

# How not to miss major spinal pathology in patients with back pain

**B**ack pain is a common presenting symptom in primary and secondary care with between 60 and 80% of the UK population experiencing back pain at some point in their lifetime (Sieper et al, 2009). Major spinal pathology is rare but delayed or missed diagnoses can lead to significant loss of function for the patient and potentially serious medicolegal consequences for the clinician (Todd et al, 2009).

The key to improving the diagnosis of major spinal pathology and reducing the incidence of secondary neurological sequelae is threefold:

1. Focused history and physical examination
2. Appropriate radiological and laboratory investigations
3. Emergent transfer of patients to specialist spinal centres for definitive management when necessary.

This article covers the essential clinical information that must be obtained from the history and physical examination in patients presenting with atraumatic back pain.

For the purpose of this article major spinal pathology is divided into infective, neoplastic and degenerative causes. The key features of each category are outlined to remind

clinicians of the breadth of major spinal pathology which is not related to trauma.

## History and examination

The history and physical assessment of patients with back pain is critical in differentiating between cases of back pain. A detailed history is vital to uncover any 'red flag' symptoms and signs before proceeding to a thorough physical examination. Red flags should alert the clinician to the potential for major spinal pathology (*Table 1*).

When examining the spine the clinician should begin by using a 'look, feel, move, and specialist test' approach as for any joint examination. The spine is unique in that an examination is not complete until a thorough neurological examination has also been performed. A per rectal examination is a mandatory component of this.

The neurological examination should follow the routine of 'sensation, power, tone, reflexes and per rectal examination'. As a minimum light-touch and pin-prick must be assessed in all dermatomes while a table of myotomal supply is included in *Figure 1* with power recorded using the MRC (Medical Research Council) scale (*Figure 1*).

Rectal examination is an essential part of any neurological examination and provides

vital information to the clinician who is assessing for major spinal pathology. One must assess for perianal sensation with a pinprick (neurotip or blunted needle) before assessing both resting and active external anal sphincter tone.

In secondary care clinicians are advised to complete an ASIA chart (American Spinal Injury Association) with all of the above information as it provides a reference for any change in neurology during the patient's admission ([http://asia-spinalinjury.org/wp-content/uploads/2016/02/International\\_Stdts\\_Diagram\\_Worksheet.pdf](http://asia-spinalinjury.org/wp-content/uploads/2016/02/International_Stdts_Diagram_Worksheet.pdf)).

The red flag symptoms and signs for each of the major spinal pathologies with their key features are outlined below.

## Major spinal pathology: key features, red flag symptoms and signs

### Degenerative: cauda equina syndrome

Cauda equina syndrome is a constellation of symptoms and signs that most commonly occur when nerves which form the cauda equina (nerve roots in the thecal sac below the level of the conus) are compressed by any space-occupying lesion. The commonest cause of cauda equina syndrome is a herniated lumbar

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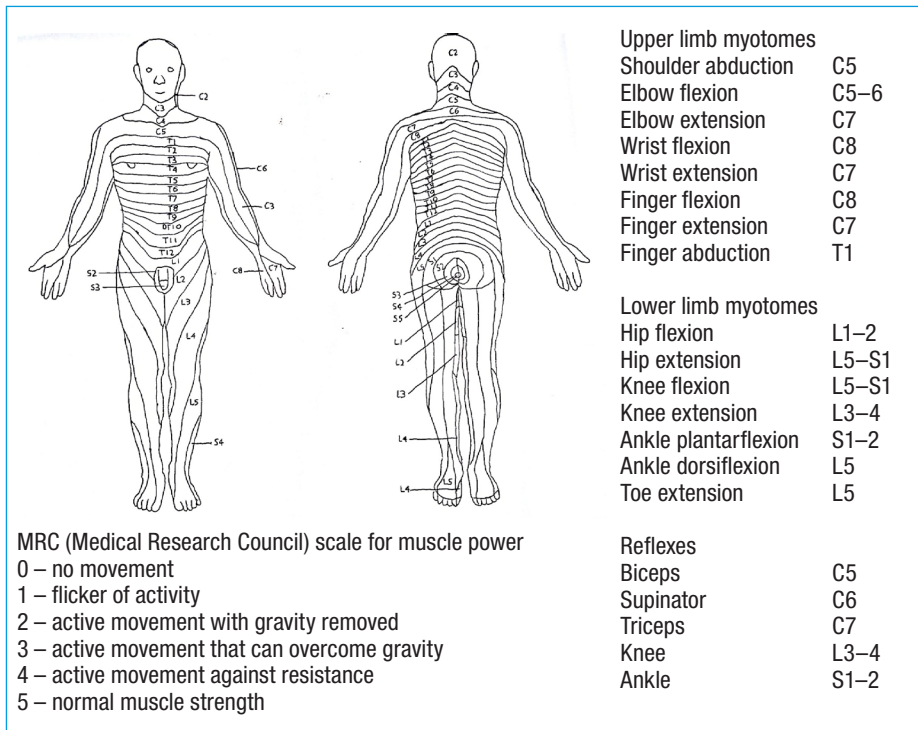
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**Table 1. Red flags for major spinal pathology**

Age <20 years or >50 years
Night sweats, fevers, chills
Non-mechanical pain
Pain at night
Thoracic pain
Immunosuppression
Severe neurological deficit or progressive neurological deficit
Sphincter disturbance (bladder or bowels)
History of malignancy
High energy trauma or spinal deformity (not discussed in this article)
Significant trauma or deformity (not discussed in this article)



**Figure 1. Dermatomes, myotomes and Medical Research Council (MRC) grading system for power. From Bowden (2013).**

disc with the commonest two affected levels being L4/5 and L5/S1 (Fraser et al, 2009). Red flag symptoms and signs are outlined below but clinicians should not base their diagnosis on a single red flag symptom or sign. A systematic review by Fairbank et al (2011) showed that the diagnosis of cauda equina syndrome is often non-specific and as few as 14–48% of patients with red flags for cauda equina syndrome go on to have a magnetic resonance imaging confirmation of the diagnosis.

### Symptoms

Symptoms of cauda equina syndrome include bilateral sciatica, saddle or genital anaesthesia or paraesthesia, urinary incontinence (overflow type as the urge to micturate is lost) and faecal incontinence (as a result of the loss of resting anal tone).

### Signs

Perianal or perineal loss of sensation to pinprick, laxity of the anal sphincter and loss of power in the lower limb (especially if bilateral signs) are all signs of cauda equina syndrome. Clinicians must be aware that red flag symptoms and signs for cauda equina syndrome can also be caused by medications, non-spinal pathology and non-urgent spinal pathology.

### Imaging

Magnetic resonance imaging should be performed in a timely fashion (Figure 2). If a clinician suspects a patient may have cauda equina syndrome, without any red flag symptoms and signs, one should consider getting emergent magnetic resonance imaging (Fairbank, 2014).

Plain radiography has limited value in patients with radicular back or leg pain unless an infective or malignant process is suspected.

### Treatment and outcomes

Cauda equina syndrome is divided into two broad categories for the ease of estimating urgency of surgery: cauda equine syndrome incomplete and cauda equina syndrome retention. In cauda equine syndrome incomplete, patients display red flag symptoms and signs of cauda equina syndrome but without bladder paralysis. Such patients should be treated emergently with decompressive surgery before they develop cauda equina syndrome retention. Patients with cauda equina syndrome retention present with bladder paralysis and the literature is unclear as to the benefit of urgent or emergent decompression of the spine in improving patient outcomes (Todd et al, 2009).

### Infection

Infections of the spinal column are rare and commonly diagnosed late. Pathogens can infect the spinal column via the haematogenous route, direct inoculation or through spread from contiguous structures. The commonest causative organism is *Staphylococcus aureus*, which accounts for more than half of all cases (Arce et al, 2001).

Bacterial infections of the vertebrae generally occur via a haematogenous route. Pathogens commonly reside in the subchondral region of the vertebrae at the vertebral end plates (spondylitis). Infections spread in an anterior to posterior direction towards the spinal cord. Pathogens such as *S. aureus* can invade through the vertebral end plates and into the intervertebral discs (spondylodiscitis). Infections can also spread into the epidural space via the arterial anastomotic networks of the spinal column where they can cause abscesses to form (Sundaram and Doshi, 2016). Epidural abscesses are a spinal cord emergency and can lead to spinal cord damage through direct compression or thrombophlebitis.

The commonest sites of spondylodiscitis are the lumbar region (58%) followed by the thoracic (30%) and cervical region (11%). This distribution is related to the difference in arterial supply in the different regions of the spine (Duarte and Vaccaro, 2013).

**Figure 2. Sagittal T2 weighted magnetic resonance image showing a large L5/S1 herniated disc causing compression of the cauda equina.**



### “ Metastatic cord compression is an oncological emergency which affects 5–10 patients in every 200 patients with terminal cancer. ”

#### Symptoms

The symptoms of infection of the spinal column can include severe back pain with an insidious onset, night pain, fever, night sweats, weight loss, low energy and chills. A history of recent infection, recent spinal instrumentation, immunosuppression secondary to HIV, diabetes or chronic kidney disease, or intravenous drug use should raise a clinician's index of suspicion when accompanied by the above symptoms.

#### Signs

Signs of infection of the spinal cord are spinal tenderness on percussion or palpation over bony spine.

#### Laboratory tests

Erythrocyte sedimentation rate, C-reactive protein, white cell count and blood cultures are needed (ideally at the peak of any febrile episode).

#### Imaging

Osteomyelitis typically takes about 10–21 days to be evident on plain film (Sundaram and Doshi, 2016). The classical plain X-ray or computed tomography findings are loss of disc height and bony change (*Figures 3 and 4*).

**Figure 3. Established spondylodiscitis of T12/L1 with associated vertebral osteomyelitis showing obliteration of the disc space with bony destruction and segmental kyphosis.**



Magnetic resonance imaging is the gold standard with high sensitivity (96%) and specificity (94%) (Duarte and Vaccaro, 2013). Magnetic resonance imaging should be performed expediently if the diagnosis is expected. There is the potential for false-positive results from magnetic resonance imaging scans with degenerate changes (Modic changes) and false-negative results in complete marrow infiltration (multiple myeloma or advanced lymphoma). Discussion with experienced musculoskeletal radiologists is therefore advised.

#### Treatment and outcomes

Antibiotic therapy remains the cornerstone of treating spinal infections with no neurological deficit. In the initial stages antibiotics are given via the parenteral route and clinicians are advised to liaise closely with their microbiology colleagues for the type of antibiotic and the duration

**Figure 4. Corresponding T2-weighted magnetic resonance imaging scan showing extensive bony destruction and loss of disc space with associated epidural abscess underlying the posterior longitudinal ligament.**



of parenteral therapy. Interestingly the literature has not found improved outcomes in patients on parenteral therapy for longer than 8 weeks. Patients may be converted to an oral antibiotic following parenteral therapy. Clinicians should expect patients' C-reactive protein levels to halve each week with antibiotic therapy (Duarte and Vaccaro, 2013).

In patients with neurological deficit secondary to spinal cord infections, surgical intervention is necessary. The purpose of the surgical intervention is multifactorial and includes decompression of the spinal canal in cases with neurological deficit, debridement of infected tissue and drainage of epidural abscesses. Debrided tissue can be sent for microbiological and histological investigation allowing for more targeted antibiotic therapy (Stokes and Arnold, 2012).

#### Neoplasia and metastatic cord compression

Neoplastic disease of the spine is most commonly secondary to metastatic deposits from the thyroid, breast, lung, prostate, kidney or lymph nodes (lymphoma). Less than 4% of cases of major neoplastic spinal pathology arises from primary spinal tumours such as multiple myeloma (Arce et al, 2001).

Metastatic cord compression is an oncological emergency which affects 5–10 patients in every 200 patients with terminal cancer. Two thirds of the cases affect the thoracic spine with the remaining third affecting the lumbosacral and cervical spine (Al-Qurainy and Collis, 2016).

Swift diagnosis with urgent imaging (magnetic resonance imaging) and early high dose corticosteroids can reduce pain and ultimately secondary cord damage (Al-Qurainy and Collis, 2016).

#### Symptoms

A history of cancer with new onset of back pain (especially thoracic pain) or unexplained weight loss may be important. Patients over 50 years of age should raise a clinician's index of suspicion when combined with the above symptoms.

#### Signs

Signs can include upper or lower limb sensory or motor disturbance with or without a sensory or motor level.

## Laboratory tests

Tumour markers (prostate-specific antigen, Ca 125, Ca 15-3, thyroid transcription factor 1), myeloma screen and bone profile should be performed.

## Imaging

Magnetic resonance imaging of the whole spine must be performed within 24 hours if there are signs of neurological deficit and known spinal metastases (National Institute for Health and Care Excellence, 2008). Positron emission tomography-computed tomography scan may be required to assess for evidence of spinal cord metastatic disease and diagnosis of the primary tumour (perform under the 2-week rule).

## Treatment and outcomes

The aims of treatment in metastatic cord compression are to reduce pain and to maintain a patient's ambulatory capacity. Treatments for metastatic cord compression include corticosteroids, radiotherapy and spinal cord decompression surgery.

Dexamethasone is a potent and effective corticosteroid for reducing cord oedema and inflammation. Corticosteroids improve patient pain and reduce the motor symptoms associated with compression, but high dose corticosteroids (>96 mg dexamethasone intravenous) do not improve patient outcomes and so current guidance is that patients receive a total daily dose of 16 mg of dexamethasone (L'Espérance et al, 2012).

In 2005 Patchell et al published the results of a randomized trial comparing surgical intervention and postoperative radiotherapy *vs* radiotherapy alone. They showed that surgical intervention with direct circumferential decompression of the spinal cord plus postoperative radiotherapy allowed patients to remain walking for the rest of their lives and improved patient survival.

Clinicians are advised to be aware of the National Institute for Health and Care Excellence (2008) guideline for managing patients with metastatic cord compression.

## Imaging

Imaging poses pitfalls in the diagnosis of spinal pathology. As a general rule, plain films are of limited value in non-traumatic back pain given the ready access to magnetic resonance imaging in most hospitals. In

patients with contraindications to magnetic resonance imaging scans (e.g. non-magnetic resonance imaging compatible pacemakers or implantable cardiac defibrillators), a computed tomography or computed tomography myelogram can be a useful adjunct. Contrast-enhanced computed tomography scans can be useful in patients with suspected malignancy as a staging examination while positron emission tomography-computed tomography is more often used by oncologists and in specialist centres rather than a primary imaging modality.

Given the severity of a potential missed diagnosis, if any of the above diagnoses is suspected then imaging should be performed urgently or the patient transferred to an appropriate centre (according to local referral pathways) where this is possible.

## Conclusions

Early recognition of major spinal pathology is essential to avoid significant patient morbidity through secondary neurological injury. In order to reduce patient morbidity clinicians must use a systematic approach to history taking and examination of the spine. The key features of major spinal pathology along with their specific red flag symptoms and signs should ease this diagnostic challenge and enable the swift transfer of patients to specialist spinal centres. **BJHM**

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## KEY POINTS

- Major pathology in back pain is uncommon but delayed or missed diagnoses can have disastrous outcomes.
- Major spinal pathology is a source of huge litigation for GPs, emergency care doctors and spinal surgeons. The average compensation payout following a missed or delayed diagnosis of cauda equina syndrome is £336 000 per case in the UK.
- Comprehensive history and examination is essential to differentiate minor and major spinal pathology.
- Red flag symptoms and signs for back pain are key to all back pain histories and physical examination.
- Prompt referral of major spinal pathology to specialist spinal centres through local and national pathways will reduce patient morbidity and delays in treatment.

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