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WHAT SHOULD BE DONE FOR THE PATIENT WITH NECK PAIN (X-RAYS SHOW CERVICAL SPONDYLOSIS)?

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INTRODUCTION
The term cervical spondylosis on an x-ray report refers to the radiographic changes associated with the degenerative process affecting the discs and the facet joints of the cervical spine. In general practice the condition is a common cause of symptoms, which most frequently begin around 50-55 years – that is somewhat later than in lumbar spondylosis – and predominantly affects males. As in lumbar disc degeneration, the radiographic changes and symptoms suffered correlate poorly, and most individuals will have some radiographic evidence of spondylosis from the age of about 35 years. As in lumbar spondylosis, early cervical spondylotic pain is often mild, intermittent and localised to the neck. As the degenerative process progresses, pain may worsen and be associated with excess local muscular activity. The latter may be an unconscious attempt at bracing the neck structures, with the aim of reducing pain, but such muscular overactivity may cause pain in the muscles themselves – think of the pain felt during a true muscle cramp! Muscle overactivity could explain why spondylotic patients often describe muscular discomfort in the neck, trapezius and supraspinatus muscles, and why tender points can often be palpated in these muscles. It is well recognised that, though poorly understood why, previously asymptomatic individuals develop persistent spondylotic neck pain following a traumatic event, such as a whiplash injury, especially when radiographs confirm spondylotic changes which must have preceded the injury.

As cervical degeneration progresses, the situation is complicated by hypertrophic facet joint changes, i.e. osteophytosis, and disc herniations, which may encroach upon nerve roots as they exit the spine in the exit foramina. The result is nerve root symptoms and potentially signs. Cervical spine instability is relatively rare in purely degenerative spondylosis, although it is more common in inflammatory conditions which have the potential to affect the soft tissues of the neck, e.g. rheumatoid and psoriatic arthritis. In primary degenerative cervical disease, secondary neurological morbidity may arise and

Uncomplicated spondylotic pain (i.e. without neurological signs or persistent arm symptoms) is common in primary care

As surgery is not helpful here, patients need reassurance that their pain is safe and that normal activities can be undertaken, despite the pain

Intermittent arm pain (brachialgia) rarely warrants surgery

Abnormal neurology, or persistent or progressive brachialgia with or without abnormal neurology, warrants neurosurgical investigation

Surgery is good at reducing compressive nerve root symptoms and signs

Surgery is also good at arresting myelopathic progression

Surgery is less good at reducing myelopathic symptoms and signs when these are chronic

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involve the nerve roots (radiculopathy), the spinal cord (myelopathy) or, less commonly, the vertebral arteries. Compressive and/or ischaemic cervical myelopathy (due to local architectural and biomechanical disturbances resulting from the spondylotic process) is the commonest cause of spinal cord disturbance in the elderly.

As cervical spondylosis is common, and arm symptoms so frequent, deciding which patients to refer surgically may pose a problem, especially as secondary neurological problems may manifest with such subtle symptoms and signs. This article thus aims to guide primary care physicians on when to suspect and how to confirm a secondary neurological problem, and thus when to appropriately refer to a cervical surgeon. A second aim is to define those patients in whom a surgical referral would not be appropriate.

**PATHOGENESIS OF DEGENERATIVE DISC DISEASE AND SECONDARY NEUROLOGICAL DISEASE**

Degeneration of the nucleus pulposus (the central part of the disc) most commonly begins in the third or fourth decade. The aetiological processes are poorly understood, but they result in loss of hydration of the disc, and cause loss of disc space height over time, which becomes progressively visible on plain cervical radiographs. In turn, bony overgrowth at the end-plate produces osteophytic ridges, or bars, which bulge posteriorly into the spinal canal and posterolaterally into the root canals. At the same time, the posterior longitudinal ligament may buckle and thicken, and the weight stress on the facet joints leads to hypertrophic osteoarthritis, i.e. osteophytosis, with bony overgrowth occurring anteromedially into the spinal and/or root canals. In addition there is the possibility of a complicating cervical disc herniation, occurring posterolaterally and thus tending to give predominantly radicular symptoms, or directly posteriorly and tending to give myelopathic symptoms. The result of these combined features is critical narrowing of the intervertebral foramina and/or spinal canal, with irritation or frank compression of the nerve roots and/or spinal cord. In patients with spondylotic features compromising the spinal/root canals without neurological signs, a sudden deterioration of symptoms and the development of neurological signs may suggest a recent disc herniation with or without pain.

Postural changes also affect the development of these changes. The ligamenta flava become inelastic with age. During extension of the neck they thus tend to fold inwards and reduce the anteroposterior diameter of the spinal canal. The combined effects of disc herniations, end-plate osteophytic ridges projecting posterolaterally and facet joint hypertrophy projecting anteromedially, as well as the infolding of thickened ligamenta flava anteriorly into the canal, cause spinal cord compression which is at its maximum during extension of the neck. However, in flexion the transverse tension on the cord from the denticulate ligaments is at its maximum and may contribute to pathological changes.

As cervical spondylosis is a progressive condition, around 50% of people over the age of 50 years, and around 75% over the age of 65 years, will show spondylotic changes on plain radiographs. However, only a small proportion will develop clinical neurological features. Those who have a pre-existing narrow spinal canal are particularly vulnerable to cord compression. Features of myelopathy are seen in cases where there is a greater than ~30% reduction in the cross-sectional area of the spinal canal. In the average person, this occurs when the sagittal diameter of the spinal canal is less than 14 mm.

Neurological features correspond with the segmental level of bony changes, and cord compression occurs in only 50% of cases. Spinal cord ischaemia, caused by reduction of arterial flow or venous stasis, may contribute to the development of clinical features. The anterior spinal artery and the microcirculation of the cord may be directly compressed or develop spasm secondary to chronic mechanical distortion. Overall, the pathophysiology of spondylotic myelopathy is multifactorial, but spinal stenosis, biomechanical aspects, disc herniation and vascular compromise all potentially play a part in the development of the problem.
CLINICAL FEATURES OF CERVICAL SPONDYLOSIS

The neurological symptoms associated with cervical spondylosis may vary from local neck pain with muscular bracing and no neurological deficit at one end of the scale, to radicular complaints due to root compression or myelopathy secondary to cord compression at the other. When typical early spondylotic neck and shoulder and neck muscle pain is followed by brachalgia, i.e. by referred or radicular pain going down into the arm and/or forearm, this suggests a progression from ‘simple spondylosis’, to nerve root irritation and compromise, and/or frank compression. Features of radiculopathy from spondylotic osteophytes may develop insidiously or acutely. Trauma or acute disc herniation may precipitate the symptoms. Bilateral symptoms are less common and may span several segments if more than one cervical level is involved. Neck and arm pain, along with weakness, are typical but one may exist without the other. Other features include sensory loss, paraesthesiae and hyporeflexia. The symptoms stem from compression of the sensorimotor roots at the intervertebral foramina, and clinical analysis of their distribution and the neurological findings may allow the segmental level to be defined. Approximately 90% of cases occur at the C5/6 and C6/7 levels, where the mobile cervical spine joins the immobile thoracic segments (see Table 1).

Radicular pain may be reproduced by exerting downward pressure on the vertex while tilting the head towards the symptomatic side. This causes narrowing of the intervertebral exit foramen and may also increase the disc bulge. This is known as Spurling’s sign and is a specific, though not particularly sensitive, test for cervical root compression.

TABLE 1. Segmental distribution of symptoms.

<table>
<thead>
<tr>
<th>Root</th>
<th>Symptoms</th>
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<tbody>
<tr>
<td>C5</td>
<td>Pain radiates to the shoulder and the anterior upper arm, along with weakness of the deltoid muscle, diminished biceps and pectoral reflex and sensory changes over the deltoid (the regimental badge area).</td>
</tr>
<tr>
<td>C6</td>
<td>Pain radiates into the lateral arm and the dorsal aspect of the forearm with weakness in the biceps muscle. Sensory changes occur in the thumb and the dorsal surface of the hand. The biceps and brachioradialis reflexes may be diminished or absent.</td>
</tr>
<tr>
<td>C7</td>
<td>Pain affects the forearm and the middle and ring fingers. Weakness of the triceps and the extensors of the wrist and fingers may occur. Sensory deficit if present is in the index and middle fingers. The triceps reflex may be reduced.</td>
</tr>
<tr>
<td>C8</td>
<td>Pain in the medial aspect of the arm and forearm with weakness in the intrinsic muscles of the hand. Paraesthesiae may arise in the ring and little fingers, and along the medial side of the forearm. The arm reflexes are preserved.</td>
</tr>
</tbody>
</table>

PROGRESSIVE NEUROLOGICAL DEFICIT

Features of cervical spondylotic myelopathy usually develop insidiously. In 75% of cases there is progression in either a stepwise (one-third) or gradual (two-thirds) fashion. Often, an initial phase of deterioration may be followed by a stable period, which may last for years. Patients notice impaired coordination of the hands and complain of difficulty with tasks such as buttoning clothes. There may be weakness and wasting of the hand muscles, and opening and closing of the fist is slowed and stiff. There is often proximal weakness and spasticity of the lower limbs leading to marked gait disturbance. The reflexes are exaggerated below the level of the stenosis. The plantar response may thus be extensor and clonus present. Sensory disturbance may be minimal and may be limited to the upper limbs, that is due to the radiculopathic problems in the neck. In around 80% of cases there may be loss of vibration sensation in the lower extremities. Some patients may have posterior column dysfunction with impaired joint position sense and two-point discrimination. Around 50% develop bladder sphincter symptoms such as urgency, but anal sphincter disturbance is rare. Lhermitte’s sign – paraesthesiae in all extremities induced by flexion or extension of the cervical spine and caused by cord compression – is seldom found. An acute myelopathy may occur as a result of a fall in an elderly patient with pre-existing spondylosis and stenosis of the vertebral canal. This may or may not have been symptomatic before the fall. A central cord syndrome typically produces weak arms and hands, but spares the peripheral corticospinal tracts, thus lower limb function is not as severely impaired.

DIFFERENTIAL DIAGNOSIS OF A SPONDYLOTIC MYELOPATHY

About 12% of patients with myelopathic features attributed to a degenerative spondylosis actually have a different underlying problem. Intraspinal tumours, syringomyelia and Arnold–Chiari malformations may all mimic spondylotic myelopathy. Differentiating non-surgical conditions such as amyotrophic lateral sclerosis and multiple sclerosis from cord compression can also be challenging. Cervical spine involvement in rheumatoid arthritis may cause cervical instability, and thus myelopathy. However, this is a feature of chronic rheumatoid disease, which should thus be obvious from the history and examination.
INDICATIONS FOR A SURGICAL REFERRAL

Symptoms of ‘simple’ or uncomplicated cervical spondylosis, i.e. localised neck pain with cervical and shoulder muscle overactivity, are clearly not associated with nerve root or cord compromise, and this can be explained to patients. As has become apparent in recent lumbar spondylosis research, the role of cervical spine operations (e.g. fusions) to treat cervical pain in the absence of neurological complications remains unproven. Isolated neck pain is therefore best managed conservatively. For such patients, an explanation that their pain is unpleasant but safe should be given, and they should be encouraged to remain active, despite their pain. This is the basis of the pain management approach, and it can be used in combination with simple analgesia.

If new symptoms or signs are due to disc herniation, it is important for patients to understand that such clinical features can resolve spontaneously, and usually do so in most people. Thus, even in those where a disc herniation is thought highly likely on clinical grounds a period of conservative treatment, with brief rest (about 3–5 days) followed by careful remobilisation, should be allowed before surgical referral is contemplated, and this is analogous to the situation with lumbar disc herniation. Where intractable brachialgia and/or clinical signs due to herniation persist or progress despite conservative management, neurosurgical opinion is warranted, as such patients would be likely to benefit from decompressive surgery. The presence of neurological deficit, such as loss of dexterity or coordination, weakness and wasting, is not necessarily an indication for surgery, although clearly if such problems persist a neurosurgical referral is indicated. Constant upper limb numbness or paraesthesia, with or without objective neurological signs, is suggestive of nerve root compromise and requires further investigation, so neurological referral is required. If such investigations do not reveal actual nerve root compression, but do show evidence of nerve root ‘irritation’ (that is, no actual compression but a disc or osteophyte in the vicinity which could possibly be causing the symptoms), then a decompression can sometimes help, so such patients should be referred. Intermittent arm symptoms may be thought of as analogous to intermittent sciatica in association with lumbar spondylosis, but they may also be brought on by nerve root traction, such as during the carrying of heavy shopping bags etc. Such symptoms usually resolve spontaneously, for example once the traction has ended, so patients should only be referred if their symptoms become constant.

The urgency of the referral depends on the severity of the neurological deficit and the rate of progression. The need for surgical intervention would be assessed on the basis of further investigations.

INVESTIGATIONS

Cervical spine x-rays

As radiological evidence of spondylosis is usually found in most members of the population from around 35 years, x-ray findings have to be interpreted carefully and in relation to individual patient’s symptoms. Plain x-rays can demonstrate loss of disc space height, anterior and posterior end-plate osteophytes, fusion or instability. A lateral view will also show the anteroposterior diameter of the spinal canal; and if this is less than 14 mm then cord compression is a real possibility.

Magnetic resonance scan

If surgery is to be contemplated then it is vital to pinpoint the actual cause of the patient’s symptoms. Magnetic resonance (MR) is the investigation of choice because it is non-invasive and demonstrates the spinal cord remarkably well. However, it cannot be used in patients with metallic implants or cardiac pacemakers, or those with claustrophobia unless the scan is undertaken with sedation. In these circumstances a computerised tomography (CT) scan is the next best option.

Neurophysiology

Needle electromyography (EMG), nerve conduction studies and evoked potentials may help to differentiate spondylotic neurological problems from motor neurone

![FIGURE 2. MR scan of the neck showing the spinal cord and surrounding tissues.](image)
disease, multiple sclerosis, peripheral nerve compression and so on.

**TREATMENT OF CERVICAL SPONDYLOSIS**

**Conservative**

This is the initial treatment of choice for the majority of cases of uncomplicated spondylotic pain. It should be primary care directed, and aimed at relief of symptoms and making patients understand that their symptoms are not unsafe, that is, the pain management approach which has already been outlined. Even where it is obvious that a disc herniation has occurred, the principle of first treatment is the same as for a lumbar disc herniation, namely conservative. Thus, over 95% of patients with acute cervical discs causing radiculopathy will respond to 4–6 weeks of such therapy. This includes short-term bed rest (no more than about 5 days), appropriate NSAIDs, muscle relaxants (Robaxin, diazepam) and physiotherapy (heat, cervical traction etc.). A rigid neck collar can also be beneficial, but only in the short term (no more than about a week). During the initial phase, heavy lifting must be avoided. Even where myelopathy has occurred, around 50% of affected patients will improve with the use of a collar. The presence of minor or stable neurological deficit does not preclude medical treatment, or dictate surgery. However, affected patients must be reviewed regularly to assess neurological progress, or otherwise. If deterioration is seen, referral is required as surgery may be necessary. As spondylotic symptoms and signs are episodic, conservative measures are beneficial during periods of exacerbation.

**Surgery**

Surgical treatment is generally reserved for patients with nerve root compression who have intractable pain and unresolving or progressive neurological deficit, and where there is a matched compressive abnormality on MR scanning. However, where intractable brachialgia occurs without neurological signs, surgery may be contemplated if it is thought that a disc or osteophyte in the vicinity of the nerve root of interest could be irritating the nerve. Surgery in this instance would include limited decompression with intervertebral body fusion.

The indications for surgery in cervical myelopathy are less easily defined. Patients with progressive and disabling morbidity, and whose general medical condition is sufficiently good to permit surgery, should be referred for a surgical opinion. Treatment consists of decompressing the relevant nerve roots and the spinal cord by removing osteophytes, discal material and hypertrophic ligaments. The approach may be anterior or posterior. Various techniques are available and the best procedure for a particular patient requires careful consideration (see Table 2).

<table>
<thead>
<tr>
<th><strong>TABLE 2. Surgical approach.</strong></th>
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<tr>
<td><strong>Anterior</strong></td>
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<tr>
<td>Anterior disectomy with fusion</td>
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<tr>
<td>Anterior disectomy without fusion</td>
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<tr>
<td>Corpectomy and instrumentation</td>
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Resolution of symptoms can be expected in 75–90% of patients after cervical root decompression. Myelopathy responds less well to decompression, with only around 60% of patients improving after surgery. Recovery is often incomplete. Surgery is thus generally advised to halt the progression of the myelopathic symptoms and signs, rather than to effect a cure. Prognosis in myelopathy correlates closely with the duration of symptoms and the severity and extent of the neurological deficit prior to surgery, so it is clearly important to establish the diagnosis early, and this requires a high index of suspicion in subtle cases.

**FURTHER READING**