

# BMJ Best Practice

## Degenerative cervical spine disease

Straight to the point of care



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## Summary

Degenerative cervical spine disease (cervical spondylosis) is osteoarthritis of the spine, which includes the spontaneous degeneration of either disc or facet joints.

Presenting symptoms include axial neck pain and neurological complications.

The most common neurological complication is cervical spondylotic radiculopathy. This results in a pattern of arm pain (specific to the nerve root involved) along with mild weakness and sensory loss in muscles and skin innervated by that nerve root.

The next most common neurological complication is loss of neurological function from pressure on the spinal cord in the cervical region (degenerative cervical myelopathy). Although this loss of function can be painful, there is usually a painless reduction of upper extremity (and sometimes lower extremity) function, which is particularly noticeable as hand clumsiness or loss of fine motor function.

Treatments differ radically depending on patient presentation, specific symptoms, and which arthritis-related or neurological complications predominate.

Neurological complications may respond to surgical decompression if symptoms do not abate after treatment with conservative measures, depending on their longevity and severity.

## Definition

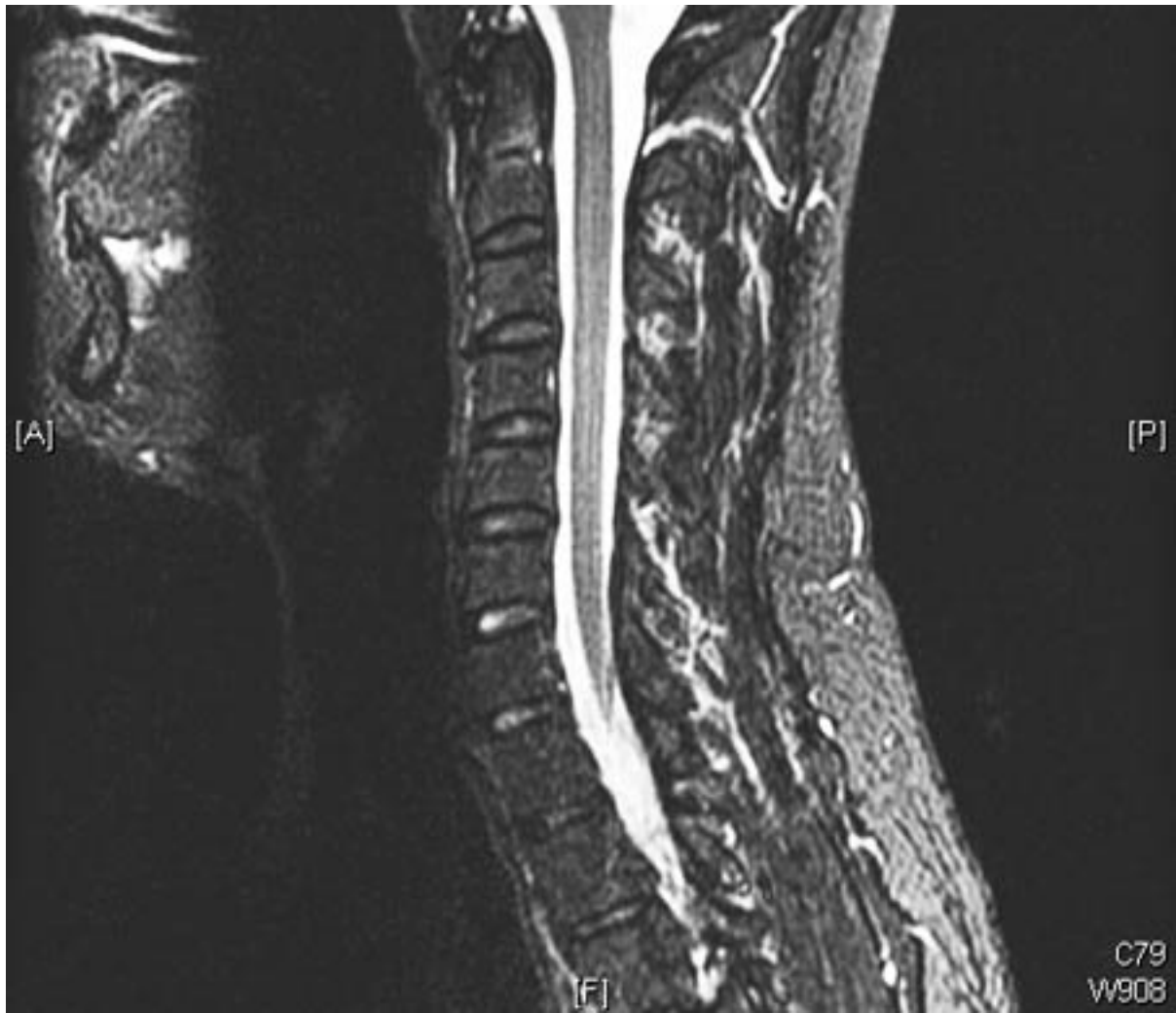
Cervical spondylosis is the specific term for osteoarthritis of the spine, which includes the spontaneous degeneration of either disc or facet joints. Alternative terms include degenerative disc disease and degenerative joint disease.

This spontaneous degeneration is commonly asymptomatic. It can lead to either arthritis-specific symptoms referable to the neck (i.e., loss of joint motion, pain on motion, joint incompetency) or neurological complications of the joint degeneration, including pressure on the spinal cord (degenerative cervical myelopathy, formerly known as cervical spondylotic myelopathy) and/or cervical nerve roots (cervical spondylotic radiculopathy).



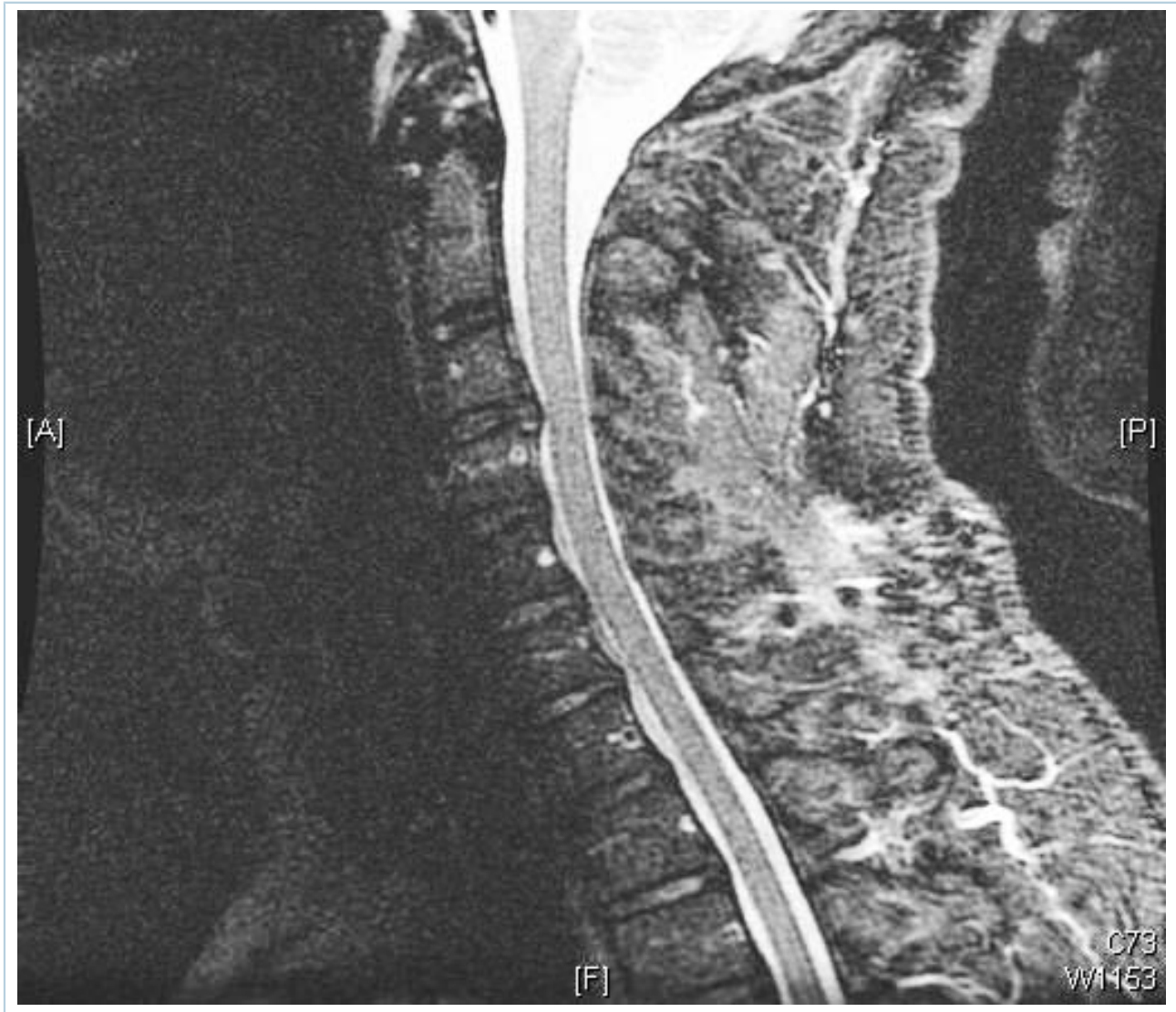
*Severe, multi-level degenerative disc disease changes but without significant spinal cord compression (i.e., neither deformation nor intrinsic T2 changes) on cervical MRI (sagittal T2)*

*Dennis A. Turner, MA, MD*



*Cervical MRI (sagittal T2) with mild degenerative joint disease and disc bulging*

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*Cervical MRI (sagittal T2) with moderate degenerative joint disease but no significant spinal cord compression*

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## Epidemiology

Cervical spondylosis incidence varies with age. Population-based magnetic resonance imaging (MRI) studies show nearly 100% of adults aged >40 years have severe degeneration of at least 1 cervical level (commonly C5/6).[1] [2] [3] [4] [5] [6] However, only a subset of patients present with axial neck pain, and patients are usually asymptomatic even though cervical radiographs and MRI may show severe, spontaneous degenerative disease.[4] [7] [8]



*Severe, multi-level degenerative disc disease changes but without significant spinal cord compression (i.e., neither deformation nor intrinsic T2 changes) on cervical MRI (sagittal T2)*

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The estimated incidence of degenerative cervical myelopathy is at least 41 per million people in North America.[9] In one study, 59% of individuals aged >40 years had signs of cervical cord compression on MRI.[8] However, only 1% to 2% of patients with cervical spondylosis proceed to surgical intervention, as non-operative treatments suffice in most patients.[10] [11] [12] [13] [14]

The incidence of cervical spine radiculopathy ranged from 0.832 to 1.79 per 1000 in one systematic review.[15]

## Aetiology

The aetiology of cervical spondylosis is underlying spontaneous joint degeneration. It is related to age and to wear and tear.[2] [7] [16] However, concordant twin studies note a significant genetic predisposition to development of cervical degeneration, in addition to occupational and activity-related factors.[17] Similarly, there appears to be a significant genetic or inherited predisposition to development of degenerative cervical myelopathy (DCM).[18]

Once the degeneration begins (typically in the second or third decade), cervical joint degeneration slowly worsens over the lifetime. The relative roles of daily wear and tear, trauma, and genetics on the rate of degeneration remain unclear, although radiographic spondylosis is generally age related and no known treatments can reverse the process.[19]

## Pathophysiology

The spine includes two basic cartilaginous joints: the disc, which initially contains a complex hydrogel material, and the facet joints, which are synovial joints.[16]

The disc hydrogel is poorly maintained with maturity due to the loss of the primary disc cells (which produce and maintain the hydrogel) and sclerosis of the end plates (preventing diffusion of nutrients). The disc joint becomes dehydrated and narrows. At a certain degree of narrowing, the annulus of the disc, which normally lacks nerve endings, can become innervated and develop osteophytes at the margins, similar to any type of mobile joint. Because the function of the facet joints is primarily prevention of rotation and flexion/extension, their degeneration is enhanced with more axial loading as the disc joint narrows, placing more stress on the facet joints.

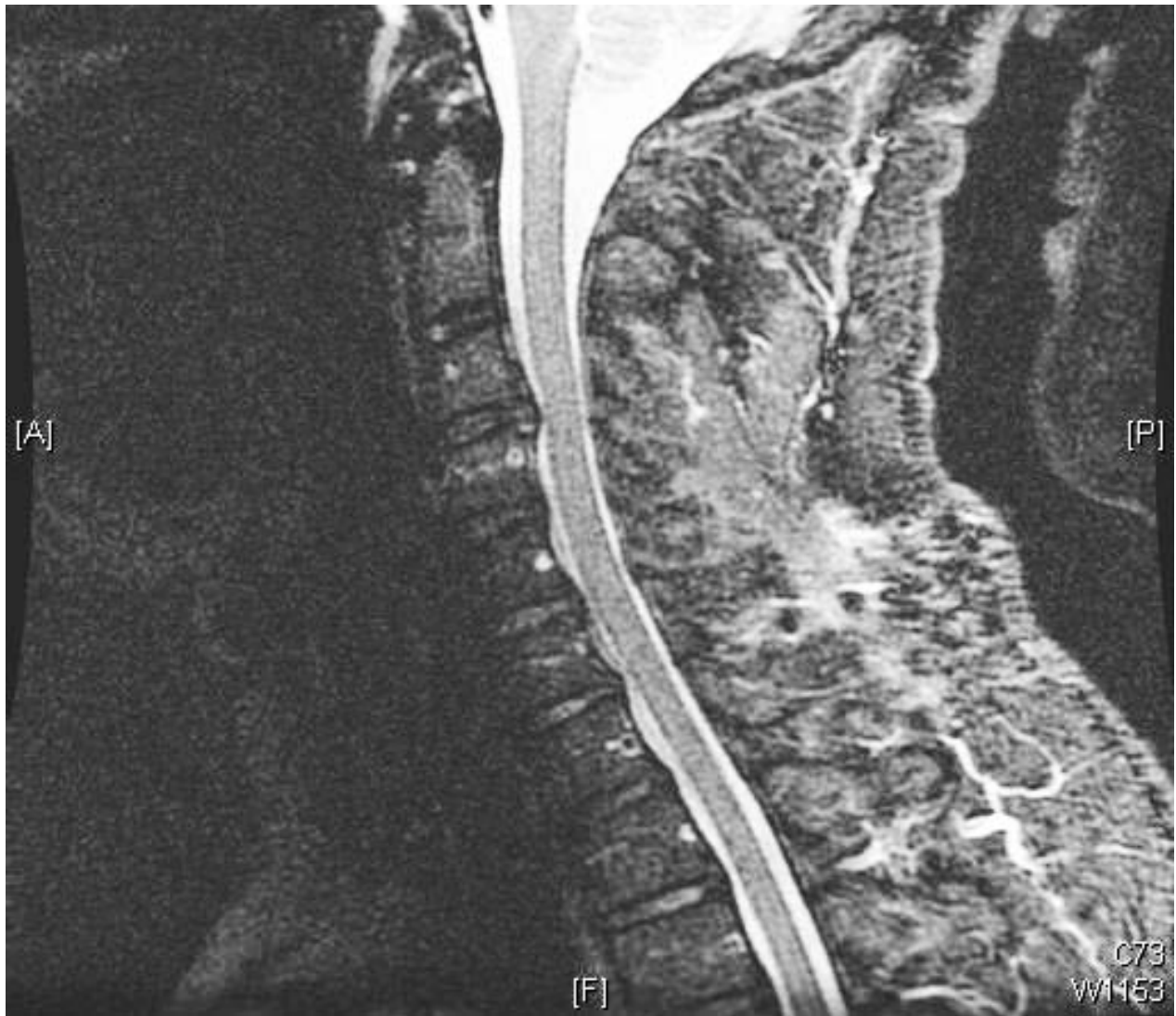
The cervical joint degeneration or spondylosis is entirely asymptomatic in many people, except perhaps for decreased cervical range of motion.[1] [4]

However, a number of patients experience axial neck pain with mild degenerative changes (i.e., limited joint narrowing only).[20] For this reason, the degree of spondylosis on cervical radiographs or magnetic resonance imaging (MRI) does not necessarily correlate with the syndrome of axial neck pain.[1] [4] [21] Idiopathic axial neck pain, such as that occurring with degenerative changes, demonstrates a poorer outcome than that associated with a specific cause.[22]

Pain in people with cervical spondylosis is thought to arise from joint receptor signals (including those of abnormal nerve fibres innervating the annulus with degeneration), which are routed to cervical paraspinal muscles in particular, resulting in paraspinal muscle spasm and characteristic interscapular and lateral neck pain.[2] [6] [7]

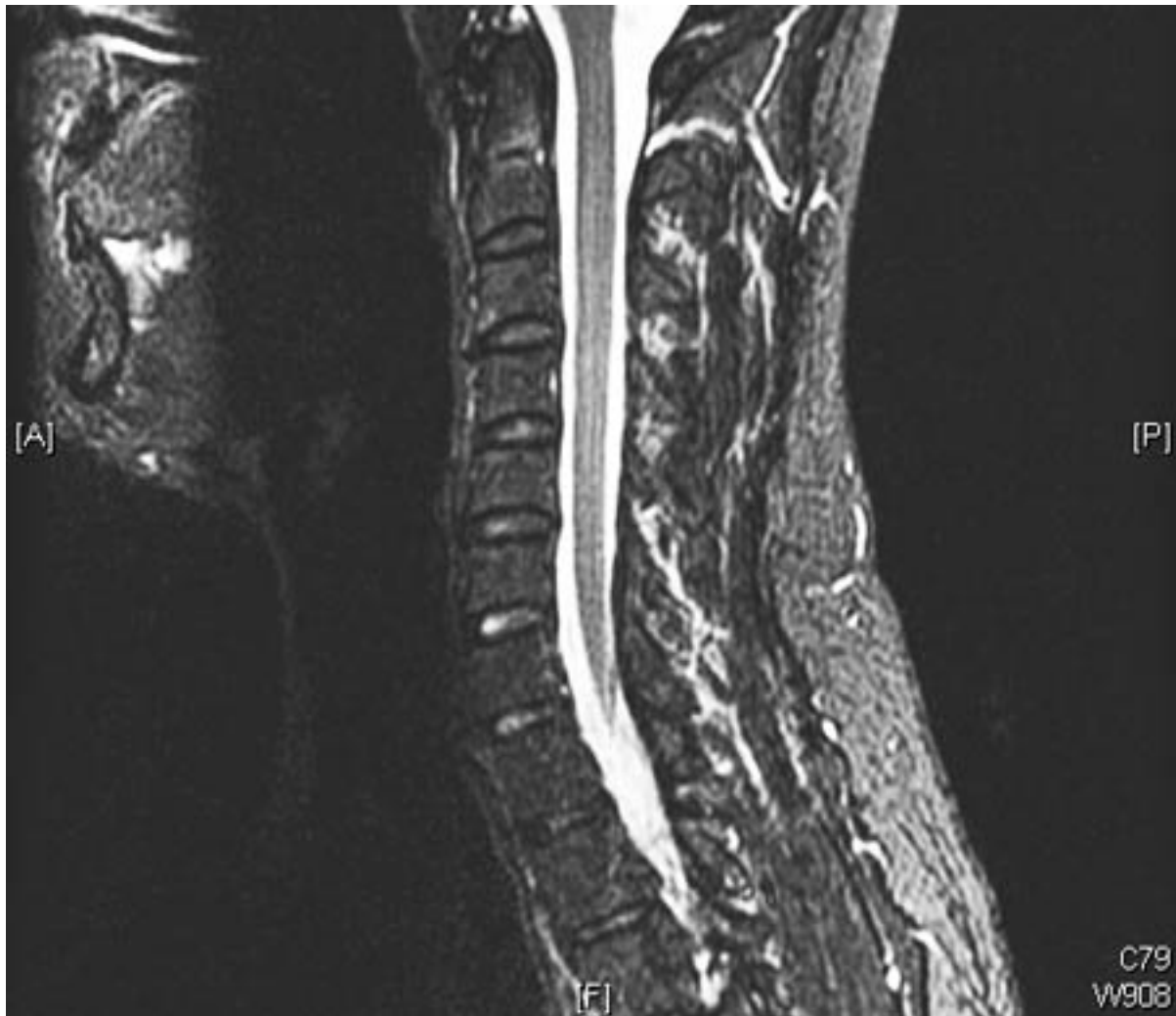
Cervical spondylotic radiculopathy (CSR) results if the nerve exiting the spinal cord and the spinal canal is pinched by either a degenerative disc (i.e., a herniated disc, wherein an annular weak spot allows displacement of disc nucleus contents to be adjacent to the nerve root) or with moderate to severe degenerative joint changes, narrowing the root exit at the foraminal level.[23] [24]

DCM usually involves severe disc and facet degeneration with changes in the alignment of the spine, such as kyphosis or spondylolisthesis, along with osteophyte formation. These lead to a significantly narrowed spinal canal and secondary spinal cord deformation.[13]



*Cervical MRI (sagittal T2) with moderate degenerative joint disease but no significant spinal cord compression*

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*A single level of spinal cord compression with T2 changes, on cervical sagittal T2 sequence in the presence of symptomatic degenerative cervical myelopathy*

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*Previous spinal cord compression at C3/4 on sagittal T2 MRI, with residual T2 changes, and new compression at C2/3 and C6/7, with T2 changes*

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## Classification

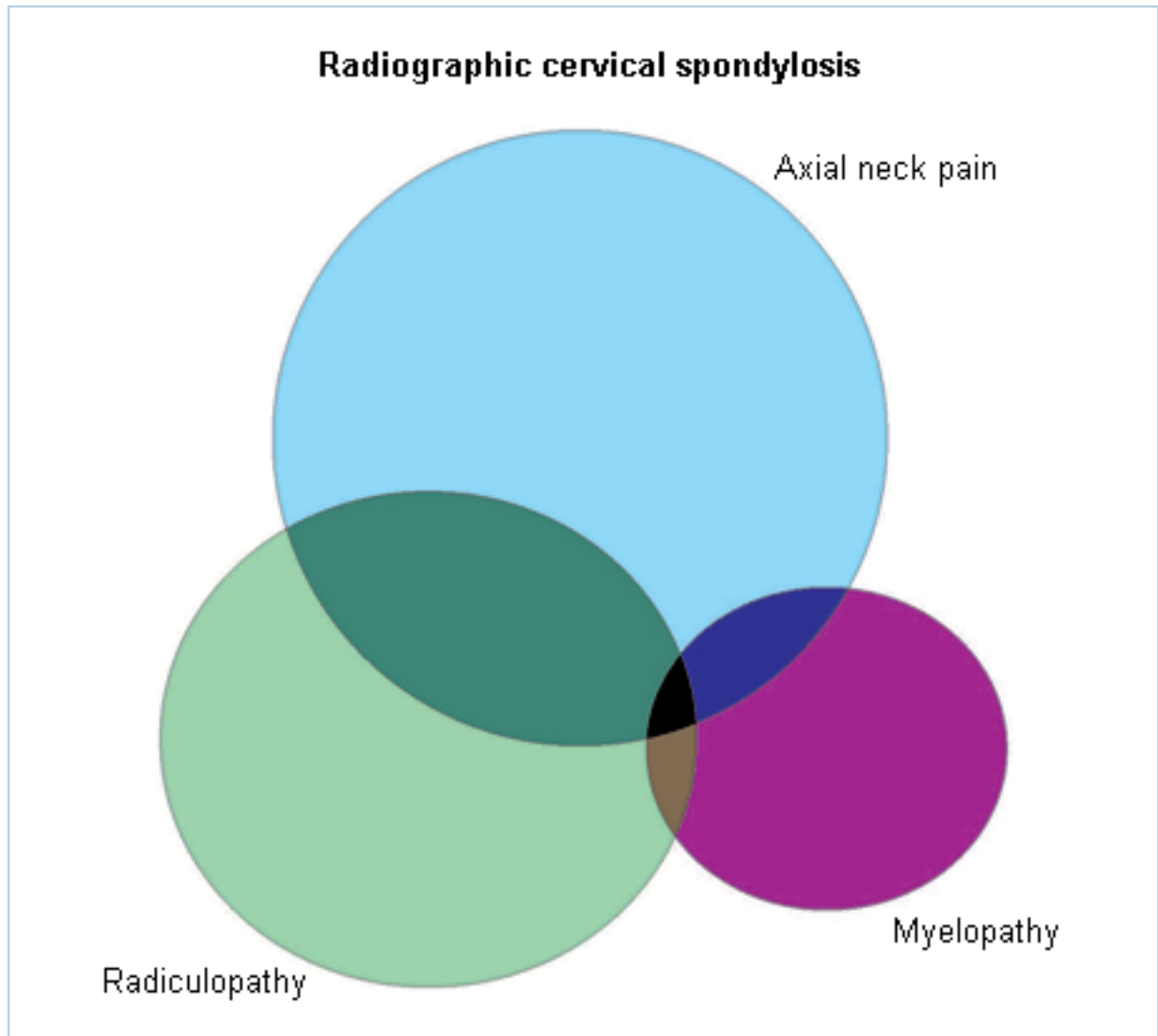
### Clinical syndromes

There is no simple, accepted aetiological classification, but symptoms cluster into clinical syndromes.

Many patients with radiographic cervical spondylosis show no symptoms, so there is commonly dissociation between radiographic studies (i.e., MRI) and presence of symptoms.<sup>[1] [2]</sup> Symptoms include:

- Axial neck pain, which includes reduced motion of the cervical spine, paraspinal muscle spasm, and referred pain, similar to other joints of the body
- Cervical spondylotic radiculopathy (CSR), a specific syndrome of radiating arm pain following a single cervical nerve root distribution that arises from mechanical compression and/or chemical irritation of that specific nerve root, usually at its exit from the spinal canal

- Degenerative cervical myelopathy (DCM), a specific syndrome of neurological deficit in the upper and lower extremities resulting from spinal cord pressure in the cervical spine, due to degenerative changes in disc and/or facet joints.



*Diagram of subsets of cervical spondylosis, including various symptoms possibly arising within the larger field of asymptomatic (radiographic) spondylosis*

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## Case history

### Case history #1

A 60-year-old man presents with diffuse paraspinal neck pain and stiffness, which has slowly worsened over 20 years. He describes significant muscle spasm in the lateral and anterior aspects of his neck, including tender, sore muscles, severe interscapular pain, and occasional headaches. The axial neck pain is worsened by activity and driving, and is improved by a heating pad and non-steroidal anti-inflammatory drugs (NSAIDs). He describes a grating or popping sound when moving his neck. Physical and neurological examinations reveal decreased range of motion of the neck, paraspinal muscle spasm, and normal sensory and motor function of his upper extremities.

## Case history #2

A 57-year-old woman presents with primarily severe and radiating arm pain, which she describes as beginning at the shoulder, and particularly worse pain in the region of the left lateral elbow. This arm pain has been present for >3 months, and she describes it as similar to a lightning bolt coursing through the left arm. No significant neck pain is apparent on the history or examination. She has also noted some weakness of arm extension and grip of the left hand, as well as a tingling sensation in the left index and middle fingers. On examination she has reproduction of her pain on turning her head to the left, significant weakness in the left triceps and absent left triceps reflex, and minimal sensory changes in the index and middle finger.

## Other presentations

A less common presentation is degenerative cervical myelopathy. This presentation is more commonly loss of function in the upper limbs (i.e., loss of fine motor function in the hands) rather than the lower limbs (i.e., gait ataxia). This syndrome is epitomised by numb or clumsy hand symptoms where the patient has initial difficulty in fine motor function. This can progress to more diffuse weakness in the upper extremities. Most of these symptoms reflect upper motor neuron pathology directly attributable to pressure on the cervical spinal cord (between the C2 and C7 levels) with resulting hyper-reflexia (depending on the level in upper and lower extremities) and, rarely, direct sensory loss. Many patients also have axial neck pain because the compression on the spinal cord is due to severe degenerative changes in the cervical spine. Radicular arm pain is rarely present.

# Approach

Cervical spondylosis may be clinically evident either from the patient's presenting symptoms (i.e., neck pain, cervical radiculopathy, or cervical myelopathy) or from an incidental finding during an evaluation of other symptoms.<sup>[7] [16]</sup>

For patients with cervical neck pain there are several symptoms that should be considered red flags and that indicate the need for further investigation to exclude important differential diagnoses:<sup>[16] [27]</sup>

- History of recent fall or trauma to the head or neck
- Unexplained weight loss
- Severe, intractable pain or severe local tenderness
- Cervical lymphadenopathy
- Unexplained fever, especially in diabetic patients
- History of cancer
- History of chronic steroid use.

## Presenting symptom of primarily axial neck pain

Axial neck pain includes components of direct pain (particularly experienced in the posterior aspects of the neck) and referred or indirect components.<sup>[2] [6] [7]</sup> Referred components include paraspinal muscle spasm initiated from joint motion, with secondary pain arising from sustained muscle contraction and stiffness. Other referred components include occipital pain and tension headaches.

Axial neck pain can exist in any axial neck muscle, including scalenes (anterior scalene syndrome), trapezius and interscapular muscles, and paraspinal muscles extending from the occiput to the lumbar region, where axial muscle spasm can spread.<sup>[20]</sup>

The degree of neck pain with cervical spondylosis is more subjective than noted on examination, with mild to moderate paraspinal muscle spasm, nearly preserved range of motion, and tenderness in the paraspinal muscle groups (scalenes, trapezius, interscapular muscles, occipital, etc.).<sup>[2] [6] [7]</sup>

For a single episode only, a therapeutic trial of treatment may be sufficient to establish the diagnosis. Further diagnostic tests may not be warranted.

Cervical radiographs are indicated for patients with severe neck pain, chronic neck pain, or pain with a history of trauma or neck surgery (recent or previous).<sup>[5]</sup> With a history of malignancy or neck surgery, guidelines suggest an MRI is more appropriate.<sup>[5]</sup>

## Presenting symptom of radiating arm pain, with or without axial neck pain

The diagnosis of cervical spondylotic radiculopathy depends on the presence of radiating arm pain (distal to the shoulder); the pattern following  $\geq 1$  well-defined dermatomes; mild weakness in the muscles innervated by a specific nerve root; and reflex changes for a single level if appropriate.<sup>[7] [28]</sup> There is rarely any significant loss of function because the nerve roots overlap considerably.

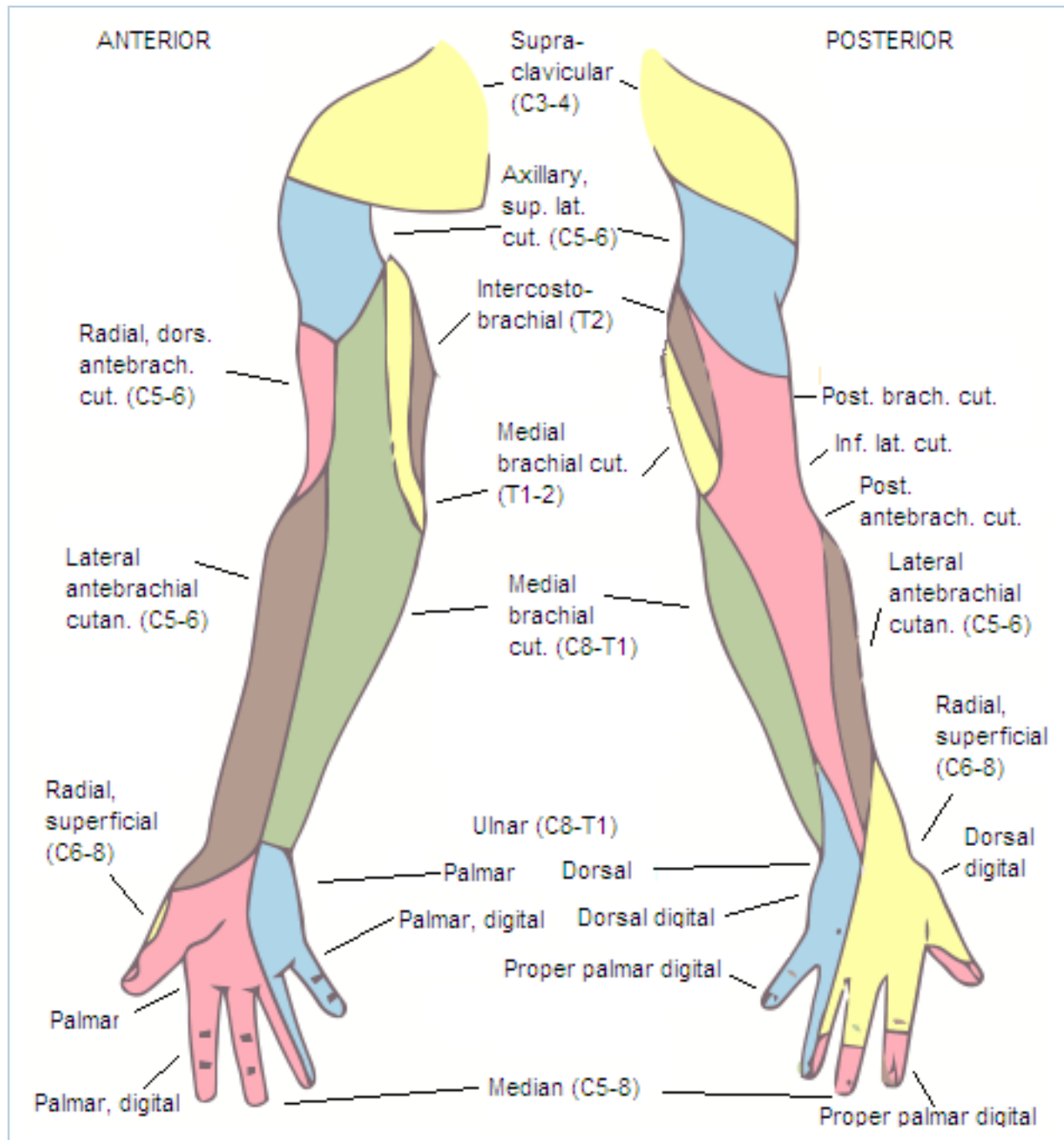


Chart showing average dermatome size and location. Radicular pain is usually confined to a single dermatome  
From the 20th US edition of Gray's Anatomy of the Human Body; used with permission

Depending on the correlation with physical and neurological examination and the duration (particularly >4 to 6 weeks), further diagnostic tests may be helpful, though not initially critical unless the history and neurological examination do not converge.[24]

In most cases, cervical radiographs are less helpful than proceeding directly to a magnetic resonance imaging (MRI) scan if the symptoms persist. If an MRI is not possible (e.g., implanted metal), then a computed tomography (CT) cervical spine scan is the next most appropriate study.[5] If a cervical CT scan with no contrast suggests spinal cord abnormalities and an MRI is not possible, the next step is a CT cervical spine scan with intrathecal contrast (CT myelography) to obtain more detail about spinal cord and nerve changes.[5]

If a single nerve root is difficult to distinguish (particularly considering the similar patterns between C6 and C7), then occasionally a nerve test, such as electromyography (EMG) or nerve conduction velocity (NCV), can be helpful. The EMG specifically tests muscles for signs of denervation that can arise between the spinal cord and muscle, while the NCV helps to localise specific areas of nerve compression or damage.

However, for localisation of a single nerve root, a specific nerve block (laterally at the nerve exit from the spine) is more definitive as a diagnostic and sometimes therapeutic intervention.<sup>[29]</sup> The EMG/NCV can help discern other entities with weakness and/or sensory loss that may mimic a radiculopathy, particularly focal mononeuropathy (i.e., diabetes) and peripheral nerve compression syndromes.

## Presenting symptoms of loss of upper extremity function, with or without axial neck pain

Degenerative cervical myelopathy (DCM) remains a poorly defined syndrome.<sup>[10] [27] [30] [31]</sup> It includes often painless reduction of neurological function arising from compression of the spinal cord due to a variety of degenerative changes in the cervical spine.<sup>[13]</sup> These changes can include bony overgrowth at any of the disc or facet joints (i.e., osteophytes), ligamentous changes or calcification, instability, or change in alignment of the joints (i.e., kyphotic deformity).<sup>[1] [3] [4]</sup> The extent of radiological involvement may not correlate with the extent of neurological involvement.

From the history of weakness and/or numb, clumsy hand syndrome, a correlative neurological examination is important to identify whether this is a subjective or objective finding.<sup>[13]</sup> The most common initial signs of myelopathy are mild hand weakness (particularly in the intrinsic muscles of the hand, such as the interossei), loss of coordination in hand function (such as typing), and mild gait ataxia.<sup>[27]</sup> More severe symptoms can include profound weakness of the hands, bowel and bladder difficulties, and severe gait ataxia.<sup>[13]</sup>

There is rarely a significant loss of proximal muscle strength in the arms or legs, and such loss would be a clear red flag beyond DCM. Cervical myelopathy can worsen acutely with injury to the cervical spine, although there is usually a pre-injury history of loss of function.

If there are neurological signs suggesting loss of function beyond a single nerve root, a cervical MRI is important to distinguish the specific nature of any neural compression. Cervical MRI scans clearly show spinal cord compression and deformation with usually internal T2 (white) signal changes in the spinal cord.<sup>[3]</sup>



*A single level of spinal cord compression with T2 changes, on cervical sagittal T2 sequence in the presence of symptomatic degenerative cervical myelopathy*

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*Previous spinal cord compression at C3/4 on sagittal T2 MRI, with residual T2 changes, and new compression at C2/3 and C6/7, with T2 changes*

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A cervical MRI with and without contrast may be considered, which will indicate alternate causes, including malignancy, infection, inflammatory diseases, and intrinsic myelopathy or internal damage to the spinal cord (i.e., multiple sclerosis, amyotrophic lateral sclerosis).[5] If the weakness and/or sensory loss is unilateral, then another consideration is brachial plexopathy (neuralgic amyotrophy) due to spontaneous viral neuronitis, often with initial neck pain.

Because the neurological abnormalities arise from spinal cord compression and upper motor neuron dysfunction rather than nerve compression, EMG or NCV is a negative diagnostic test in cervical myelopathy, as nerve studies primarily demonstrate lower motor neuron changes. However, the EMG/ NCV can be helpful to differentiate cervical myelopathy from more peripheral disorders, such as ulnar neuropathy or carpal tunnel syndrome, which can mimic many of the symptoms.

## Asymptomatic but noted to have cervical spondylosis on diagnostic evaluation for some other condition

This is a common form of presentation. The scan itself is interpreted as abnormal and the patient seeks to know the significance of the scan findings.<sup>[1] [4]</sup> The patient's presenting symptom commonly resolves by the time of consultation regarding the scan findings.

A correlation between the patient's history and neurological and physical examination is critical to decide whether further diagnostic tests are warranted.<sup>[2] [6]</sup> If clear neurological abnormalities are noted, then an MRI scan is suggested if possible.<sup>[32]</sup> If the patient has had an MRI scan, a thorough discussion with the patient may be critical to decide whether to suggest treatment in an asymptomatic patient, particularly when specific risks may arise from this treatment.

Common asymptomatic findings include vertebral body haemangiomas (which are congenital, although can rarely expand over time), disc or facet degenerative changes (which are age related in severity and extent), disc bulging, annular tear, and presence of a visible central spinal canal (often mislabelled as a syrinx).<sup>[1] [4]</sup>

## History and exam

### Key diagnostic factors

#### presence of risk factors (common)

- Cervical spondylosis is associated with increasing age (>40 years), and there may be a family history or history of trauma, myofascial strain, or cervical surgery.

#### spontaneous onset of neck pain (common)

- More likely to be associated with cervical spondylosis, particularly if multiple episodes over time. If the neck pain is acute and associated with an event, cervical myofascial strain or trauma may be considered, particularly if neck pain is more severe. Neck pain following an infection or with a history of systemic neoplasia may suggest more serious conditions.<sup>[19]</sup>

#### cervical muscle pain and spasm (common)

- Axial neck pain can exist in any axial neck muscle, including scalenes (anterior scalene syndrome), trapezius and interscapular muscles, and paraspinal muscles extending from the occiput to the lumbar region, where axial muscle spasm can spread.<sup>[20]</sup>

#### headaches or occipital pain (common)

- Referred components include occipital pain and cluster or tension headaches.<sup>[25]</sup>

#### weakness or numbness (common)

- Subjective presence focuses the differential on either neurological complications of cervical spondylosis or some other neurological problem with similar complaints.<sup>[13] [27]</sup>

#### presence of radiating arm pain (common)

- Pain distal to the shoulder triggers a concern for radiculopathy; radiating pain is rarely present in cervical myelopathy.<sup>[19]</sup>

### reflex changes (common)

- Decreased reflexes are a sign of radiculopathy, whereas increased reflexes may signal cervical myelopathy, possibly in the upper extremity but particularly in the lower extremity.[\[27\]](#)

### proximal arm weakness (uncommon)

- Can occur with C5 radiculopathy, but is uncommon with cervical myelopathy, suggesting a wider differential in many cases.[\[27\]](#)

### distal hand weakness (uncommon)

- Particularly in the intrinsic hand muscles (e.g., interossei, abductor pollicis brevis), suggests cervical myelopathy.[\[27\]](#)

### gait ataxia (uncommon)

- Difficulty walking in a straight line. Can indicate cervical myelopathy, through compression of white matter tracts descending to the lower spinal cord.[\[13\]](#) [\[19\]](#)

## Other diagnostic factors

### cervical muscle spasm (common)

- A common secondary symptom associated with cervical spondylosis.[\[25\]](#)

### decreased cervical range of motion (common)

- Commonly caused by degenerative changes, similar to osteoarthritis at any joint.[\[19\]](#)

### sensory changes (common)

- Common and often less helpful in diagnosis unless a specific root (radiculopathy) or peripheral nerve pattern suggests a different diagnosis (e.g., carpal tunnel syndrome with median nerve hypalgesia).[\[27\]](#)

## Risk factors

### Strong

#### age >40 years

- Population-based MRI studies show nearly 100% of adults aged >40 years have severe degeneration of at least 1 cervical level (commonly C5/6).[\[1\]](#) [\[2\]](#) [\[3\]](#) [\[4\]](#) [\[5\]](#) [\[6\]](#) However, only a subset of patients present with axial neck pain, and patients are commonly asymptomatic.[\[4\]](#) [\[25\]](#) [\[8\]](#)

### Weak

#### head or neck trauma

- May accelerate the disc and facet degeneration process, particularly if there has been a fracture of an aspect of the joint (i.e., a facet fracture).

## previous cervical spine surgery

- May predispose adjacent joints to accelerated degenerative changes, particularly after a cervical fusion.[16] This has been difficult to prove because these joints also spontaneously degenerate, and the rate of change shows little difference with or without previous surgery. However, particularly posterior cervical surgery (i.e., a laminectomy) may enhance the paraspinal muscle spasm symptoms seen with cervical spondylosis-related axial neck pain.[26]

## previous cervical myofascial strain

- A previous soft-tissue injury to the neck may have resulted in a cervical myofascial strain (including whiplash injury), which can predispose to the same types of axial cervical pain symptoms as seen from degenerative changes alone.

## genetic predisposition

- Some forms of severe, accelerated degenerative changes, including diffuse idiopathic skeletal hyperostosis, ankylosing spondylitis, and ossification of the posterior longitudinal ligament, are more prone to occur in some populations.[16] These less-common forms of severe degenerative changes may also lead to markedly decreased neck motion due to calcification around the joints and ligaments. Both cervical degenerative changes and degenerative cervical myelopathy show a tendency for genetic predisposition.[17] [18]

# Investigations

## 1st test to order

| Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Result                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>cervical MRI</b> <ul style="list-style-type: none"> <li>• Ordered if neck pain persists for 4 to 6 weeks, radicular pain does not subside with treatments, or more severe deficit suggestive of myelopathy is present. This would normally be the primary study ordered from the clinic setting once these criteria are met.[5] [33]</li> <li>• MRI is also indicated for patients with neck pain and a history of malignancy, prior cervical spine surgery, or if there is suspicion for infection.[5]</li> </ul> | <b>bone destruction, spinal cord or nerve compression, intradural or epidural pathology</b>                                               |
| <b>cervical x-ray</b> <ul style="list-style-type: none"> <li>• Indicated for patients with severe neck pain, chronic neck pain, or pain with a history of trauma or neck surgery (recent or previous).[5] Flexion/extension radiographs have limited value in degenerative disease.[34]</li> </ul>                                                                                                                                                                                                                    | <b>presence of degenerative joint disease or degenerative disc disease, malalignment, spinal canal stenosis, fracture, or instability</b> |

## Other tests to consider

| Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Result                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>cervical CT scan</b> <ul style="list-style-type: none"> <li>An extension to cervical radiographs to obtain more detail about bone structure, such as in ossified posterior longitudinal ligament calcification, trauma setting, or instability.</li> <li>Also indicated if an MRI is not possible (e.g., implanted metal).<sup>[5]</sup></li> </ul>                                                                                                                                                                                                                                                 | <b>bone destruction, spinal cord or nerve compression; intradural or epidural pathology</b>                                                     |
| <b>cervical CT myelogram</b> <ul style="list-style-type: none"> <li>If a cervical CT scan with no contrast suggests spinal cord abnormalities and an MRI is not possible, then the next step is a CT cervical spine scan with intrathecal contrast (CT myelography) to obtain more detail about spinal cord and nerve changes.<sup>[5]</sup></li> <li>Primarily indicated only if an MRI is not possible (e.g., implanted metal).<sup>[5]</sup></li> </ul>                                                                                                                                             | <b>presence of disc herniation or nerve root compression</b>                                                                                    |
| <b>cervical/upper extremity electromyography or nerve conduction velocity</b> <ul style="list-style-type: none"> <li>Ordered if brachial plexopathy, peripheral neuropathy, or peripheral nerve compression suspected, or mimicking radiculopathy or myelopathy.</li> <li>Electromyography or nerve conduction velocity is a negative diagnostic test in cervical myelopathy, as nerve studies primarily demonstrate lower motor neuron changes. In degenerative cervical myelopathy, the neurological abnormalities arise from spinal cord compression and upper motor neuron dysfunction.</li> </ul> | <b>may show changes of muscle denervation; localises the problem to the root or reveals changes in keeping with peripheral nerve entrapment</b> |
| <b>cervical nerve root block</b> <ul style="list-style-type: none"> <li>Ordered when specific nerve root involved with radiculopathy cannot be clinically or radiologically determined.<sup>[29]</sup></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                      | <b>positive test if nerve block relieves patient's radicular pain temporarily; localises single nerve root</b>                                  |

# Differentials

| Condition                                           | Differentiating signs / symptoms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Differentiating tests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Whiplash injury (cervical myofascial strain)</b> | <ul style="list-style-type: none"><li>• Caused by acceleration/ deceleration injuries to the neck, most commonly from rear-end automobile accidents. Approximately 50% of patients continue to experience chronic symptoms.[35] Broad spectrum of symptoms, including neck stiffness, shoulder or arm pain, myalgias, paraesthesias, headache, facial pain, and vertigo.</li></ul>                                                                                                                                                                       | <ul style="list-style-type: none"><li>• Plain x-rays usually ordered to rule out fracture or subluxation due to a ligament tear. X-rays sometimes reveal a straightening of the natural curve in the neck because of extensive muscle spasm. Most patients will have normal radiological studies. If disc herniation or nerve root compromise is suggested, an MRI study can help pinpoint the problem.[5]</li></ul>                                                                                                                 |
| <b>Acute disc herniation</b>                        | <ul style="list-style-type: none"><li>• History of repetitive cervical stress or, rarely, from a single traumatic incident. Increased risk may accrue because of vibrational stress, heavy lifting, prolonged sedentary position, whiplash accidents, and frequent acceleration/deceleration.</li><li>• Cervical radiculopathy can result from nerve root injury in the presence of disc herniation or stenosis, most commonly foraminal stenosis, leading to sensory, motor, or reflex abnormalities in the affected nerve root distribution.</li></ul> | <ul style="list-style-type: none"><li>• Best diagnosed by an MRI scan. If &gt;1 level of herniation appears, a CT myelogram can help distinguish which disc is irritating the spinal nerve.</li><li>• If radiculopathy symptoms are present, an electromyogram (EMG) can reveal which nerve is affected, but does not confirm disc herniation. EMG is most effective when the MRI shows &gt;1 level of herniation and there is no definite motor, sensory, or reflex deficit, to distinguish which nerve root is affected.</li></ul> |
| <b>Metastatic malignancy</b>                        | <ul style="list-style-type: none"><li>• Spontaneous but severe, persistent pain, particularly with bony involvement, which does not resolve with initial treatments.</li><li>• Bone invasion is common in known malignancy, but can often be the initial sign of an advanced, undiagnosed malignancy.</li></ul>                                                                                                                                                                                                                                          | <ul style="list-style-type: none"><li>• Cervical MRI showing mass lesion of bone or soft tissue or multiple lesions suggestive of bony metastases.</li></ul>                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Multiple myeloma</b>                             | <ul style="list-style-type: none"><li>• Multiple myeloma is seen in older patients, is rapidly progressive, and commonly presents with neurological symptoms due to vertebral body collapse. Patients may also have</li></ul>                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"><li>• X-rays of the cervical spine show ≥1 lytic vertebral bodies.</li><li>• Multiple myeloma is a plasma cell dyscrasia characterised by infiltration of the bone marrow by</li></ul>                                                                                                                                                                                                                                                                                                             |

| Condition                                 | Differentiating signs / symptoms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Differentiating tests                                                                                                                                                                                                                                                                               |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                           | symptoms associated with hypercalcaemia and renal failure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>plasma cells, and the presence of a monoclonal immunoglobulin or immunoglobulin fragment in the serum and/or urine.</li> <li>Bone marrow aspirate and biopsy with histopathology shows atypical plasma cell infiltrates.</li> </ul>                          |
| <b>Osteomyelitis or discitis</b>          | <ul style="list-style-type: none"> <li>More severe, spontaneous neck pain, often following systemic infection, with marked decreased range of motion, or with progressive neurological changes in upper extremities. Commonly begins as a cervical discitis (i.e., disc space infection) because the disc is highly susceptible to infection. Spreads to adjacent bone, with severe neck pain. Often this entity follows sepsis at some interval, so patient may be over their septic episode by the time the actual neck pain begins.</li> </ul> | <ul style="list-style-type: none"> <li>Cervical MRI usually shows evidence of bone or disc space infection. Infected areas typically appear with decreased signal intensity on T1-weighted images and increased signal intensity on T2-weighted images.</li> </ul>                                  |
| <b>Epidural abscess</b>                   | <ul style="list-style-type: none"> <li>Commonly an extension of discitis through spinal venous spread, leading to severe neck pain. In advanced cases, leads to compressive myelopathy from spinal cord compression.</li> </ul>                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>Cervical MRI is the preferred test because both the epidural collection and its effect on the spinal cord are easily discernible, as well as the likely source of the infection. MRI with contrast helps to indicate the spread of the infection.</li> </ul> |
| <b>Cervical bone or joint instability</b> | <ul style="list-style-type: none"> <li>More severe spontaneous neck pain or progressive loss of neurological function.</li> <li>Presence of underlying medical conditions such as rheumatoid arthritis (i.e., C1/2), previous trauma, previous surgery, congenital abnormality (skull base), or spontaneous degenerative spondylolisthesis.</li> </ul>                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>Cervical radiographs together with cervical MRI helpful to distinguish presence of instability, levels involved, and features of associated condition.</li> </ul>                                                                                            |
| <b>Fibromyalgia</b>                       | <ul style="list-style-type: none"> <li>Presents with widespread body pain persisting for &gt;3 months with multiple tender points; somatic</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>No radiographic or laboratory test; the diagnosis is strictly clinical. However, if the patient does not</li> </ul>                                                                                                                                          |

| Condition                                               | Differentiating signs / symptoms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Differentiating tests                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | complaints include chronic headaches, sleep disturbance, depression and anxiety, irritable bowel syndrome, genitourinary disturbances, and diffuse sensory disturbances.                                                                                                                                                                                                                                                                                                                                                                                                          | meet clinical criteria for a diagnosis, tests including FBC, thyroid function test, rheumatoid factor, and antinuclear antibody may detect the cause of symptoms.                                                                                                                                                                   |
| <b>Polymyalgia rheumatica (PMR)</b>                     | <ul style="list-style-type: none"> <li>• Presents with history of neck, shoulder girdle, and/or hip girdle stiffness and pain, occurring in patients aged &gt;50 years (usually women). Patients complain of difficulty rising from seated or prone positions, varying degrees of muscle tenderness, shoulder/hip bursitis, and/or oligoarthritis.</li> <li>• Rapid improvement is almost invariable within 24 to 48 hours with low-dose prednisolone.</li> </ul>                                                                                                                 | <ul style="list-style-type: none"> <li>• Diagnosis is made by history and with supportive laboratory tests indicating an elevated erythrocyte sedimentation rate or C-reactive protein.</li> <li>• Diagnostic and therapeutic corticosteroid trial.</li> </ul>                                                                      |
| <b>Giant cell arteritis (GCA) or temporal arteritis</b> | <ul style="list-style-type: none"> <li>• Associations are new-onset unilateral headache, jaw claudication associated with chewing tough foods, diffuse mandibular discomfort, dental discomfort, sinus pain and pressure, and/or tongue pain. Blindness, diplopia or blurry vision, and an abnormally thickened, tender, erythematous, or nodular temporal artery are also found.</li> <li>• Patients aged &gt;50 years with new-onset headache should be screened for GCA or temporal arteritis. Up to 50% of patients with GCA also have polymyalgia rheumatica.[36]</li> </ul> | <ul style="list-style-type: none"> <li>• Elevated erythrocyte sedimentation rate or CRP.</li> <li>• A positive temporal artery biopsy showing a granulomatous vasculitis confirms the diagnosis of GCA.</li> <li>• Diagnostic and therapeutic corticosteroid trial.</li> </ul>                                                      |
| <b>Ankylosing spondylitis</b>                           | <ul style="list-style-type: none"> <li>• A chronic progressive inflammatory arthropathy predominantly affecting the axial spine and sacroiliac joints. Patients present with severe pain and spinal stiffness, which may ultimately lead to spinal fusion (bamboo spine). These patients have extreme disability as</li> </ul>                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• Clinical diagnosis. There is no diagnostic test. HLA-B27, although not diagnostic, is helpful if it is positive. Inflammatory markers such as erythrocyte sedimentation rate and CRP are generally unhelpful in diagnosing or monitoring. Radiographs of the cervical spine may</li> </ul> |

| Condition                                          | Differentiating signs / symptoms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Differentiating tests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                    | a consequence. Peripheral joints, entheses (tendon or ligament attachments to bone), and extra-articular sites such as the eye and bowel are frequently affected.                                                                                                                                                                                                                                                                                                                                                                                                                                                           | show spinal fusion (bamboo spine).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Rheumatoid arthritis (RA)</b>                   | <ul style="list-style-type: none"> <li>• Pain and/or swelling in several joints, significant joint stiffness in the morning or after rest, progressive loss of joint function, symmetrical joint involvement, and good response to non-steroidal anti-inflammatory drugs (NSAIDs), with most patients presenting in their 50s.</li> <li>• Less-common extra-articular features such as rheumatoid nodules over the extensor surfaces of tendons or vasculitic skin involvement may be seen. Clinical signs seen in more severe presentations include pleuritis, pericarditis, and inflammatory eye disease.</li> </ul>      | <ul style="list-style-type: none"> <li>• Baseline radiographs of the hands and feet and spine show erosion of cartilage.</li> <li>• Rheumatoid factor (RF) is positive in about 70% of patients with RA.[37] Anti-cyclic citrullinated peptide antibodies are found in about 70% of patients with RA.[38] They can be positive when RF is negative and seem to play more of a pathogenic role in the development of RA.</li> <li>• Erythrocyte sedimentation rate or CRP levels are usually obtained to reflect the level of inflammation. However, up to 40% of patients with RA may have normal levels.[39]</li> </ul> |
| <b>Cluster headache/chronic headache syndromes</b> | <ul style="list-style-type: none"> <li>• Diagnosed from the clinical history. The most important historical factors are frequency of headaches, duration of attacks, severity of attacks, whether the headache is constant or intermittent, or unilateral or bilateral, associations (nausea, sensitivity to light or noise), and presence of trigger factors or associations with injury or analgesic overuse.</li> <li>• Headache episodes lasting &lt;2 hours are in keeping with chronic cluster headaches. Episodes lasting &gt;2 hours would be in keeping with either migraine or tension-type headaches.</li> </ul> | <ul style="list-style-type: none"> <li>• Is a clinical diagnosis of exclusion.</li> <li>• Cervical myelogram, CT scan, or MRI will be negative for cervical disc disease or spinal cord disease.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Osteoporosis</b>                                | <ul style="list-style-type: none"> <li>• Common in postmenopausal women or older men with maternal history of fragility fractures/osteoporosis,</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Measurement of bone mineral density using dual-energy x-ray absorptiometry (DXA) is the definitive test</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Condition                          | Differentiating signs / symptoms                                                                                                                                                                                                                                                                                                                                                     | Differentiating tests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    | low BMI, and tobacco use. Patients with osteoporosis are asymptomatic until fracture occurs.                                                                                                                                                                                                                                                                                         | <p>and preferred procedure diagnosis. Use of DXA for screening patients with risk factors will diagnose many cases of osteoporosis.</p> <ul style="list-style-type: none"> <li>• X-ray can reveal osteopenia and/or fractures (e.g., vertebral fractures), but is not diagnostic of condition.</li> <li>• Quantitative CT or quantitative ultrasound of the heel can be used to measure trabecular bone density if DXA is unavailable.</li> </ul>                                                                     |
| <b>Spinal compression fracture</b> | <ul style="list-style-type: none"> <li>• Usually a history of trauma, although the acute event is not always recalled; pain at rest and at night; previous history of fractures; tenderness to palpation over the midline; increased kyphosis; normal neurological examination unless there is retropulsion of bone into the neural elements, such as in burst fractures.</li> </ul> | <ul style="list-style-type: none"> <li>• Plain radiograph shows wedging of the vertebral bodies, typically anteriorly; kyphotic deformity; only the anterior half of the vertebral body is involved in compression fractures.</li> </ul>                                                                                                                                                                                                                                                                              |
| <b>Polymyositis</b>                | <ul style="list-style-type: none"> <li>• History of symmetrical weakness of shoulder and pelvic girdles.</li> </ul>                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Elevated muscle enzyme levels (e.g., creatine kinase) often with a positive antinuclear antibody titre.</li> <li>• Characteristic changes in an electromyogram include increased needle insertional activity, spontaneous fibrillations, low-amplitude short-duration polyphasic motor potentials, and complex repetitive discharges.</li> <li>• Diagnosis is confirmed with muscle biopsy, indicating immune cell infiltration and destruction of muscle fibres.</li> </ul> |
| <b>Thoracic outlet syndrome</b>    | <ul style="list-style-type: none"> <li>• Intermittent unilateral or bilateral upper extremity numbness, often with no objective sensory loss, and weakness noted rarely. Cervical myelopathy is constant, with both upper and lower extremity</li> </ul>                                                                                                                             | <ul style="list-style-type: none"> <li>• Brachial angiograms may show vascular stenosis and electromyogram/nerve conduction velocity may show proximal brachial plexus changes consistent with thoracic outlet.</li> <li>• Cervical radiology may demonstrate a skeletal</li> </ul>                                                                                                                                                                                                                                   |

| Condition                            | Differentiating signs / symptoms                                                                                                                                                                                                                                                                                                                                                                         | Differentiating tests                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | <p>neurological changes often noted.</p> <ul style="list-style-type: none"> <li>Caused by compression of the neurovascular structures just above the first rib and behind the clavicle, involving the lower 2 nerve roots of the brachial plexus (C8 and T1). Less commonly, C5, C6, and C7 involvement leads to symptoms referred to the neck, ear, chest, and outer arm.</li> </ul>                    | <p>abnormality, cervical or first rib, clavicle deformity, pulmonary disease, or Pancoast tumour.</p> <ul style="list-style-type: none"> <li>Colour-flow duplex scanning, arteriography, or venography of the arm may demonstrate vascular thoracic outlet syndrome.</li> <li>Cervical myelogram, CT scan, or MRI will be negative for cervical disc disease or spinal cord disease.</li> </ul>                                                        |
| <b>Brachial plexus injury</b>        | <ul style="list-style-type: none"> <li>Unilateral severe proximal and distal weakness and sensory loss, often following injury, or spontaneous (neuralgic amyotrophy) following viral infection, in a different pattern from cervical radiculopathy or myelopathy.</li> </ul>                                                                                                                            | <ul style="list-style-type: none"> <li>Electromyogram/nerve conduction velocity can easily differentiate lower versus upper motor neuron changes.</li> <li>MRI or cervical myelogram may show root avulsion changes.</li> </ul>                                                                                                                                                                                                                        |
| <b>Multiple sclerosis</b>            | <ul style="list-style-type: none"> <li>Spinal manifestations can mimic all signs of cervical compressive myelopathy and overlap. However, in almost all cases there are also brain lesions and neurological findings.</li> </ul>                                                                                                                                                                         | <ul style="list-style-type: none"> <li>Brain MRI typically shows changes. On cervical MRI there is no compression but intrinsic spinal cord lesions are usually noted.</li> </ul>                                                                                                                                                                                                                                                                      |
| <b>Mononeuritis multiplex (MNM)</b>  | <ul style="list-style-type: none"> <li>Distinctive clinical presentation of progressive motor and sensory deficits in the distribution of specific peripheral nerves.</li> <li>Involvement of each nerve occurs either sequentially or simultaneously.</li> <li>Pain is a frequent symptom; usually neuropathic pain within the area of sensory loss and deep pain in the affected extremity.</li> </ul> | <ul style="list-style-type: none"> <li>Diagnosis is based on clinical picture and characteristic vasculitic changes seen on nerve or muscle biopsy without demyelination.</li> <li>An electromyogram can distinguish MNM caused by vasculitis, infection, or neoplastic infiltration from multiple entrapment neuropathies.</li> <li>Cervical myelogram, CT scan, or MRI will be negative for cervical disc disease or spinal cord disease.</li> </ul> |
| <b>Amyotrophic lateral sclerosis</b> | <ul style="list-style-type: none"> <li>Can mimic cervical myelopathy, but typically has more severe proximal weakness, fasciculations, brainstem findings (i.e.,</li> </ul>                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>Cervical MRI does not show any significant spinal cord compression but may show intrinsic spinal cord lesions.</li> </ul>                                                                                                                                                                                                                                                                                       |

| Condition                             | Differentiating signs / symptoms                                                                                                                                                                                                                                                                      | Differentiating tests                                                                                                                                                                 |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                       | tongue fasciculations), and no sensory changes.                                                                                                                                                                                                                                                       |                                                                                                                                                                                       |
| <b>Complex regional pain syndrome</b> | <ul style="list-style-type: none"> <li>Severe, diffuse upper extremity pain (usually unilateral) in a non-radicular distribution, typically following an injury or a surgical procedure on that upper extremity. There are no specific sensory or motor changes beyond limitation by pain.</li> </ul> | <ul style="list-style-type: none"> <li>Cervical MRI and typically electromyogram/nerve conduction velocity will both be normal. Sympathetic blocks may help differentiate.</li> </ul> |
| <b>Hereditary muscular dystrophy</b>  | <ul style="list-style-type: none"> <li>Severe proximal and distal weakness without sensory changes from an early age.</li> </ul>                                                                                                                                                                      | <ul style="list-style-type: none"> <li>Cervical MRI and electromyogram/nerve conduction velocity will show only myopathic changes and no spinal cord compression.</li> </ul>          |

## Screening

There is no role for routine screening with cervical radiographs or cervical magnetic resonance imaging, as the frequency of asymptomatic abnormalities in the population approaches 100% as age reaches 40 years.<sup>[1] [3] [4]</sup>

# Approach

In patients with symptomatic cervical spondylosis, there are 3 main clinical syndromes:

- Axial neck pain
- Cervical spondylotic radiculopathy (CSR)
- Degenerative cervical myelopathy (DCM).

The last two syndromes may overlap and both include degrees of axial neck pain.[\[2\]](#) [\[6\]](#) [\[7\]](#) [\[16\]](#)

Neck pain may be acute or chronic, and may occur with or without neurological symptoms due to radiculopathy and/or myelopathy. It is the most common symptom, and the most easily treatable.

The evidence about the effects of individual interventions for these clinical syndromes is often contradictory because of the poor-quality randomised controlled trials (RCTs) conducted in diverse groups and the tendency for interventions to be given in combination.[\[2\]](#) [\[6\]](#) [\[40\]](#)

## Axial neck pain

First-line treatment of acute (<6 weeks), non-traumatic axial neck pain is physiotherapy, including cervical traction.[\[41\]](#) [\[42\]](#) The degree of axial neck pain can be assessed by simple outcome measures to determine the effects of subsequent treatment.[\[33\]](#) [\[41\]](#) [\[42\]](#) [\[43\]](#) [\[44\]](#) It is unclear whether patient education alone is helpful for treatment.[\[45\]](#) [\[46\]](#) Complementary and alternative treatments demonstrate minimal long-term efficacy.[\[47\]](#)

Depending on the severity of pain, the additional use of non-steroidal anti-inflammatory drugs (NSAIDs) may be beneficial in individual patients.[\[40\]](#)

If muscle spasm is a feature of the pain, muscle relaxants and manoeuvres (including heat, massage, and cervical pillows) may be beneficial in some patients.[\[14\]](#) The addition of trigger-point and/or facet joint injections and transcutaneous electrical nerve stimulator (TENS) units may also be beneficial, but high-quality evidence is lacking.[\[7\]](#) [\[11\]](#) [\[21\]](#) [\[44\]](#) [\[48\]](#) [\[49\]](#) [\[50\]](#) [\[51\]](#)

Additional treatment modalities include various forms of cervical epidural injection, chiropractic treatment, acupuncture, and other, less orthodox approaches, particularly electrotherapy, laser therapy, and cervical spine manipulation therapy.[\[14\]](#) [\[29\]](#) [\[41\]](#) [\[44\]](#) [\[49\]](#) [\[50\]](#) [\[52\]](#) [\[53\]](#) [\[54\]](#) [\[55\]](#) These therapies may entail additional risks, and the evidence does not support treatment for axial neck pain.[\[52\]](#) [\[56\]](#)

All of these treatments are symptomatic, to relieve specific parts of the patient's complaints, and none have any effect on the underlying cervical spondylosis or affect the long-term nature of the cervical degenerative changes. Very few treatments have any effect beyond 6 weeks.[\[7\]](#) [\[21\]](#)

Chronic neck pain (>6 weeks) may be managed by continuing these symptomatic treatments if they improve the patient's discomfort. Axial neck pain is starting to receive consideration for cervical arthroplasty, although this procedure is not yet approved for axial neck pain alone by organisations such as the US Food and Drug Administration.[\[16\]](#) [\[57\]](#) Physicians should refer to local consultants on indications for the procedure in their region. In general, surgery is not helpful for treatment of neck pain, but the evidence is of low quality.[\[58\]](#)

## Cervical spondylotic radiculopathy

Radiating arm pain can be severe and is initially managed with oral analgesia combined with physiotherapy and cervical traction.[7] [21] NSAIDs are typically used as first-line treatment, with escalation to opioids if the patient's pain remains uncontrolled. Oral corticosteroid therapy may also benefit individual patients.[21] Because patients initially have severe pain, a combination of these treatments is suggested at the outset to curtail the nerve irritation.[24]

Depending on the timing and outcome of these initial treatments, subsequent more invasive treatments may consist of epidural corticosteroids or cervical nerve root block at the suspected level to maintain a positive effect from the oral corticosteroids.[23] [29] [53] [56]

In most patients (around 75%), the severe arm pain will spontaneously relent by 4 to 6 weeks. The pain eventually resolves with conservative measures, but it may take 1 to 2 years to disappear completely.[16] [23] [59]

If the pain does not resolve and if all symptoms, signs and diagnostic studies converge to indicate pressure on a single nerve root, then surgical nerve decompression may be helpful.[16] [23] [26] [60]

There are a variety of surgical approaches for nerve decompression. Either anterior cervical discectomy with fusion (ACDF) or posterior nerve decompression procedures are generally selected, based on the patient's symptoms, number of levels of involvement, and specific anatomy from the cervical MRI scan. A minimum of 2 to 3 months of conservative therapy is usually required. Because significant weakness or neurological change is rarely associated with radiculopathy, the primary decision for considering surgical decompression is the patient's subjective degree of pain and the significance of the discomfort.

Another approach is cervical arthroplasty, where an artificial disc is placed instead of a bone graft and plate to avoid a fusion and retain motion; multiple randomised studies have been carried out, but these procedures are not yet routinely performed everywhere.[61] [62] Despite these multiple randomised studies, there is not yet any clear evidence regarding improved relief of radicular arm pain with arthroplasty compared with ACDF. However, although there are no clear data yet on the prevention of adjacent segment stenosis over time, arthroplasty may provide a lower rate of re-operation compared with ACDF.[61] [62] [63]

## Degenerative cervical myelopathy

Surgical decompression is the preferred first-line acute treatment in patients with moderate and severe symptoms who are good surgical candidates, although two RCTs do not show any short-term benefit for mild to moderate myelopathy.[13] [28] [31]

Adequate treatment of the severe underlying degenerative joint disease (DJD) usually requires fusion or immobilisation of the segments, leading to loss of range of motion of the cervical spine.[26] [60] With anterior approaches, adjacent segments often develop DJD over time, leading to adjacent segment stenosis. With posterior approaches there can be either instability (following laminectomy alone) or near complete loss of cervical range of motion, with the typical extensive posterior fusion needed. Furthermore, decompression surgery typically only stabilises spinal cord function (with only mild improvement in symptoms) because there is usually existing permanent damage to the spinal cord at the time of surgery. The trend is consequently towards earlier surgery, while the patient has more of a chance of returning to normal function, or surgery while the patient is asymptomatic.[10] [26] [28] [30] [60]

Conservative treatment consists of immobilisation in a hard cervical collar.<sup>[10]</sup> This is the preferred treatment for patients who are poor surgical candidates. In some countries, although not all, it is also used for those who have mild, chronic symptoms. This conservative treatment has been shown in mild to moderate myelopathy to be equivalent (over 1 to 3 years) to surgical decompression.<sup>[28]</sup>

There are no long-term drug treatments that are helpful in management of degenerative cervical myelopathy; short-term corticosteroids may be used as a bridge prior to possible surgical decompression, but for <2 weeks due to their side-effects profile.

Surgical treatment of all levels of cervical myelopathy is considered the standard of care in some countries, with supporting evidence from a prospective multi-centre study.<sup>[26] [60] [64]</sup> Surgical decompression is therefore typically offered to patients on presentation, although there is variability between individual surgeons. Due to this bias and the worry that patients may experience irreversible deterioration if surgical decompression is delayed, it is very unlikely that any randomised surgical trials for cervical myelopathy will be undertaken.<sup>[30]</sup>

# Treatment algorithm overview

Please note that formulations/routes and doses may differ between drug names and brands, drug formularies, or locations. Treatment recommendations are specific to patient groups: [see disclaimer](#)

| Acute ( summary )                                      |         |                                                                      |
|--------------------------------------------------------|---------|----------------------------------------------------------------------|
| axial neck pain                                        |         |                                                                      |
|                                                        | 1st     | physiotherapy                                                        |
|                                                        | adjunct | non-steroidal anti-inflammatory drugs (NSAIDs)                       |
|                                                        | adjunct | muscle relaxants                                                     |
|                                                        | adjunct | trigger-point and/or facet joint injections                          |
| cervical spondylotic radiculopathy (CSR)               |         |                                                                      |
|                                                        | 1st     | analgesics                                                           |
|                                                        | adjunct | physiotherapy and traction                                           |
|                                                        | adjunct | oral corticosteroids                                                 |
|                                                        | 2nd     | epidural anaesthesia or cervical nerve root block                    |
|                                                        | 3rd     | surgical nerve decompression                                         |
| degenerative cervical myelopathy (DCM)                 |         |                                                                      |
| ■ moderate to severe symptoms: good surgical candidate | 1st     | surgical decompression                                               |
| ■ mild symptoms or poor surgical candidate             | 1st     | conservative treatment with immobilisation in a hard cervical collar |

# Treatment algorithm

Please note that formulations/routes and doses may differ between drug names and brands, drug formularies, or locations. Treatment recommendations are specific to patient groups: [see disclaimer](#)

## Acute

### axial neck pain

#### 1st physiotherapy

- » Physiotherapy is the first-line treatment for axial neck pain, which is a mechanical or musculoskeletal form of pain.[21] Advice on posture, sleeping position, daily activities, work and hobbies, stretching exercises, mobility exercises, and head, neck, and shoulder exercises may benefit individual patients.[41] [42]
- » Infrared heat therapy and transcutaneous electrical nerve stimulation (TENS) may also be beneficial, but high-quality evidence is lacking.[2] [6] [51]
- » Cervical manipulation can be associated with serious neurological complications.[44] [52]
- » Although physiotherapy is of most value in the first 6 weeks, it can be continued intermittently as required to treat exacerbations of pain or chronic pain beyond 6 weeks.

#### adjunct non-steroidal anti-inflammatory drugs (NSAIDs)

Treatment recommended for SOME patients in selected patient group

##### Primary options

- » **ibuprofen**: 300-400 mg orally every 6-8 hours when required, maximum 2400 mg/day

OR

- » **naproxen**: 250-500 mg orally twice daily when required, maximum 1250 mg/day

OR

- » **diclofenac potassium**: 50 mg orally (immediate-release) twice or three times daily when required

OR

- » **diclofenac sodium**: 100 mg orally (extended-release) once daily when required

## Acute

» May supplement physiotherapy in patients with mechanical neck pain.[21] [40]

» There is no clinical efficacy difference between various NSAIDs, but many patients tolerate one better than others or may have individual-based treatment preferences.

» All NSAIDs may cause gastric irritation. This can be partially alleviated by anti-ulcer medications or taking medicines with food.[2] [6]

### adjunct muscle relaxants

Treatment recommended for SOME patients in selected patient group

#### Primary options

» **tizanidine**: 4 mg orally every 6-8 hours when required initially, increase by 2-4 mg/dose increments according to response, maximum 18 mg/day

OR

» **methocarbamol**: 1500 mg orally four times daily for 2-3 days initially, then decrease dose according to response, usual dose 4000-4500 mg/day given in 3-6 divided doses

OR

» **diazepam**: 5-10 mg orally every 8 hours when required

» Because cervical muscle spasm is a critical component of cervical spondylosis, medications may alleviate some of the secondary pain effects in combination with physical measures to relax muscles.[14] There is no clinical efficacy difference between various medications. All medications may cause drowsiness sufficient to interfere with driving or critical activities.[2] [6] [21]

### adjunct trigger-point and/or facet joint injections

Treatment recommended for SOME patients in selected patient group

#### Primary options

» **dexamethasone**: 4 mg intra-articularly/intrasynovially/into tendon sheath as a single dose  
Dexamethasone phosphate salt is generally used.

## Acute

» These injections are usually performed by either a radiologist (under CT or fluoroscopy control) or a pain management anaesthesiologist (under fluoroscopic control) as needed.<sup>[48]</sup>

» A long-acting corticosteroid preparation is usually added to a long-acting local anaesthesia medication.<sup>[2] [6] [11]</sup>

» Trigger-point and/or facet joint injections with corticosteroid (with or without a local anaesthetic) may be considered medically necessary if trigger points have been identified by palpation, if degenerative disease of facet joints is identified, and if medical management therapies such as physiotherapy, NSAIDs (unless contraindicated), and muscle relaxants have not controlled pain.

### cervical spondylotic radiculopathy (CSR)

#### 1st analgesics

##### Primary options

» **ibuprofen**: 400-800 mg orally every 6-8 hours when required, maximum 2400 mg/day

OR

» **naproxen**: 250-500 mg orally twice daily when required, maximum 1250 mg/day

OR

» **diclofenac potassium**: 50 mg orally (immediate-release) twice or three times daily when required

OR

» **diclofenac sodium**: 100 mg orally (extended-release) once daily when required

##### Secondary options

» **paracetamol/hydrocodone**: 5 mg orally every 4-6 hours when required, maximum 60 mg/day  
Dose refers to hydrocodone component only.

OR

» **oxycodone**: 5-10 mg orally (immediate-release) every 4-6 hours when required; 10 mg orally (controlled-release) every 12 hours

## Acute

» Medicines are used as first-line treatment for radicular pain in an attempt to reduce symptoms.

» There are two common levels of analgesics beyond NSAIDs: codeine-like opioid analgesics such as hydrocodone, and morphine-like opioid analgesics such as oxycodone.

» The addictive potential and harm from overdose of opioid drugs should always be considered.

### adjunct **physiotherapy and traction**

Treatment recommended for SOME patients in selected patient group

» All patients with cervical radicular pain who have physical difficulty with daily activities should be offered physiotherapy, including posture correction, stretching exercises, and active range-of-movement exercises.[21]

» Physiotherapy and particularly cervical traction can help to enlarge foramina narrowed by cervical spondylosis. It may provide further room for nerve roots and subsequently decrease the severity of the nerve tightness (hence partially alleviating the radicular pain).[2] [6] Traction regimen of 5 to 8 kg (12 to 18 pounds) for 30 to 45 minutes several times a day is recommended.

### adjunct **oral corticosteroids**

Treatment recommended for SOME patients in selected patient group

#### **Primary options**

» **prednisolone**: 60-80 mg orally once daily for 2-3 days, then taper dose gradually over 10-14 days

» Usually limited to 8 to 10 days total due to systemic toxicity, but can be helpful as an initial treatment to decrease nerve irritation and radicular pain.[11] [21]

### 2nd **epidural anaesthesia or cervical nerve root block**

» Depending on the timing and outcome of initial treatments, subsequent more invasive treatments may consist of epidural corticosteroids or cervical nerve root block at the suspected level to maintain a positive effect from the oral corticosteroids.[23] [29] [53] [56]

» To be given by a radiologist or pain management anaesthesiologist.

### 3rd **surgical nerve decompression**

## Acute

» If the pain does not resolve and if all symptoms, signs and diagnostic studies indicate pressure on a single nerve root, then surgical nerve decompression may be a helpful treatment in some patients.[16] [23]

» Either anterior cervical discectomy with fusion (ACDF) or posterior nerve decompression procedures are generally selected, based on the patient's symptoms, the number of levels of involvement, and the specific anatomy from the cervical MRI scan.

» A minimum of 2 to 3 months of conservative therapy is usually required. Because there is rarely any significant weakness or neurological change associated with radiculopathy, the primary decision for considering surgical decompression is the patient's subjective degree of pain and the significance of the discomfort.

» Another approach is cervical arthroplasty, where an artificial disc is placed instead of a bone graft and plate to avoid a fusion and retain motion; multiple randomised studies have been carried out, but these procedures are not yet routinely performed everywhere.[61] [62] Despite these multiple randomised studies, there is not yet any clear evidence regarding improved relief of radicular arm pain with arthroplasty compared with ACDF. However, although there are no clear data yet on the prevention of adjacent segment stenosis over time, arthroplasty may provide a lower rate of re-operation compared with ACDF.[61] [62] [63]

» Anterior cervical discectomy is less painful, but swallowing problems may occur.[16] [26] [65]

» Posterior cervical discectomy may be associated with increased neck pain, but does not typically involve a fusion, resulting in preservation of motion.

### degenerative cervical myelopathy (DCM)

■ moderate to severe symptoms: good surgical candidate

1st

#### surgical decompression

» Surgical decompression is the preferred treatment in patients with moderate and severe symptoms and who are good surgical candidates, although two randomised controlled trials do not show any short-term benefit for mild to moderate myelopathy.[13] [26] [28] [31] [60] There are no long-term drug treatments that are helpful in management

## Acute

of DCM; corticosteroids may be used short-term, such as a bridge prior to possible surgical decompression, but for less than a 2-week period due to severe side effects over time.

» Cervical degeneration is usually severe at this point, necessitating multi-level surgery and fusion.[13] [28]

» There is often existing and irreversible function loss at the time of surgery that usually cannot be alleviated. Surgery is therefore typically considered to stabilise function rather than necessarily improve it. This surgery has higher risks than surgery for radiculopathy, particularly of neurological worsening.

» Surgical treatment of all levels of cervical myelopathy is considered the standard of care in some countries, despite no existing specific evidence supporting this option. Surgical decompression is therefore typically offered to patients on presentation, although there is variability between individual surgeons. Due to this bias and the worry that patients may experience irreversible deterioration if surgical decompression is delayed, it is very unlikely that any randomised surgical trials for cervical myelopathy will be planned.[30]

..... ■ **mild symptoms or poor surgical candidate**

**1st**

**conservative treatment with immobilisation in a hard cervical collar**

» Conservative treatment is the preferred approach for patients who are poor surgical candidates. In some countries, although not all, it is also used for those who have mild, chronic symptoms.

» Conservative measures implemented in randomised trials primarily consist of immobilisation in a hard cervical collar, which has been shown to be equivalent (over 1 to 3 years) to surgical decompression in mild to moderate myelopathy.[28] There are no long-term drug treatments that are helpful in management of DCM; corticosteroids may be used short-term, such as a bridge prior to possible surgical decompression, but for less than a 2-week period due to severe side effects over time.

## Emerging

### Decompressive surgery for asymptomatic severe cervical spondylosis

Patients without overt neurological symptoms or signs may be considered for surgery before they develop neurological abnormalities, following the concept that early, aggressive treatment may prevent neurological complications (although the risk of such neurological complications is very low - i.e., <0.1%).<sup>[13]</sup> For example, patients may experience severe myelopathy even with minor trauma due to the pre-existing stenosis. An early procedure may prevent this from occurring. Conversely, many patients are asymptomatic. There are no studies of the natural history of the disease to suggest what proportion may become symptomatic, whereas all surgery has known immediate risks and some loss of mechanical function of the cervical spine. Because there are no available data on the likelihood of an asymptomatic patient spontaneously developing cervical myelopathy over time, the consensus at this time is that surgical risks typically outweigh the spontaneous risk of developing neurological compromise in most asymptomatic patients.<sup>[31]</sup>

### Cervical arthroplasty

Joint replacement of the cervical spine is now Food and Drug Administration-approved in the US for use in anterior cervical procedures for cervical radiculopathy.<sup>[16] [24] [57]</sup> However, parallel to lumbar arthroplasty and anterior lumbar interbody fusion, these devices may also be effective in treating axial neck pain that can be attributed to cervical degenerative disc disease.<sup>[61] [66]</sup> Follow-up studies and meta-analyses have demonstrated superiority in neck disability outcome and reduced secondary operations with arthroplasty compared with anterior cervical discectomy and fusion procedures.<sup>[62] [67] [68] [69]</sup>

## Primary prevention

Spontaneous degenerative changes of the spine are not preventable, and they progress relentlessly with age in almost all populations studied. However, the presence or absence of degenerative changes on radiographs and magnetic resonance imaging studies does not necessarily correlate with axial neck pain.<sup>[1] [3] [4]</sup> Some activities may worsen axial neck pain (e.g., occupational positions, neck positions while sleeping, chronic injury from heavy lifting, and strains), although data are incomplete on these associations.

## Patient discussions

Advise patients that cervical spondylosis is a spontaneous condition of the joints and bones of the spine that slowly worsens with age and perhaps use. There are no known treatments that halt the progression of the underlying degeneration, although many treatments exist for the symptoms arising from this degeneration.<sup>[19]</sup> Axial neck pain is a common, benign condition of the cervical spine. It is usually treatable with conservative measures and is likely to spontaneously improve. If degeneration leads to neurological complications, such as radiculopathy (arm pain) or myelopathy (loss of function), then surgical treatments (i.e., nerve or spinal cord decompression) can sometimes be helpful to treat those conditions as they arise in order to stabilise function and improve pain. Counsel patients about the symptoms of cervical myelopathy and advise them to seek urgent medical attention should such symptoms develop.

## Monitoring

### Monitoring

Monitoring depends on the patient's specific and subsequent symptoms. Degenerative changes deteriorate slowly, so further diagnostic studies are usually indicated only if the patient's symptoms substantially change or worsen.

## Complications

| Complications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Timeframe        | Likelihood    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|
| <b>progressive degeneration after surgical intervention leading to disease at adjacent levels</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>long term</b> | <b>medium</b> |
| <p>Long-term surgical risks include alteration of the mechanical aspects of cervical joint function (e.g., by fusion, partial removal) and possibly increasing the pace of degeneration by transferring stress to adjacent segments.<sup>[26]</sup></p> <p>Once a single level is surgically treated for symptoms, the patient has a much higher risk of developing long-term progression at adjacent levels or instability at previously treated levels. The only method to prevent this would be multi-level fusion, but this results in significant loss of motion. Adjacent levels can always deteriorate.</p> |                  |               |
| <b>acute myelopathy or quadriplegia</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>variable</b>  | <b>low</b>    |
| <p>Acute myelopathy occurs in only a very small fraction (&lt;0.1%) of patients with cervical spondylosis, although it can result in quadriplegia. As with any spinal cord injury, care of respiration, skin, bowel function, and bladder function are particularly important. Neurological function tends to improve over time with rehabilitation. Occasionally, surgical decompression may be indicated.</p>                                                                                                                                                                                                    |                  |               |

## Prognosis

### Axial neck pain

Axial neck pain with cervical spondylosis has no cure and is usually considered to deteriorate with age. Yet many patients with severe cervical spondylosis (on radiographic studies) have no axial neck pain; the presence of pain may not necessarily correlate with the degree or severity of radiographic spondylosis.<sup>[1] [3] [4]</sup>

Patients presenting with axial neck pain typically improve over time, although the pain may recur and may be severe.<sup>[19]</sup> The patient may need lifelong pain management treatment if the pain is persistent and prolonged.

Patients presenting primarily with axial neck pain rarely develop a more severe condition in the sense of the degenerative joint disease leading to either radiculopathy or myelopathy.

## Cervical spondylotic radiculopathy

Long-term outcome studies suggest that cervical radiculopathy eventually resolves in most patients over 1 to 2 years if not treated surgically.<sup>[24]</sup> The role of surgery is therefore primarily to speed up or enhance the natural degree of recovery, particularly if the patient has severe pain.

## Degenerative cervical myelopathy

Once patients undergo adequate decompressive surgery, their neurological function typically stabilises for many years.<sup>[64]</sup> Clear neurological worsening can usually be attributable to a specific cause, such as adjacent segment stenosis after limited anterior fusion, instability with subsequent spinal cord pressure, such as kyphotic angulation after laminectomy, or instability, such as C7/T1 subluxation, after C3 to C7 posterior fusion. However, unprotected levels can progressively deteriorate even with surgery and can, over time, cause new areas of spinal cord compression that may need further treatment.

Most cervical spine surgery enhances a baseline level of axial neck pain, and patients will often need long-term treatment of their difficult axial neck pain.<sup>[31]</sup>

## Asymptomatic abnormalities

There are no studies detailing the best approach to asymptomatic patients who present with worrisome abnormalities such as cervical stenosis. Most abnormalities are of unknown significance, and treatment (particularly surgery) should not be suggested unless it is clear to the patient that the procedure is not to treat a symptom but to prevent a specific problem from occurring in the future. Surgical treatment may possibly be indicated in some patients with asymptomatic abnormalities who, when followed over time, develop new symptoms suggestive of disease progression.

## Diagnostic guidelines

### North America

**ACR appropriateness criteria: cervical neck pain or cervical radiculopathy** (<https://www.acr.org/Quality-Safety/Appropriateness-Criteria>)

**Published by:** American College of Radiology

**Last published:** 2018

**Diagnosis and treatment of cervical radiculopathy from degenerative disorders** (<https://www.spine.org/Research-Clinical-Care/Quality-Improvement/Clinical-Guidelines>)

**Published by:** North American Spine Society

**Last published:** 2010

**Guidelines for the surgical management of cervical degenerative disease** (<https://thejns.org/toc/spi/11/2>)

**Published by:** Joint Section on Disorders of the Spine and Peripheral Nerves of the American Association of Neurological Surgeons and Congress of Neurological Surgeons

**Last published:** 2009

## Treatment guidelines

### United Kingdom

**Percutaneous endoscopic laser cervical discectomy** (<https://www.nice.org.uk/guidance/ipg303>)

**Published by:** National Institute for Health and Care Excellence

**Last published:** 2009

## North America

**A clinical practice guideline for the management of patients with degenerative cervical myelopathy: recommendations for patients with mild, moderate, and severe disease and nonmyelopathic patients with evidence of cord compression (<https://aospine.aofoundation.org/clinical-library-and-tools/ao-spine-guidelines>)**

**Published by:** AO Spine North America; Cervical Spine Research Society

**Last published:** 2017

**Clinical practice guideline for the chiropractic treatment of adults with neck pain ([https://www.jmptonline.org/article/S0161-4754\(13\)00237-6/fulltext](https://www.jmptonline.org/article/S0161-4754(13)00237-6/fulltext))**

**Published by:** Canadian Chiropractic Association; Canadian Federation of Chiropractic Regulatory and Education Boards

**Last published:** 2014

**Diagnosis and treatment of cervical radiculopathy from degenerative disorders (<https://www.spine.org/Research-Clinical-Care/Quality-Improvement/Clinical-Guidelines>)**

**Published by:** North American Spine Society

**Last published:** 2010

**Guidelines for the surgical management of cervical degenerative disease (<https://thejns.org/toc/spi/11/2>)**

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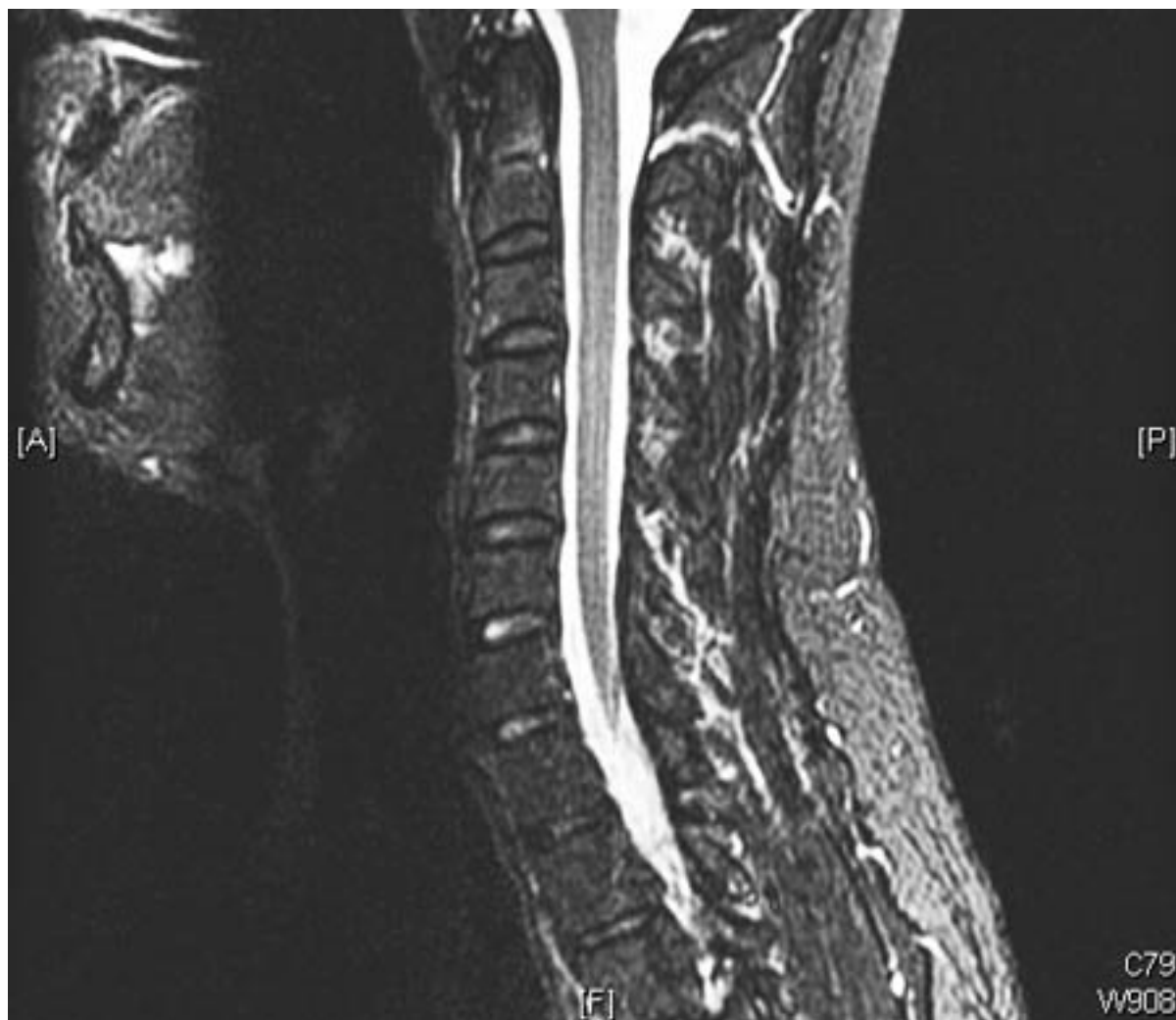
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# Images



*Figure 1: Severe, multi-level degenerative disc disease changes but without significant spinal cord compression (i.e., neither deformation nor intrinsic T2 changes) on cervical MRI (sagittal T2)*

*Dennis A. Turner, MA, MD*



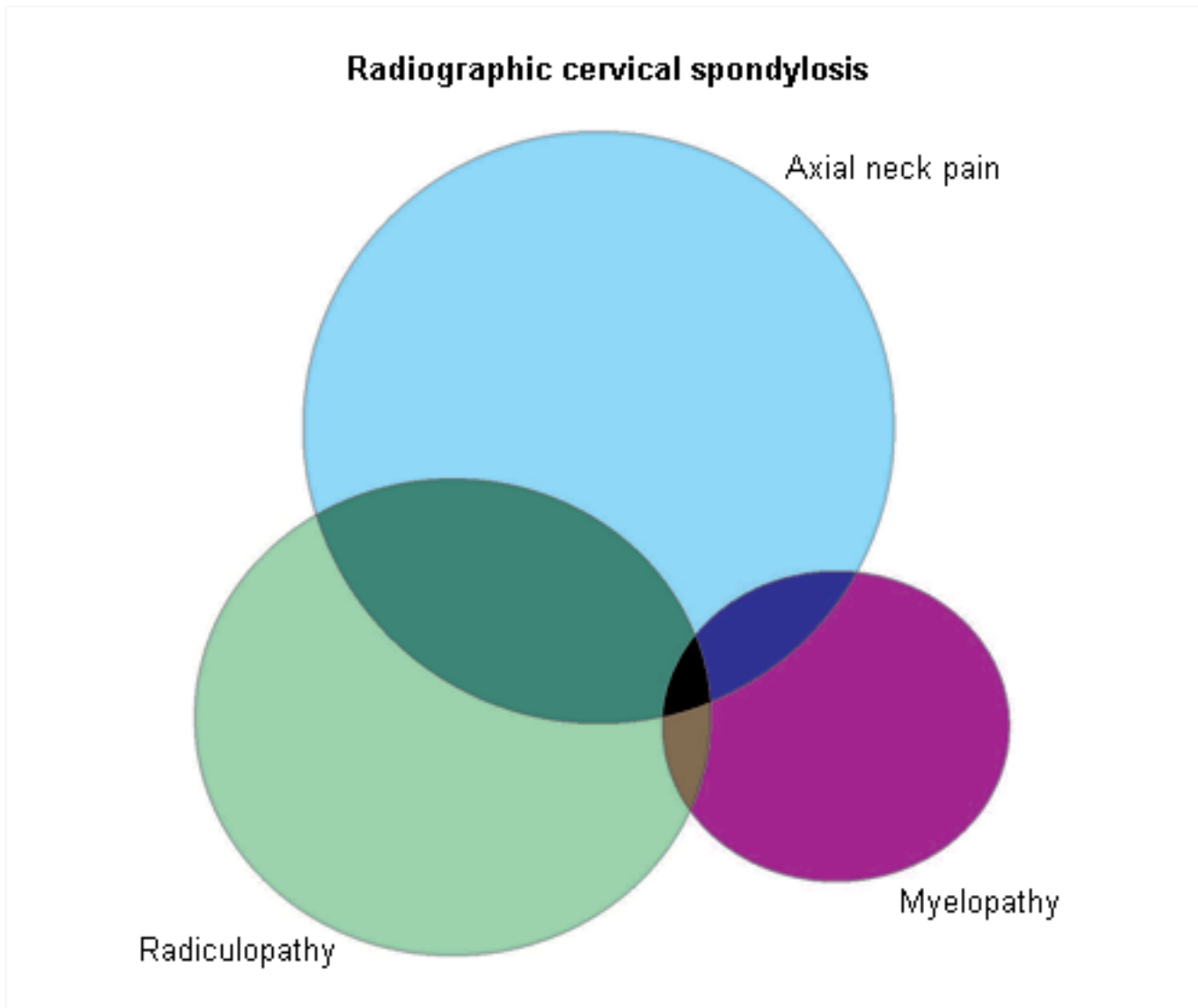
*Figure 2: Cervical MRI (sagittal T2) with mild degenerative joint disease and disc bulging*

*Dennis A. Turner, MA, MD*



*Figure 3: Cervical MRI (sagittal T2) with moderate degenerative joint disease but no significant spinal cord compression*

*Dennis A. Turner, MA, MD*



*Figure 4: Diagram of subsets of cervical spondylosis, including various symptoms possibly arising within the larger field of asymptomatic (radiographic) spondylosis*

*Dennis A. Turner, MA, MD*



*Figure 5: A single level of spinal cord compression with T2 changes, on cervical sagittal T2 sequence in the presence of symptomatic degenerative cervical myelopathy*

*Dennis A. Turner, MA, MD*



*Figure 6: Previous spinal cord compression at C3/4 on sagittal T2 MRI, with residual T2 changes, and new compression at C2/3 and C6/7, with T2 changes*

*Dennis A. Turner, MA, MD*

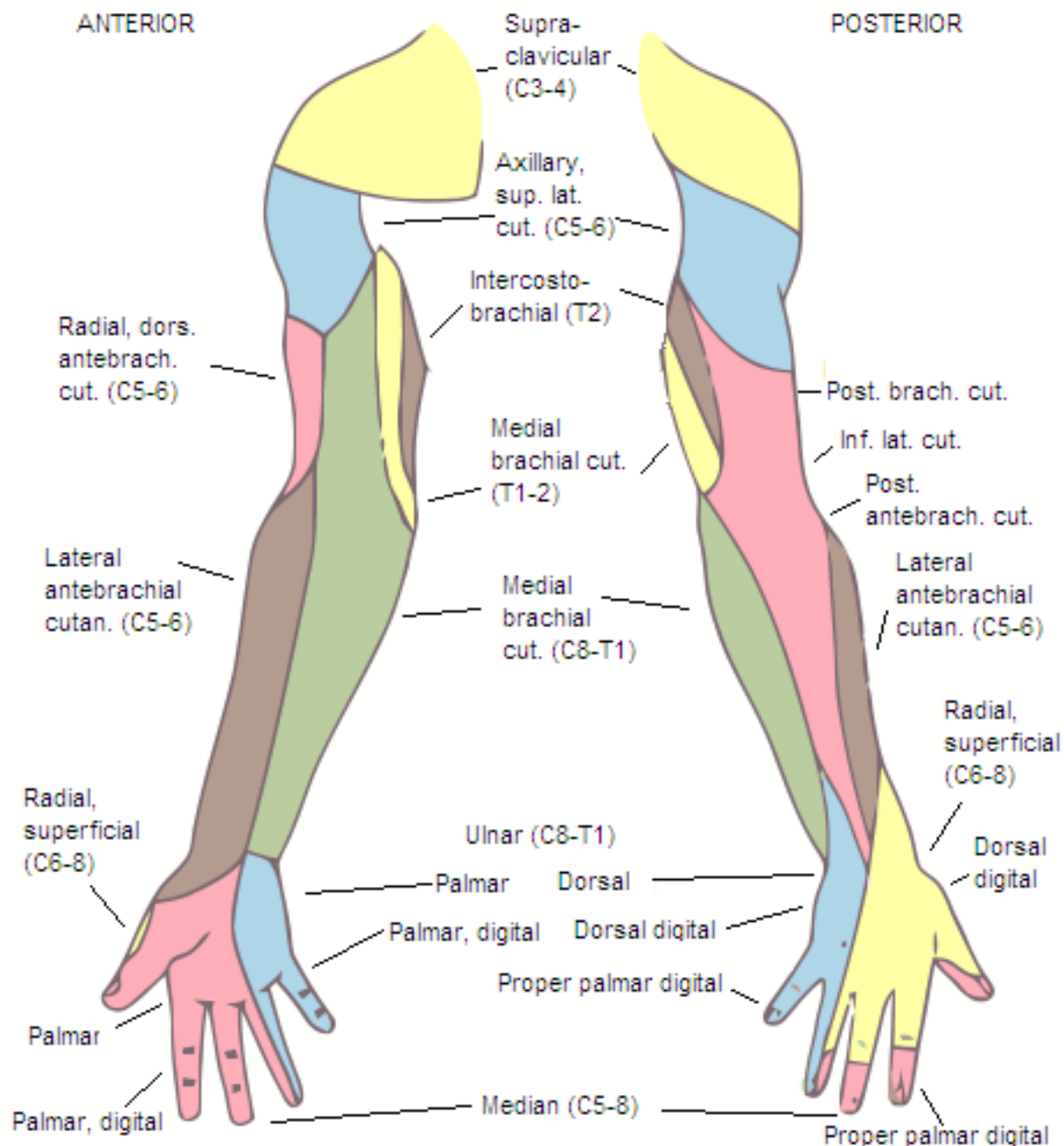


Figure 7: Chart showing average dermatome size and location. Radicular pain is usually confined to a single dermatome

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## Figure 1 – BMJ Best Practice Numeral Style

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