**Focus On**

The surgical management of metastatic spinal cord compression

**Introduction**

Metastatic spinal cord compression (MSCC) is defined as the compression of the dural sac and its contents by an extradural tumour mass. Improved oncological outcomes have resulted in more frequent presentation of MSCC. Autopsy data demonstrate spinal metastases in 70% of the commonest cancers and an incidence of symptomatic MSCC in up to 10%. Successful treatment achieves maintenance or recovery of spinal cord function, pain control, spinal stability, improved quality of life and is cost-effective.

**Background**

Until the 1980s posterior decompressive laminectomy was the usual surgical option. Cohort studies subsequently demonstrated that laminectomy has no advantage over radiotherapy in terms of neurological function or pain control, with the additional risks of wound breakdown, infection and instability. Therefore radiotherapy became the mainstay of treatment until the mid 1980s when improved outcomes with anterior decompression were reported. Recent technological advances and improved evidence in the form of a meta-analysis and randomised controlled trial have strengthened surgery's role. Spinal decompression and stabilisation have been shown to restore or maintain ambulation, provide pain relief, improve quality of life and survival.

**Role of surgery**

Current guidelines suggest that surgery is considered for in patients with a prognosis exceeding a life expectancy of more than three months. This estimate is typically made by oncologists and is dependant primarily on the tumour type and staging. Given that the reported surgical complication rate is between 20% and 30%, risks must be carefully balanced against the potential benefits when deciding the preferred treatment in order to maximise the quality of remaining life.

**Indications for surgery**

Spinal surgery is undertaken, where possible, before the development of spinal cord compression in those with a life expectancy, tumour type and physiological status favouring surgical intervention over conservative treatment. In these patients the indications for surgery are:

(i) **Mechanical.** Instability is typically manifest as mechanical axial pain exacerbated by movement, standing, and walking. Computed tomography is the best imaging modality to assess bone quality, the risk of fracture and potential or actual collapse requiring stabilisation.

(ii) **Neurological.** Impending or actual cord compromise. Magnetic resonance imaging will normally demonstrate neural compression whether or not there is an associated neurological deficit.

(iii) **Palliative.** Pain not responding to conservative measures.

(iv) **Oncological.** Patients with an apparently truly solitary metastasis in whom curative strategies may occasionally be indicated. Usually this is only considered for renal cell and thyroid carcinomas.

**Indications for radiotherapy**

Radiotherapy is indicated in patients who are not surgical candidates. In surgical candidates pre-operative radiotherapy carries the risk of wound infection and breakdown but has an important role after operation. Given the exquisite radiosensitivity of haematological malignancies such as lymphoma and multiple myeloma, treatment with conventional external beam radiation can be employed as first-line treatment, providing the spine is stable.

**Classification and scoring**

Prognostic scoring systems such as that suggested by Tokuhashi, Ajiro and Umezawa can help in deciding the appropriateness of scale and type of surgery. Factors include performance status, histological type, neurological deficit and the number of bone, vertebral and visceral metastases. Evaluation and summation of these factors can help to predict survival and plan a surgical strategy. Strategies range from palliative posterior decompression and stabilisation for those with a prognosis of less than one year to resection and reconstruction of the vertebral column through anterior, posterior or combined approaches for those with a prognosis longer than this.

**Role of spinal angiography and embolisation**

Spinal angiography may be indicated to facilitate surgery through embolisation of hypervascular tumours (particularly those of renal or thyroid origin) through either transarterial or transcatheter routes using particles, coils, polyvinyl alcohol (PVA) or Gelfoam (Pfizer Inc., New York). Retrospective comparative studies have shown a reduction in subsequent intra-operative blood loss by over 50%, with surgery ideally being performed within a few days (embolised vessels eventually recanalise). Embolisation,
particularly of cervical tumours, carries a small risk (1.4%) of permanent neurological complications.

**Surgical strategies for thoracolumbar metastases**

Of symptomatic metastases, 80% to 90% involve the thoracolumbar spine. Axial pain is the most common symptom. The surgical approach depends on the level and anatomical distribution of the disease. In the upper thoracic spine (T2 to T5) posterior transpedicular or posterolateral approaches (costotransversectomy) are often used because of the anatomical difficulties of anterior access at this level. For lesions between T6 and L5 anterior, posterior or combined procedures can be employed depending on the surgeon’s preference, prognosis, relevant comorbidities and tumour topography (distribution of disease within the spine overall as well as the individual vertebra). There is some evidence that an anterior approach is preferable in terms of minimising blood loss and wound-related complications while allowing a durable reconstruction of the anterior column (Fig. 1). Wound infection and healing problems have an incidence of between 2.4% and 19% for posterior approaches, 1% and 5% for anterior approaches and 11% and 25% for combined approaches.

**Surgical strategies for cervical metastases**

The cervical spine is involved in 8% to 20%. Lesions at the occipitocervical junction (C0 to C2) are less likely to cause neurological compromise because of the greater canal capacity at this level, although they may require stabilisation with posterior instrumentation. In the absence of instability radiotherapy is recommended. The subaxial cervical spine (C3 to C6) is the predominant region affected; the recommended surgical approach is anterior corpectomy and reconstruction (Fig. 2). Combined anterior-posterior surgery is employed for circumferential disease or multi-level involvement. At the cervicothoracic junction (C7 to T2) there is greater risk of neurological deficit because of any kyphosis, a smaller spinal canal and a poorer local blood supply. Modern cervicothoracic posterior instrumentation techniques have improved biomechanically and may suffice, without the complexity of anterior-posterior and posterolateral approaches.

**Role of vertebroplasty and kyphoplasty**

Vertebroplasty and kyphoplasty are among the most commonly used treatments for axial mechanical pain secondary to vertebral osteolysis or compression fractures. Prospective studies have demonstrated effective pain relief and satisfactory functional outcomes. Vertebroplasty involves the injection of radiopaque polymethylmethacrylate cement under fluoroscopic control and kyphoplasty involves balloon insufflation inside the vertebra followed by balloon removal and cement injection. The cement stabilises the vertebral body and also has an antitumour effect through cytotoxic activity and thermal necrosis. The advantage of improved sagittal alignment in patients undergoing kyphoplasty appears short-lived. However, kyphoplasty does appear to have a lower incidence of symptomatic cement extravasation (up to 13.5% with vertebroplasty). Contraindications to vertebroplasty or kyphoplasty include a retropulsed bone fragment or epidural tumour causing
myelopathy, coagulopathy and allergy to either the bone cement or opacification agent.42

The combination of vertebroplasty/kyphoplasty and posterior spinal instrumentation in the form of a “hybrid construct” (Fig. 3) has the advantage of providing anterior structural support and restoring the posterior tension-band with a posterior surgical approach and a shorter posterior construct.

Surgical management of a solitary spinal renal metastasis

The potentially curative outcome of en bloc tumour resection for a solitary renal cell carcinoma metastasis is well known. En bloc resection involves surgical removal of the tumour in a single piece, fully encased in a layer of healthy tissue. In the spine this is often not feasible given the distribution of disease, the need to preserve...
neurological function and the scale of procedure necessary for restoration of spinal stability. The recurrence rate after en bloc resection of a solitary renal metastasis in the published literature is 13% across six publications (2/15 patients).43-48 Boriani presented unpublished data in 25 patients undergoing en bloc resection, demonstrating 4% recurrence at 30 months, compared with 24% in 42 patients undergoing intraläsional gross resection. Whether en bloc resection actually alters survival rates is unknown.

Organisation and provision of service
In order to efficiently and effectively diagnose, treat and provide appropriate overall care for patients with MSCC there are a number of requirements. Patients and their carers (including medical staff) need improved education about the possibility of MSCC and who to contact if concerned. In each cancer network and every hospital there need to be clear pathways for referral and investigation. A lead coordinator (MSCC co-ordinator) provides a reliable point of contact, triage, advice on immediate spinal care and access to defined availability of urgent magnetic resonance imaging. Co-ordinators should liaise with defined senior professional advisers (oncologists, spinal surgeons and, when necessary, radiologists) to achieve timely decision-making about definitive management and its timing.

Summary
The primary aims of surgery in the treatment of metastatic spinal cord compression are to preserve or recover neurological function, treat spinal instability and provide pain relief with the aim of maintaining functional independence and quality of life. This can be effectively achieved through a variety of surgical approaches that are dependent on physiological status, clinical symptomatology, life expectancy, primary diagnosis and tumour topography. Improved oncological control of the primary disease means many patients are now living for years with their disease, thereby making more durable spinal reconstruction a more frequent and justifiable consideration.

Mr I Siddique
Mr Alistair J Stirling MB ChB, FRCS Ed
Royal Orthopaedic Hospital
Birmingham
UK

References


