotton wool’. Bowel and bladder dysfunction may supervene; according to Epstein et al, 20% of patients with CMS over the age of 65 have bladder dysfunction, mostly associated with urinary retention.133

![Fig 8.24 • Mechanical factors involved in cervical spondylotic myelopathy (coronal section). PLL, posterior longitudinal ligament.](image)
Table 8.3 Nurtick’s classification of disability in spondylotic myelopathy

<table>
<thead>
<tr>
<th>Grade</th>
<th>Symptoms and signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Root symptoms and signs</td>
</tr>
<tr>
<td></td>
<td>No evidence of cord involvement</td>
</tr>
<tr>
<td>I</td>
<td>Signs of cord involvement</td>
</tr>
<tr>
<td></td>
<td>Normal gait</td>
</tr>
<tr>
<td>II</td>
<td>Mild gait impairment</td>
</tr>
<tr>
<td></td>
<td>Able to be employed</td>
</tr>
<tr>
<td>III</td>
<td>Gait abnormality prevents employment</td>
</tr>
<tr>
<td>IV</td>
<td>Able to ambulate only with assistance</td>
</tr>
<tr>
<td>V</td>
<td>Chair-bound or bedridden</td>
</tr>
</tbody>
</table>

**Signs**

Examination of the neck is usually not very painful but reveals a gross full articular pattern of limitation with a hard end-feel, suggesting severe arthrosis. Flexion and extension may elicit electric shock sensations in the extremities (Lhermitte’s sign), which is present in about one-quarter of myelopathic patients.135,136

**Neurological examination**

Compression of the spinal cord typically leads to ‘upper motor neurone’ findings distal to the level of compression (i.e. spasticity, hyperreflexia, clonus, positive Babinski and Hoffmann signs). These often occur in combination with ‘lower motor neurone’ findings at the level of compression (e.g. weakness, hyporeflexia and atrophy). For example, in a lesion at C4 level, with compression of both C5 nerve roots and of the spinal cord at that level, everything above C5 is normal. C5 shows weakness of abduction and external rotation of the shoulder and some weakness of flexion of the elbow. There is no spasticity and the biceps jerk is sluggish or absent. Below C5 there is spasticity, with clonus and hyperreflexia: an exaggerated triceps jerk and clonus at the patella and the ankle.

Other functional tests can be performed and, when positive, are very suggestive of CSM, though none of these tests in itself has pathognomonic value. Ono et al, for instance, observed a characteristic abnormality in the hands of patients with CSM. There was inability to extend the ulnar two or three fingers, despite the relatively well-preserved function of the wrist, thumb and index finger. Rapid extension of the fingers was impossible, even in patients with less advanced disease. Also Hoffman’s sign is very often positive. The sign is described as follows. The pronated hand is supported so that it is completely relaxed and the fingers partially flexed. The middle finger is firmly grasped and partially extended, and the nail is flicked by the examiner’s thumbnail. The flicking should be done with considerable force. The sign is present if quick flexion of both the thumb and the index finger results. A positive sign is highly indicative of possible pyramidal tract pathology. Shimizu et al described the scapulohumeral reflex, which is positive in more than 95% of patients with high cervical cord compression. The scapulohumeral reflex is elicited by tapping the tip of the spine of the scapula and acromion in a caudal direction and is positive when elevation of the scapula or abduction of the humerus is seen. The reflex centre of the scapulohumeral reflex is clinically presumed to be located between the posterior arch of C1 and the caudal edge of the body of C3. A hyperactive scapulohumeral reflex therefore provides useful information about dysfunction of the upper motor neurones cranial to the level of the C3 vertebral body. As the disease develops, Babinski’s sign and its variants, Chaddock (stimulation below the external malleolus causes extension of the great toe) and Oppenheim (stroking down the medial side of the tibia causes extension of the great toe), become positive.141

In addition, sensory disturbances are very often present. There may be loss of contralateral pain and temperature sensation because of compression of the spinothalamic tract. The neurological level is several segments below the area of compression. Ipsilateral proprioception and vibration sense may be disturbed as a result of a lesion of the posterior columns. Dermatomal sensation (appreciation of light touch as well as tactile discrimination in pinprick tests) can be affected by a dorsal nerve root compression.

**Differential diagnosis**

The differential diagnosis of CSM is not easy. It is important to exclude both multiple sclerosis and upper motor neurone disease (amyotrophic lateral sclerosis), as their presentations are very similar to that of CSM. A thorough neurological examination is therefore necessary. Most importantly, CSM does not affect the cranial nerves or the normal jaw reflex, whereas the other two disorders may. Other disorders in the differential diagnosis include spinal tumours, cerebrovascular disorders that cause spastic hemiplegia and peripheral neuropathy.

**Amyotrophic lateral sclerosis**

Amyotrophic lateral sclerosis (ALS) is a disorder of the anterior horn cells and of the pyramidal tract (first motor neurone). The disease starts between the ages of 40 and 70 in one (commonly upper) limb and advances progressively to the contralateral upper and later the lower limbs. Depending on the localization in the upper or lower motor neurone, spastic or weak paralysis will predominate. The classic triad is atrophic weakness of the hand and forearm muscles, minor spasticity of the legs and generalized hyperreflexia, but without sensory changes; as a pure motor neurone disease ALS does not affect sensation. A diagnosis of ALS is further favoured if there are muscular fasciculations in the face, tongue or lower extremities. The diagnosis is supported by typical findings on electromyography (EMG).

**Multiple sclerosis**

Multiple sclerosis (MS) is a chronic inflammatory disease of the central nervous system with the morphological hallmarks of inflammation, demyelination, axonal loss and gliosis. The spinal form of MS in particular may mimic the clinical course of CSM: there is a generalized spastic paralysis and clonus, and the patient also experiences paraesthesia. However, the patient is younger – the average age of onset is 30 years. Diagnosis relies on EMG findings, typical appearances on MRI and cerebrospinal fluid analysis.
Capsuloligamentous disorders

Capsuloligamentous disorders of the cervical spine are sometimes described under the heading 'postconcussional syndrome'. This is a term used to describe the occipital headache and/or upper cervical pain that remain after a concussion which may have sprained the upper cervical ligaments and, less often, the muscles. The pain is believed to be caused by ligamentous adhesion formations.

However, the diagnosis is often tentative and, as the patient is very often claiming compensation, the examiner has to take into account the possibility of neurosis or aggravation. Careful history taking and clinical examination should enable the examiner to come to a precise diagnosis. When the patient presents a history with inconsistencies or unlikely combinations of findings and this is followed by an examination during which the signs do not correspond, the patient is probably confabulating. However, when adhesions in the occipito-atlantoaxial ligaments are responsible, the picture is one of pain at the extremes of extension, both rotations and both lateral flexions.
The condition can easily be treated by mobilization. One to three sessions of quick stretch manipulations break the adhesions, after which all symptoms should disappear.

**Disorders causing pain on resisted movements of the neck**

**Musculotendinous lesions**

The presence of a clear contractile tissue pattern is suggestive of a musculotendinous lesion but this is not common in the region of the neck. Only two conditions are rarely encountered: a lesion of the semispinalis or splenius capitis muscle and a lesion of the longus colli muscle, so-called retropharyngeal tendinitis.

**Lesions of the semispinalis or splenius capitis muscle**

It is understandable that a patient who has had an accident severe enough to cause concussion may also suffer from musculotendinous lesions in the suboccipital muscles. This is infrequent but after recovery from concussion the patient may be left with unilateral or bilateral occipital pain, sometimes radiating to the head. In most instances, a lesion of the occipital muscles does not occur in isolation but in combination with a lesion of the occipito-atlantoaxial ligaments.

On examination, resisted movements are positive. In unilateral pain, resisted extension and resisted side flexion towards the painful side are both painful. In bilateral cases, resisted extension and resisted flexion to both sides may be positive. Palpation shows the lesion to lie at the insertion of the semispinalis capitis muscle, rarely at that of the splenius capitis.

Treatment consists of two or three sessions of deep transverse massage. In more chronic cases, up to 6 weeks’ treatment may be required.

**Lesion of the longus colli muscle** *(retropharyngeal tendinitis)*

Retropharyngeal calcific tendonitis, also known as acute calcific prevertebral tendinitis, is a clinical syndrome that was described originally by Hartley in 1964, and was later demonstrated to be secondary to calcium hydroxyapatite deposition in the longus colli muscle. This muscle is a paired neck flexor that comprises the prevertebral space (Fig. 8.25). Classically, calcification affects the superior oblique portion of the longus colli muscle at the C1–C2 level (Fig. 8.26). The condition affects adults within a reported age range of 21–81 years, with its greatest distribution between 30 and 60 years. The incidence of this condition is rare, although its true incidence is probably higher than previously thought.

The history and clinical examination are very characteristic. The patient quite suddenly develops a severe, bilateral pain occupying the whole head and neck area and can hardly move the head. Swallowing is very painful and hurts so much that the head is held with both hands. The pain is felt not in the throat, but in the neck. There is no fever. After a few days the pain diminishes, and disappears completely after a few weeks.

On examination a full articular pattern of limitation of movement is found on active testing. Passive movements show a different pattern: when they are done gently, flexion and both side flexions can be performed to full range; extension and both rotations remain very limited and the end-feel is spastic. Resisted rotations and resisted flexion are painful.

The lateral radiograph shows swelling of the retropharyngeal space and amorphous calcification anterior to C1–C2. The thickening of the shadow thrown by the longus colli muscles is such that it increases from the usual 3 mm to 10 or 15 mm.

CT shows the pathognomonic tendinous calcifications within the longus colli and can also demonstrate sterile fluid smoothly expanding the retropharyngeal space. In the presence of a fluid collection, the possibility of infection must be considered, specifically abscess from lymphadenitis.
Disorders causing symptoms on active and/or resisted shrugging of the shoulders

Examination of the shoulder girdle is part of the scan examination of the cervical spine. Some conditions in the scapular area and shoulder girdle may provoke positive signs during this examination. These lesions are extensively discussed in the online section *The shoulder girdle*. They are:

- Lesion of the costocoracoid fascia
- Lesion of the sternoclavicular joint
- Lesion of the first costotransverse joint
- Lesion of the conoid/trapezoid ligament
- Lesion of the subclavian muscle
- Lesion of the levator scapulae muscle
- Thoracic outlet syndrome
- Upper lung disorder (warning sign).

Serious disorders

Resisted movements of the neck may be painful and/or weak in more serious conditions, because the muscular contraction pulls at an affected structure (i.e. bone) or squeezes a tender structure (i.e. inflamed lymph glands or abscess). This combination of signs has to be considered a warning sign. The possible conditions are:

- Vertebral metastases
- Fracture of the first rib
- Fracture of the spinous process of C7 or T1
- Wedge fracture of a vertebral body
- Glandular fever
- Retropharyngeal abscess
- Postconcussional syndrome
- Lesion of the sternoclavicular joint (see the online section *The shoulder girdle*).

The differential diagnosis includes traumatic fracture/dislocation of the vertebra, retropharyngeal abscess, meningitis and infectious spondylodiscitis.

Treatment consists of rest and administration of oral non-steroidal anti-inflammatory drugs for 1–2 weeks. The condition undergoes spontaneous cure in 2–3 weeks; pain eases, motion returns, and swelling and calcification disappear almost simultaneously.

Access the complete reference list online at [www.orthopaedicmedicineonline.com](http://www.orthopaedicmedicineonline.com)
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