Diagnosis and management of degenerative neck pain

Introduction

Neck pain is a common presenting complaint, but the precise patho-aetiology is often unclear. Broadly speaking, the cause of neck pain can be considered as degenerative or non-degenerative (*Table 1*). While detailing the important non-degenerative causes the clinician should not miss, this article reviews the diagnosis and management of the common degenerative orthopaedic causes of neck pain.

Spondylosis refers to the age-related degenerative changes within the spinal column involving bone and soft tissue structures. It is analogous to osteoarthritis except that it relates to the degenerative changes within intervertebral discs rather than at synovial joints and is very common, frequently presenting late with subtle clinical symptoms and signs. The posterior facet joints do develop osteoarthritis with age, as these are synovial joints, but for practical purposes, both of these conditions can be treated as degenerative joint disease.

Table 1. Differential diagnosis of neck pain

Non-degenerative	Fracture
	Subluxation or dislocation
	Infection
	Neoplastic
	Vascular
Degenerative	Axial neck pain
	Cervical radiculopathy
	Cervical myelopathy

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Clinical syndromes

There are three principal clinical degenerative syndromes, although patients often have dual pathology.

Axial neck pain

This is the commonest of these syndromes although the aetiology is not entirely clear. The pain is most likely to arise from improper posture and muscle fatigue leading to activation of nociceptive pathways within soft tissue structures. Prior neck injury is, however, an independent risk factor (Croft et al, 2001). There is a lifetime prevalence of up to 66% with 1:20 of the population affected at any one time (Cote et al, 2004).

Cervical radiculopathy

Age-related changes in the bony and soft tissue architecture of the spinal column gradually encroach on the nerve roots resulting in pain, and loss of sensorimotor function in a dermatomal distribution. The incidence has been reported to be as high as 83/100 000 of population, rising to a prevalence of 3.5/1000 of the over 50-year-old population (Radhakrishnan et al, 1994).

Cervical myelopathy

This condition occurs when the spinal cord, rather than the nerve roots, is compressed as a consequence of spondylotic changes in the cervical spine. This leads to often subtle upper motor neurone signs in both the upper and lower limbs. Owing to these subtle clinical findings in the early stages, the true incidence and prevalence is debated.

Clinical assessment

The clinician must initially exclude non-degenerative causes of neck pain in all patients, and certain key features in the history can be viewed as 'red flag' symptoms (*Table 2*) that should raise suspicion of a non-spondylotic aetiology. Appropriate management should be expediated, including immobilization with a cervical collar, urgent investigation ideally with magnetic resonance imaging and prompt referral to a spinal expert. The definitive management of these non-degenerative conditions is beyond the scope of this review and can be found in other texts.

History

The common clinical scenarios of the three common degenerative cervical conditions are highlighted below.

Axial neck pain

Posterior neck pain is common, particularly triggered by extension and rotation. There may also be a concurrent long-standing suboccipital headache. Pain per se may be perceived locally, or it may radiate to the occiput, shoulder, scapula or arm, causing some difficulty in differentiating from cervical radiculopathy.

Cervical radiculopathy

Characteristically pain is described in the neck with a dermatomal distribution in the arm. Depending on severity there may

Table 2. 'Red flag' symptoms

Possible cervical fracture, facet joint subluxation or dislocation	History of trauma
	Elderly with minor trauma, beware the forehead bruise
	Known ankylosing spondylosis
Possible malignancy	Constant pain
	Pain worse at night
	Weight loss
	Young <20 years or elderly >50 years
Possible infection	Systemic symptoms: fever, rigors, night sweats
	Intravenous drug user
	Recent cervical spine surgery
Possible acute neurological compression	Progressive neurology
	Sphincter disturbance, urinary or faecal incontinence
	Unable to walk or 'weak legs'
	Rapidly progressing upper and lower limb symptoms

also be associated sensory, motor and hyporeflexia deficits. The symptoms are usually aggravated by extension and lateral rotation of the head to the side of the pain (i.e. the Spurling test).

The classic presentation is of an ipsilateral abducted arm with the head laterally flexed to the opposite side – these two techniques relieve pressure on the nerve root by opening up the neural foramen and decreasing the stretch on the nerve root.

Cervical myelopathy

Cervical myelopathy has an insidious onset, which typically becomes apparent in patients over 50 years old. A history of increasing clumsiness, loss of fine motor skills and ataxia are the common features. Motor weakness and wasting develop later along with hyperreflexia, clonus of normal deep tendon reflexes and the onset of pathological reflexes – all of which characterize an upper motor neuron lesion. Depending on location of spinal cord compression, pain, temperature, proprioception and vibration sense may all be affected.

As the myelopathy progresses urinary frequency, urgency or incontinence may develop. Since myelopathy often does not exist in isolation, concomitant axial neck pain and radiculopathy are common.

While the above details the common features of cervical spondylosis there are some less common manifestations that can cause confusion:

1. The primary sensory loss may not be classically dermatomal in nature, but rather present in a glove-like distribution
2. Tandem spinal stenosis is a simultaneous cervical and lumbar stenosis resulting from spondylosis. It is a triad of findings: neurogenic claudication, complex gait abnormality, and a mixed pattern of upper and lower motor neurone signs
3. Dysphagia may be present if the spurs are large enough to compress the oesophagus
4. Vertebrobasilar insufficiency and vertigo may be observed on neck extension
5. Elevated hemidiaphragm, secondary to spondylotic compression of the C3–4 nerve roots, may be another finding.

Examination

As with any musculoskeletal examination, a 'look', 'feel', 'move' and 'special tests' sequence should be adopted.

Look

Clearly check both sagittal and coronal plane alignment of the cervical spine. Asking the patient to stand with his/her back against a wall and then checking if the patient is able to touch his/her occiput to the wall (the wall test) is a good screening test for ankylosing spondylosis. Ensure any previous surgical scars, both anterior and posterior, are not missed.

Assess gait by asking the patient to walk a short distance four times, to assess the following clinical signs:

1. Observe gait. Does patient exhibit a broad-based, ataxic or an external rotated gait pattern?
2. Walk heel-to-toe: will exaggerate ataxia
3. Walk on heels: screening test for ankle dorsiflexors (L4 and L5)
4. Walk on tip toes: screening test for ankle plantiflexors (S1).

Ask the patient to stand upright with eyes closed – this is Romberg's test which assesses both ataxia and proprioception.

Feel

Gently palpate the posterior aspect of the neck and specifically check the spinous processes, interspinous areas and paraspinal soft tissue structures.

Move

Simple screening tests of movement will quickly highlight any reduction in range of movement associated with a degenerative cervical spine. Check in sequence:

1. Flexion (chin to chest) and extension (look at ceiling)
2. Lateral flexion (ear to left and right shoulder)
3. Lateral rotation (look to left and right).

Upper limb neurological examination

Sequentially assess the dermatomal sensation, myotomal power and the specific cervical myelopathic reflexes: Hoffman and inverted radial (*Figure 1*).

Also consider two special tests: the Spurling test where radicular pain is exacerbated by extension and lateral bending of the neck toward the side of the lesion, causing additional foraminal compromise, and the Lhermitte test where a generalized electrical shock sensation is associated with passive neck extension.

Lower limb neurological examination

Unless some concurrent lower spinal pathology is suspected, the lower limb assessment can be refined to the following specific findings:

1. Tone: possibly increased
2. Brisk reflexes: knee reflex (L3 and L4), ankle reflex (S1)
3. Clonus: five or more beats is abnormal
4. Extensor plantar response (i.e. the Babinski reflex).

Investigations

Patients with the warning signs or symptoms of cervical spine tumour, infection, fracture or neurological injury (*Table 2*) should be referred immediately for appropriate expert consultation and imaging, normally computed tomography and magnetic resonance imaging. Patients without red flag warning signs should be given a trial of 4–6 weeks of conservative treatment before imaging investigations.

X-ray

A plain radiograph is a simple initial investigation that will demonstrate radiographic features of spondylosis such as intervertebral disc space narrowing, osteoarthrosis of the facet and uncovertebral joints, osteophytes, and end-plate sclerosis (*Figure 2*).

Computed tomography scan

A fine cut (less than 5 mm) computed tomography scan provides a cost-effective and detailed structural view of the bony architecture and pathology, in particular compressive osteophytes, foraminal stenosis and ossification of the posterior longitudinal ligament. Further, the axial views afford assessment of spinal canal volume and the sagittal views quantify disc space collapse and neural foramen stenosis.

Computed tomography scanning should be used for all acute cervical pathology with alarm symptoms and for preoperative planning. However, owing to poor soft tissue resolution its use in chronic cervical pathology is often better in conjunction with a magnetic resonance imaging scan.

Magnetic resonance imaging

Magnetic resonance imaging is the investigation of choice as it affords a detailed image of the soft tissues, including the neural elements, disc, joint capsule, ligaments and direct visualization of intramedullary cord changes (*Figure 3*).

Myelography

Myelography involves injection of radiopaque dye into the spinal canal and subsequent imaging, either plain radiography or computed tomography scanning. It provides good diagnostic images. However, it is an invasive procedure and there are concerns about the small but significant risk of infection and cord puncture (Farese et al, 1990; Robertson and Smith, 1990).

Although there is some justification for its use where the clinical picture does not correlate with the computed tomography or magnetic resonance imaging findings (Perneczky et al, 1992), few radiologists in the UK routinely perform a cervical myelogram.

Non-operative management

Pharmaceutical

Simple analgesics, non-steroidal anti-inflammatory drugs, narcotic analgesics, corticosteroids, muscle relaxants and antidepressants are all commonly used to relieve neck pain and radiculopathy.

Rest

A short period of rest and the use of a soft collar with the neck in mild flexion may sometimes alleviate acute pain and spasm.

Physical therapies

Physical modalities, such as heat, cold, therapeutic ultrasound, massage, use of transcutaneous electrical nerve stimulation and cervical traction, have showed no significant benefit in acute or chronic neck pain (Philadelphia Panel, 2001). However, a 4–6-week course of physical therapy, including isometric exercises, active range of motion exercises, aerobic conditioning, and resistive exercises, has been found to be helpful for patients with chronic neck pain (Wang et al, 2003; Chiu et al, 2005).

Non-operative treatment of cervical radiculopathy has a 40–70% success rate (Vallee et al, 2001).

Non-operative management is not generally beneficial for cervical myelopathy,

Figure 1. Upper limb neurological examination in cervical spondylosis. Adapted from Rao et al (2007).

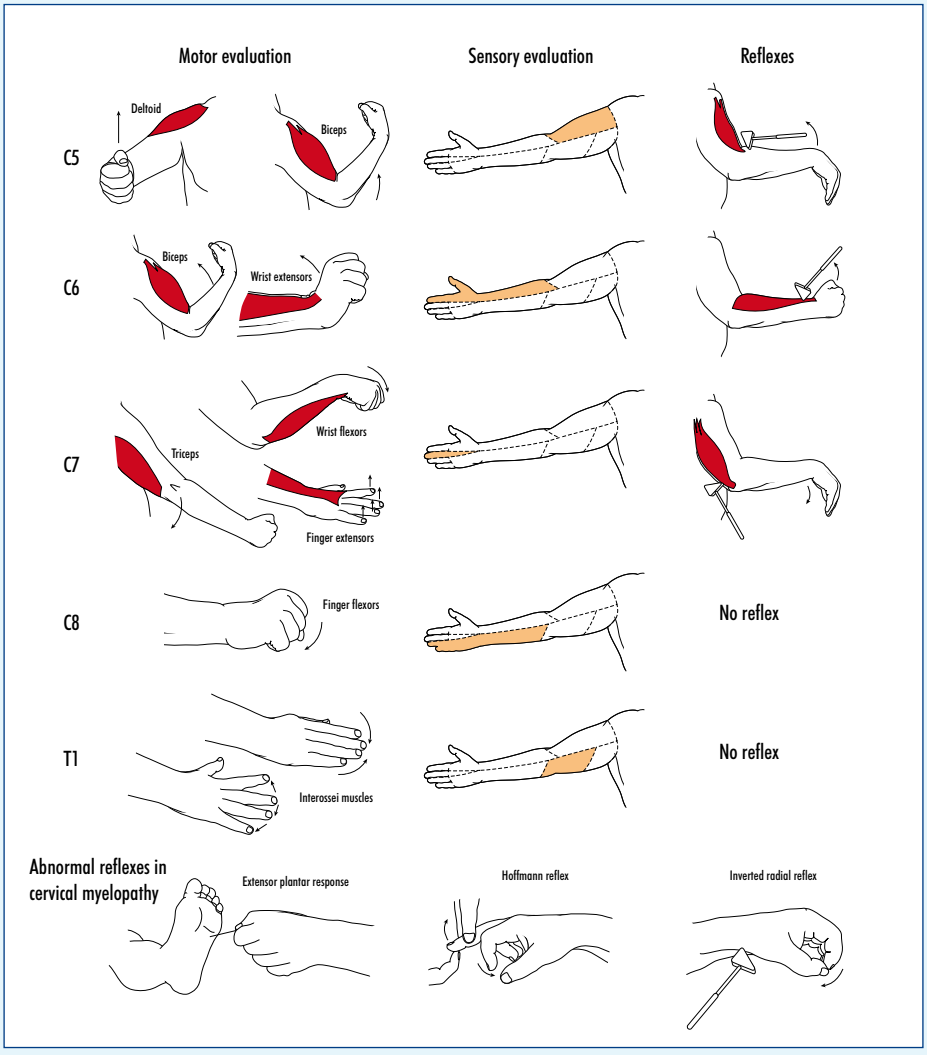


Figure 2. Radiograph of multi-level cervical spondylosis.

Figure 3. Magnetic resonance imaging of cervical spondylosis with associated spinal cord compression and intramedullary cord oedema.

although patients over 65 years old with a minimum transverse spinal cord area of >70 mm^2 have a better response. However, patients with cervical myelopathy undergoing a trial of conservative therapy should be discouraged from high-risk activities, manipulation therapies and prolonged flexion of the head (Kadanka et al, 2002).

Operative management

Following an exhaustive trial of non-operative management, surgical intervention can be considered for select cases, provided the benefits of the procedure can justify the inherent operative risks. The surgical options are outlined below.

Degenerative axial neck pain

Most patients respond to non-operative management (Gore et al, 1987) although the outcome is influenced by various psychological factors (Riley et al, 1969).

Patients should be considered for operative management in the following circumstances:

1. Severely limiting pain that is not responsive to conservative treatment over a 12-month period in which a non-organic cause has been ruled out
2. Patients with 'pseudo-axial' neck pain (patients with C3–4 nerve root impingement) unresponsive to a trial of conservative treatment for 6–12 weeks
3. Patients who have disabling neck pain following surgery in whom their grafts or metalwork have migrated.

In the first group some studies have demonstrated a beneficial outcome with anterior cervical discectomy and fusion for axial neck pain (Palit et al, 1999).

Cervical radiculopathy

Indications for surgery in patients with symptomatic cervical radiculopathy are:

1. Patients with disabling radiculopathy who have failed to respond to a 6–12-week trial of conservative treatment
2. Patients with a progressive motor deficit or a disabling motor deficit.

Patients should have documented radiological evidence of cervical pathology in keeping with their clinical signs and symptoms.

Anterior cervical discectomy and fusion is considered an excellent option for cervical radiculopathy, with good to excellent clinical results reported in 70–90% of patients (Gore and Sepic, 1984) (*Figure 4*).

Factors predicting a superior outcome with anterior cervical discectomy and fusion include (Lunsford et al, 1980):

- Male gender
- Greater segmental kyphosis (i.e. an anterior sagittal plane deformity)
- A greater preoperative range of motion of the neck
- Greater hand grip strength
- A low functional disability score.

Other surgical options for radiculopathy include posterior foraminotomy, although there is no clear evidence that any of these are better than anterior cervical discectomy and fusion.

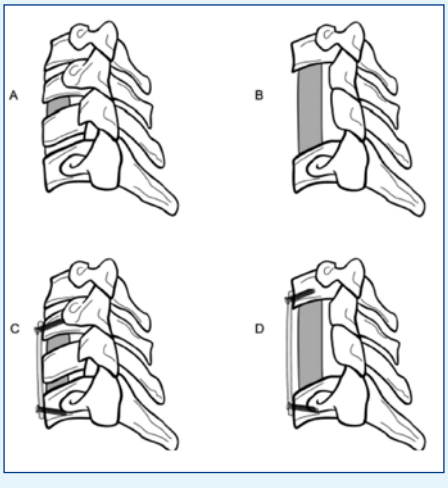
Cervical myelopathy

Patients with severe or progressive myelopathy should be considered for surgical intervention. Once the level of spinal cord compression has been identified by magnetic resonance imaging, surgery aims to restore the normal spinal canal dimension. Depending upon whether the spinal cord compression has been caused by anterior or posterior structures, the surgical approach can be planned accordingly.

Anterior surgery

Appropriate level spinal cord decompression can be performed, with an anterior discectomy or corpectomy and fusion, with or without instrumentation (*Figure 4*). A variety of techniques have been described to achieve stability following decompression, including autograft, allograft and technical spacers such as titanium or polyether ether ketone (*Figure 5*) (Mondorf et al, 2009). However, a prospective, randomized trial has shown no difference in outcome between autograft and a titanium cage (Hacker et al, 2000).

Figure 4. Common anterior operative interventions used for cervical spondylosis. a. Anterior cervical discectomy and insertion of a spacer for fusion. b. Anterior cervical corpectomy and insertion of a strut bone graft. c. Anterior cervical discectomy followed by insertion of a bone spacer for fusion and application of an anterior plate. d. Anterior cervical corpectomy, insertion of a strut graft and application of an anterior plate. From Rao et al (2006).



Posterior surgery

At the appropriate level, laminoplasty (hinging open of the lamina) and laminectomy (surgical excision of the lamina) both have similar outcomes in symptomatic myelopathy.

Longer operative times and more blood loss have been reported with anterior cervical surgery, whereas frequent axial neck pain and postoperative stiffness are more commonly reported after laminoplasty. A meta-analysis revealed that 55% of more than 2000 patients showed some neurological recovery following laminoplasty (Ratliff and Cooper, 2003).

Cervical disc replacement

Cervical interbody fusion is associated with accelerated degeneration of adjacent discs and reduced range of movement, and this has led to the development of cervical arthroplasty, a rapidly advancing area of spinal surgery. The aim is to maintain the mobility of the disc joint and several prostheses are currently available (*Figure 6*).

Most current designs involve cobalt–chromium endplates in combination with an ultra-high molecular weight polyethylene insert, a bearing surface commonly used in lower limb arthroplasty. Clinical

Figure 5. Solis interbody cervical cage, manufactured from polyether ether ketone with titanium spikes.

trials are ongoing and the first reports are encouraging, but long-term studies will be essential before this technique is widely used (Le et al, 2004). **BJHM**

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Figure 6. The Cervitech PCM artificial cervical disc.

KEY POINTS

- Consider symptoms and signs to formulate a differential diagnosis.
- Always exclude the 'red flag' symptoms and signs that signify potentially life-threatening conditions.
- X-ray and magnetic resonance imaging are the investigations of choice.
- An intense non-operative management scheme, of at least 4–6 weeks, should be first-line treatment.
- Operative intervention can be beneficial for radiculopathy and may be considered for myelopathy.
- Cervical disc replacement is a developing technology but long-term results are not yet available to justify its use outside specialist centres.