Metastatic spinal cord compression (MSCC) is a common complication of cancer. In 1997 there were an estimated 4,000 cases in the UK but the annual incidence is likely to have increased in more recent years as patients with cancer live longer. MSCC requires urgent diagnosis and treatment; most patients unable to walk at presentation will remain non-ambulant despite treatment whereas intervention will preserve mobility in the majority of those who can walk when they present. Treatment follows a combined pathway of care based around surgery for neural decompression and stabilisation, and radio/chemotherapy for disease control and pain relief. As with all malignant disease, rapid access to high quality cross sectional imaging has revolutionised diagnosis and management strategies and become the standard of care in recent years.

### Treatment strategies in MSCC

Management of patients with MSCC should be directed by a multidisciplinary team with specialists from oncology, spinal surgery (neurological or orthopaedic), radiology and palliative care, together with allied healthcare professionals. Several key questions must be answered when formulating a management plan for a patient with MSCC:

1. **What is the nature of the patient’s neurological disability and how rapidly is it progressing?** If no disability, do they have spinal pain only?
2. **What is the site of the primary tumour and is it likely to respond to nonsurgical treatments?**
3. **Does the patient have deformity or instability (demonstrable or impending) at the level of spinal infiltration?**
4. **What is the patient’s life expectancy with and without treatment of the spinal disease?**

This last question is often particularly challenging to answer accurately. The likely response to oncological treatment may be unknown. The degree of recovery from treatment of MSCC is likely to influence survival but may also be difficult to predict.

For many years MRI has been the investigation of choice for soft tissue disease of the spine, particularly tumours that cause neurological compression. It may be supplemented by CT for review of bony pathology and fractures. Contrast enhanced CT scanning of the chest, abdomen and pelvis is used to assess the overall burden of metastatic cancer. This demonstrates the extent of metastatic disease and also often the specific primary tumour site and size, as a baseline study prior to oncological treatment.

Within the UK a mandate to treat MSCC has been defined in guidelines by The National Institute for Health and Clinical Excellence (NICE). These state that MRI is required for patients with suspected MSCC. If there is suspected spinal disease without neurological symptoms (i.e., pain alone) MRI should be performed within a week. For those with pain and neurological symptoms suggestive of neurological compression, MRI should be performed within 24 hours or sooner as dictated by the patient’s symptoms. If MRI is not available at the hospital to which the patient presents, they should be transferred to a regional centre where the study can be performed and ongoing management be planned.

The lack of 24-hour access to on-site MRI is a common problem faced by those looking after patients with acute neurological conditions outside neuroscience centres. The traditional solution has been to transfer the patient to a regional centre with out-of-hours MRI facilities. However, patients with MSCC usually do not require surgical intervention outside normal hours and frequently not at any stage in their illness. Therefore, the likelihood is that their inter-hospital transfer is for imaging that does not cause them to be admitted and treated in the receiving centre. Indeed, if the regional radiotherapy facility is somewhere else again, the patient with MSCC may be subjected to multiple ambulance transfers between three separate institutions. Transferring patients between hospitals unnecessarily subjects them to inconvenience and discomfort, may delay rather than expedite definitive treatment (if it cannot be provided at the regional centre) and increases demand on tertiary and transport resources.

### Non-MR imaging for patients with MSCC

While MR may be the definitive investigation to confirm or refute MSCC, it is not the only imaging study required to plan treatment. As stated, CT scanning of the chest, abdomen and pelvis is required to establish extent of systemic disease and validity—or futility—of aggressive treatment of the spinal disease. CT scanning is widely available: in most hospitals 24 hours a day. Some patients cannot undergo MRI due to implantable devices or claustrophobia. CT myelography can be performed for such patients, however it is a specialised investigation rarely available outside regional centres and, as such, does not help to solve the challenge of imaging the patient with suspected MSCC presenting to a local hospital outside routine working hours.

The use of plain radiographs of the spine to diagnose or exclude MSCC is specifically discouraged in the NICE guidelines. However, if access to MRI involves transferring a patient to another hospital, it is reasonable to consider other imaging modalities available on-site.

As staging CT of the chest, abdomen and pelvis is performed in the majority of patients presenting with MSCC, we considered whether this investigation would also be sufficient to diagnose MSCC. This approach would allow patients with known cancer and suspected MSCC to be fully evaluated by a CT scan used not only to stage their systemic disease but also to establish the presence or absence of spinal cord compression.
of spinal neurological compression. This would inform the urgency of patient management; an MRI scan would still be required but it could be expedited, with interhospital transfer if necessary, if neurological compression was seen on the CT. Conversely, if this spinal cord compression was not suspected from the CT, the MRI could be deferred until the next available slot at the hospital the patient presented to.

We investigated this in a retrospective study of MSCC patients who had undergone staging body CT and spinal MRI during the same clinical episode. We asked blinded observers (radiology trainees) to review CT scans of the chest, abdomen and pelvis looking for evidence of spinal metastatic disease or neural compression. The CT scans were performed using routine body imaging protocols in patients with metastatic spinal disease of varying severity, from limited disease (bony lesions without extraosseous extension or neural compression), to severe (bony destruction, expansion, vertebral collapse, angulation and neurological compression). With the use of PACS software allowing multiplanar reformating there was a high level of agreement between the CT scans and the ‘gold standard’ of spinal MRI for the same patients, reviewed by a consultant neuroradiologist experienced in spinal neuro-oncology imaging. When the patients were separated solely on the basis of “compression present” or “compression not present” there was around 89% sensitivity for MSCC and 92% specificity. Diagnostic accuracy was associated with seniority of the reporting radiology trainee.

This is not a surprising finding; before MRI became widely available, CT was recognised as highly sensitive for malignant spinal disease. We suspect that CT has become undervalued due to the presence of an apparently more sophisticated imaging modality.

What, therefore, is the role of CT in the emergency diagnosis of MSCC? If resources were no object, all hospitals would offer 24-hour access to MRI and all MSCC patients would have immediate access to the gold standard investigation without delay. In that case they would require a body CT scan purely for systemic disease staging to assess prognosis (and occasionally to image bony involvement for surgical decision making). However, such resource provision is not practical.

**Recommendations**

If MRI is readily available on-site it should be the primary investigation in the patient with cancer and suspected MSCC. However, if MRI is not immediately available we believe that CT of the chest, abdomen and pelvis covering the level of suspected spinal neurological compression should be performed. This CT scan should be used to answer two questions: Firstly, the extent of metastatic disease and secondly, is there spinal disease with likely neurological compression? This second piece of information in conjunction with knowledge of the patient’s degree of disability and rapidity of progression allows a more informed discussion with the regional oncology and spinal surgery service. Transfer for MRI may still be needed in some cases. However, employing this strategy may avoid many patient transfers between hospitals purely for MRI scans that are unlikely to result in admission and treatment at the receiving institution, or alter the management of the patient during the subsequent 24 hours.

**References**


**FIGURE 1**
Suggested algorithm for imaging and assessment of patients with suspected MSCC, according to MRI availability on site.
FIGURE 3
Illustrative cases of MSCC accurately diagnosed on CT scanning.
Top: A 62-year-old patient presenting with falls and quadripariesis with neck pain and a neglected breast tumour. Left – CT cervical spine (sagittal reformat) shows destruction of C2 and an obvious soft tissue mass compression the spinal cord. Right – sagittal T2 weighted MRI (and other sequences, not shown) shows the same appearances but adds little clinical or preoperative information.
Bottom: A 64-year-old man presents with worsening lower limb weakness over four days and thoracic back pain. Left – CT scan (sagittal reformat) shows vertebral body destruction, angulation and cord compression at T9. Right – MRI scan confirms the diagnosis but adds little information.