**Malignant Spinal Cord Compression: Highlights on Specific Management Aspects**

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**ABSTRACT**

Malignant spinal cord compression is a common oncological emergency. Three cases are presented to illustrate some important management aspects of malignant spinal cord compression. In general, the definitive treatment of malignant spinal cord compression depends on the patient’s performance status, the life expectancy and the type of malignancy. Radiotherapy is the mainstay of treatment. Single fraction or short radiotherapy courses have been shown to give similar functional outcome as compared with long radiotherapy courses but with more in-field recurrence rates. The choice of fractionation of radiotherapy is also based on the patient’s performance or functional status, the estimated life expectancy and the cancer types. Early diagnosis and prompt treatment of malignant spinal cord compression before manifestation of neurological deficits is crucial to preserve the neurological function. High awareness of the risk factors and any suspicious back pain are essential to detect spinal cord compression at the impending state. After irradiation, in-field recurrence of malignant spinal cord compression is not uncommon. Limited number of studies have shown good functional outcome of re-irradiation. Re-irradiation can be considered for an in-field recurrence of spinal cord compression at the irradiated area in selected patients.

**CASE PRESENTATION**

Case 1

Mr. A, a 34-year-old gentleman, was diagnosed to have renal cell carcinoma of the left kidney in August 2005. He was treated by radical nephrectomy. Pathology showed pT3N0 grade 3 disease and adjuvant treatment was not indicated. In June 2007, he developed low back pain and bilateral lower limb weakness. He was admitted to hospital. Upon admission, his lower limb power was grade 3 to 4 out of 5. There was impairment of sensation from T10 downwards and tenderness over T10 to T12. An urgent MRI confirmed a spinal cord compression at T9 by an extradural mass. Lung metastases were also detected. He then received a laminectomy and a left costotransversectomy of T9 together with debulking of the tumour and an internal fixation and thoracic posterior spinal fusion. A course of radiotherapy to the spine from T7 to T11 with a total dose of 25Gy in 5 fractions was given after surgery. After treatment, his lower limb power improved but he still remained chair bound. Three months later, he experienced increasing back pain and numbness in his lower limbs. The lower limb power further deteriorated and he became paraplegic. An urgent MRI confirmed an in-field recurrence of spinal cord compression at T8 to T10. In view of fair pre-recurrence functional status and previous treatment by fractionated radiotherapy, re-irradiation was not offered. Re-operation was deemed not feasible. He also declined any systemic treatment.

Case 2

Mr. B, a 63-year-old gentleman, was found to have inoperable and locally advanced renal cell carcinoma of the right kidney invading the inferior vena cava and the psoas muscle together with lung metastases in January 2001. He was put on symptomatic treatment. In May 2004, he developed spinal cord compression and examination showed a lower limb power of grade 3 out of 5 and a sensory level at T9. X-ray showed blurred left pedicles of T9 and T12. CT scan showed a left paravertebral mass with erosion of the underlying vertebrae and ribs from T6 to T10, compressing the spinal cord. He then received a course of urgent radiotherapy to the spine from T8 to T12 with a total dose of 24Gy given in 6 fractions. He regained full power in his lower limbs and he could walk independently after treatment. Four months later, the patient developed sudden onset of lower limb weakness. The lower limb power deteriorated to grade 2 out of 5. An urgent MRI revealed a recurrence of spinal cord compression at the irradiated area.
Due to the extensive disease, surgery was deemed not feasible. In view of the patient’s good performance status and good pre-recurrence functional status, a second course of radiotherapy to levels T10 to T12 was subsequently given. A total dose of 24Gy were given in 8 fractions. Mr. B’s lower limb power improved after the second course of radiotherapy. He remained fully ambulatory for the remaining six months of his life.

Case 3

Mr. C, a 57-year-old gentleman, was diagnosed to have carcinoma of the stomach with peritoneal metastases in September 2007. He was treated by distal gastrectomy and then palliative chemotherapy. Palliative chemotherapy was stopped in December 2007 due to disease progression. In January 2008, he experienced increasing back pain with normal lower limb power and normal sphincter function. X-ray showed erosion of T8 and L1, L2, L4 and L5. A course of urgent radiotherapy to the spine from T7 to T9 and from T12 to L5 was subsequently given for the impending cord compression. Mr. C remained fully ambulatory after treatment.

INTRODUCTION

Malignant spinal cord compression is one of the most common oncological emergencies. A population-based study \(^1\) showed that 0.23% cancer patients presented with spinal cord compression at the diagnosis of their cancers and 2.54% patients who died from cancer had experienced at least one episode of spinal compression. Primary cancers of the lung, breast, prostate and nasopharynx; multiple myeloma; and unknown primary are the common cancers associated with malignant spinal cord compression. About 70% of the malignant spinal cord compressions are located at the thoracic spines.

MANAGEMENT STRATEGY

When malignant spinal cord compression is suspected, detailed clinical evaluation including a complete neurological assessment should be performed to confirm the diagnosis, predict the prognosis and guide the definitive treatment. An urgent MRI of the spine is the investigation of choice to establish the diagnosis and locate the exact level of compression. Dexamethasone should be given soon after cord compression is suspected to rescue the neurological deficits. Adequate analgesia is required to control any associated back pain.

The definitive treatment of malignant spinal cord compression depends on the performance status, the life expectancy, the type of malignancy and previous treatments to the involved spines. For most patients, radiotherapy is the mainstay of treatment. For patients who have poor performance status and very limited life expectancy, supportive treatment with dexamethasone will be the treatment of choice. For patients who have a single level compression, unknown histology, unstable spine or tumors that are refractory to radiotherapy, surgery treatment should be considered, especially if the patient has good performance status and relatively long estimated life expectancy. Occasionally, chemotherapy is helpful in highly selected patients, such as paediatric chemosensitive tumour, and recurrence of malignant spinal cord compression at irradiated area caused by chemosensitive tumour.

Some important management aspects of malignant spinal cord compression, including the fractionation issues of radiotherapy, management of the impending spinal cord compression and management of the recurrence of spinal cord compression at irradiated areas are discussed in the following sessions and the important points are highlighted in Table 1, 2 and 3 respectively.

FRACTIONATIONS OF RADIOTHERAPY

Radiotherapy is the mainstay of treatment for malignant spinal cord compression. However, the optimal fractionation of radiotherapy for malignant spinal cord compression has not been well established. The common fractionations include single fraction (8Gy in 1 fraction), short courses (16Gy in 2 fractions over 1 week, 20Gy in 5 fractions over 4 weeks), and long courses (30Gy in 10 fractions over 2 weeks and 40Gy in 20 fractions over 4 weeks). Both retrospective and prospective clinical studies \(^2-5\) showed that single fraction or short courses gave similar functional outcome when compared with long courses, but had more in-field recurrence rates and thus higher re-irradiation rates. However, single fraction or short courses are more convenient to the patient and occupy less...
machine time. Single fraction, such as 8Gy in one fraction, may be the radiotherapy fractionation of choice for malignant spinal cord compression in non-ambulatory patients who have limited life expectancy. On the other hand, for ambulatory patients who have a relatively long life expectancy, it may be better to adopt the fractionated radiotherapy, such as 28Gy in 7 fractions and 5Gy in 5 fractions, to avoid in-field recurrence of spinal cord compression at the irradiated area.

IMPENDING SPINAL CORD COMPRESSION

It is well known that early diagnosis and prompt treatment of malignant spinal cord compression is crucial to preserve the neurological function. In general, the functional outcomes are related to the ambulatory status of the patients at the time of treatment. Many clinical studies have reported high effectiveness of prophylactic radiotherapy for subclinical malignant cord compression in the prevention of development of neurological deficits. However, the diagnosis of malignant spinal cord compression is frequently made only after manifestation of significant neurological deficits. Many studies have thus tried to identify the risk factors related to the development of malignant spinal cord compression in cancer patients. The risk factors identified by these studies include bone metastases in carcinoma of the lung, carcinoma of the breast and carcinoma of the prostate; eroded pedicles or collapsed vertebrae; and extensive bone metastases. In addition, these clinical studies have also tried to define any clinical features that can screen out the malignant spinal cord compression at the impending status before a frank manifestation of neurological deficits.

Many studies have identified that back pain is one of the early presenting symptoms of malignant cord compression. About 88% to 95% of the patients with spinal cord compression will have back pain and the pain will be present from a few days to months before the manifestation of neurological deficits. Patients will experience a sudden increase in the intensity of the pain, a change of the location or the character of a relatively stable chronic back pain. The pain is usually intensifying or developing at night, unrelied in the recumbent position; and aggravated by coughing, sneezing or straining. It is of radicular pain in nature. When patient develops back pain in the presence of the high risk factors, cord compression should be suspected. An MRI of the spine is mandatory to exclude an impending spinal cord compression and urgent radiotherapy will be indicated to prevent neurological deficits.

RECURRENCE OF SPINAL CORD COMPRESSION AT IRRADIATED AREAS

After irradiation, an in-field recurrence of spinal cord compression is not uncommon. In a series of 335 breast cancer patients with malignant spinal cord compression, a 9% in-field recurrence rate of cord compression was reported. Both retrospective and prospective studies demonstrated a higher in-field recurrence rate with single dose or shorter courses of radiotherapy than with the long courses.

The treatment options for an in-field recurrence at irradiated areas also depends on patient’s general condition, the disease status, the neurological function, the pre-recurrence functional status and the previous radiotherapy fractionation. For the patients who have good performance status and good life expectancy with only single level involvement, the feasibility of surgical treatment should be assessed. Oncologists usually have hesitation in offering re-irradiation to the spinal cord after previous fractionated radiotherapy to same site. This is because of the worries that the lesion may be radioresistant and re-irradiation may cause radiation myelopathy. There are only a limited number of studies reporting the outcomes of re-irradiation for an in-field recurrence of spinal cord compression at irradiated areas. Schiff reported the functional outcomes of 54 patients receiving two courses of radiotherapy to the spinal cord. In this series, an equivalent neurological outcomes of radiotherapy-naive patients was achieved with 90% ambulatory patients remained ambulatory and 43% non-ambulatory patients became ambulatory after the treatment. Only one episode of radiation myelopathy was reported. In another retrospective series of re-irradiation of malignant spinal cord compression, 62 patients received re-irradiation for an in-field recurrence of metastatic spinal cord compression after a single dose of 8Gy or a short course with 20Gy given in 5 fractions. Thirty four patients received another
single fraction of 8Gy, fifteen patients received 15Gy in 5 fractions and thirteen patients received 20Gy in 5 fractions. The accumulative biologically effective dose was 80-100 Gy². Among all patients, 40% showed improvement of motor function, 45% no change and 15% deterioration of motor function. No radiation myelopathy was observed. Both series can demonstrate satisfactory effectiveness of re-irradiation in rescuing the neurological deficits after an in-field recurrence of spinal cord compression at irradiated areas.

After re-irradiation, it is expected that some of the patients will eventually develop radiation myelopathy if the total dose to the irradiated spinal cord exceeds the tolerance dose. However, there will be a latent period before the onset of radiation myelopathy. Wong has reported a median latent period of 11.4 months with the range from 3.8 to 25 months before the onset of radiation myelopathy after two courses of radiotherapy to the spinal cord. The patients may still enjoy a period of good functional status even if the patients eventually develop the radiation myelopathy. In case of in-field recurrence of spinal cord compression, the feasibility of re-irradiation should be assessed if the patients have good performance status and good pre-recurrence functional status.

CONCLUSION

Malignant spinal cord compression is one of the most debilitating complications of cancer. It has a great impact on patients’ quality of life. High awareness of the risk factors and any suspicious back pain is crucial to detect spinal cord compression at the impending status and to offer prompt treatment by radiotherapy to avoid neurological deficits. Radiotherapy is the mainstay treatment of spinal cord compression. However, the optimal fractionation has not yet been well established. The choice of fractionation is based on the performance status, the functional status, the estimated life expectancy and the cancer types. For in-field recurrence of spinal cord compression at the irradiated areas, re-irradiation may rescue the neurological dysfunction in selected patients.

Table 1:
Highlights on fractionation of radiotherapy for malignant spinal cord compression

- Retrospective and prospective clinical studies showed short course radiotherapy (8Gy x 1 or 4Gy x 5) do not have an inferior functional outcome than long course radiotherapy (3Gy x 10, 2.5Gy x 15 and 2Gy x 20) but have higher re-irradiation rates.
- Short course radiotherapy is more convenient to the patient and occupies less machine time.
- For patients with limited life expectancy, non-ambulatory: can consider single fraction - 8Gy x 1
- For patients with longer life expectancy, ambulatory, and favorable histology: better to adopt fractionated radiotherapy - 4Gy x 7 or 5Gy x 5

Table 2:
Highlights on management for impending malignant spinal cord compression

- Clinical awareness is crucial in detection of impending spinal cord compression
- High risk factors of malignant spinal cord compression identified:
  1. Cancer of breast, prostate and lung with bone metastases,
  2. eroded pedicles/collapsed vertebrae
  3. extensive bone metastases
- Suspicious back pain associated with malignant spinal cord compression:
  1. sudden change in intensity, location or character of chronic pain
  2. intensifying or developing at night, unrelieved in the recumbent position;
  3. intensified by coughing, sneezing or straining
  4. radicular pain
- In high risk patients with suspicious back pain, an urgent MRI is requested to exclude malignant spinal cord compression and urgent radiotherapy is indicated
Table 3:
Highlights on management of in-field recurrence of malignant spinal cord compression at irradiated areas

- Treatment options of recurrence of spinal cord compression at irradiated area depend on the general condition, the disease status and pre-recurrent functional status
- Need detailed evaluation for diagnosis and exclusion of other level of compression
- MRI will be indicated in selected cases when further treatment is mandatory
- Re-irradiation can improve the functional status of highly selected group of patients, especially, who have only received a single dose or a short courses of radiotherapy with good performance status, long life expectancy and good pre-recurrence functional status

References