Spinal Cord Compression, an Overview for Radiation Oncologists

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Abstract

Spinal cord compression is a major cause of morbidity and or mortality in a cancer patient. This is one of the few oncologic emergencies, as delay in therapy leads to frank paralysis. Several key areas must be considered in the diagnosis and management of spinal cord compression. Because the outcome can be devastating, a diagnosis must be made early and treatment initiated promptly. The purpose of this paper is to present an overview of the important points to radiation oncologists regarding the management of spinal cord compression in an evidence-based approach.

Key Words

Spinal cord compression, radiotherapy, review.

Introduction

Spinal cord compression (SCC) can be defined as a Compression of the dural sac and its contents by an extradural tumor mass.1) In most series prostate cancer, breast cancer, and lung cancer each account for 15–20% of patients with SCC.2,3) Non-Hodgkin lymphoma, multiple myeloma, and renal cancer each typically account for a further 5–10% of patients. SCC is found in about 5% of cancer patients at autopsy. The incidence is expected to increase with improvement in palliative therapy of metastatic disease.

Clinical Presentation

About 60–80% of SCC occurs in the thoracic spine, 15–30% in the lumbosacral region, and less than 10% involves the cervical spine. Up to 50% of patients have involvement of more than one area of the spine.4,5) Pain is present in about 90% of patients at the time of diagnosis for a median of 2 months.6,7)

About 60–85% of patients have weakness at the time of diagnosis.2) Moreover; two-thirds of patients with SCC are non-ambulatory when diagnosed.8) Patients tends to be less aware of sensory deficits than they are of weakness. Sensory deficits are slightly less common than weakness, but are detectable in 40–90% of patients.9) Bowel and bladder dysfunction tend to occur late.

Diagnosis

Clinically suspected SCC must be confirmed by imaging not only to define the diagnosis, but also to make informed decisions about further treatment. MRI remains the most useful diagnostic tool in SCC. It is non-invasive, has high soft-tissue resolution, can image several planes, and can reconstruct. MRI has a sensitivity of 93%, a specificity of 97%, and an overall diagnostic accuracy of 95% in detection of SCC. Management decisions are changed by MRI results in more than 40% of patients.10)

One study showed that employing the scanning MRI as the first diagnostic test was the most rapid and costeffective means of diagnosing spinal cord compression.10) About 5% to 10% of patients had unsuspected sites of disease elsewhere in the spinal axis, necessitating full spinal evaluation.11) Bayley et al12) looked at several factors that predict subclinical SCC in patients with metastatic prostate carcinoma. These factors were the presence of back pain, raised alkaline phosphatase levels, low hemoglobin concentration, use of narcotic analgesics, bone scan extent of disease, Gleason’s score, and the duration of hormonal therapy prior to entering the study. Using multivariate logistic regression analysis, the extent of disease, Gleason’s score

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and the duration of hormonal therapy were predictive of subclinical SCC. Patients with extensive bone scan disease (>20 metastases) had a 32% risk of SCC prior to starting hormone therapy, and they were at a 44% risk of SCC after 24 months of hormone therapy. Another study\(^\text{(13)}\) confirmed the results of Bayley et al’s findings in that back pain was not predictive of SCC, and suggest that patients with high-risk bone scans should be examined further in order to detect potential SCC early. Thus, any situation where spinal cord compression is suspected should be considered an emergency, and immediate arrangements for appropriate investigations should be undertaken.

**Treatment**

**General**

The treatment should be individualized. Palliation is the objective. The goals are the return to ambulation, prevention of progression of neurologic injury, local tumor control and pain relief. Supportive care including pain management, bed rest, anti-coagulation, prevention of constipation should be considered.

**Steroids**

Steroids should be started whenever the diagnosis is suspected, because they rapidly improve pain and function. Dexamethasone is the drug of choice, but the dosage is controversial. Two small randomized clinical trials addressed the role of steroids in the management of SCC. While one trial showed no difference between high and moderate doses of steroid,\(^\text{(14)}\) the other showed improvement in ambulation with high dose steroids compared to none. However, high dose steroids had a remarkable toxicity.\(^\text{(15)}\)

**Surgery**

Surgery remains the only method that leads to immediate relief of SCC and direct mechanical stabilization of the involved vertebra. Indications for surgery include patients with no prior history of cancer, previously irradiated area, neurologic deterioration during radiotherapy or patients with spinal instability or bony compression of their spinal cord. In a randomized trial, Patchell\(^\text{(16)}\) and his colleagues demonstrated a benefit from adding surgery to radiotherapy versus radiotherapy alone. Although there was no survival benefit, patients who underwent surgery retain the ability to walk longer and more often.

**Radiotherapy**

Potentially curative radiation therapy may be offered to patients with radiosensitive tumors (e.g. lymphoma, multiple myeloma, small-cell lung carcinoma). Other indications for primary radiotherapy include patients with life expectancy of less than 3-6 months, multiple levels of SCC, paraplegia of greater than 12 to 24 hours duration or co-morbid conditions that preclude surgery.

Various dose schedules have been tried for pain relief and reversal of compression. The most commonly used prescriptions are 30 Gray (Gy) in 10 fractions 20 Gy/5 fractions and 8 Gy/1 fraction. There was no difference in pain relief between single fraction and multifraction radiotherapy.\(^\text{(17)}\) However, patients given single fraction needed re-treatment more often than did those given fractionated treatment. Since fractionation helps to lower the risk of spinal-cord injury, single fraction radiation is reserved for very sick patients.

Radiation should be centered on the site of epidural compression. Up to 25% of patients develop recurrent spinal-cord compression after irradiation. Sixty four percent of patients with early recurrence (within 3 months) have disease within two vertebral bodies of the site of initial compression.\(^\text{(18)}\) Accordingly, the irradiated area should extend to one and possibly two vertebral bodies above and below the site of compression. Fields are oriented as opposed laterals in the cervical spine to minimize doses to the pharynx, as single posterior fields in the thoracic spine, and as single posterior or anterior–posterior opposed fields in the lumbar spine based on the anatomical depth of the spine. Posterior fields are centered on processes of the spine and kept symmetric with a width of 6–8 cm at treatment depth. They may, however, be extended laterally to include paraspinal masses associated with the compression. Therapy is then usually given by
6 MV photon machines, which is sufficient for all but obese patients where higher energies are needed. Currently, a planning CT- scan is used in many centers which solve most of the previously mentioned problems.

**Prognosis And Outcome**

Prognostic factors include functional status at the time of the therapy, radiosensitivity of the tumor and the rapid onset of neurologic deficits. Radiotherapy maintained ambulation in 80–100% of patients treated in several series who had begun treatment when they were still ambulatory. About one-third of patients who are not mobile nor paraplegic before treatment will regain the ability to walk, as will 2–6% of paraplegic patients. From the perspective of neurological prognosis, about 10% of patients eventually have local recurrence, and risk of recurrence increases with survival.

Median survival in patients undergoing radiotherapy for SCC varies between 3 months and 6 months according to historical series. Survival is higher in patients who are ambulatory either before or after irradiation. Patients with radiosensitive tumors and single spinal metastasis have longer survival than patients with lung cancer, multiple vertebral metastases, or visceral or brain metastases.

**Re-irradiation**

With the progress of modern multimodality cancer treatment, re-treatment of late recurrences or second tumors became more commonly encountered in the management of patients with cancer. Spinal cord re-treatment with radiation is a common problem in this regard. Because radiation myelopathy may result in functional deficits, many oncologists are concerned about radiation-induced myelopathy when re-treating tumors located within or immediately adjacent to the previous radiation portal. There are data suggesting that a second course of spinal radiation can be given reasonably safely to patients with no other satisfactory options. Although repeat irradiation may result in a cumulative dose exceeding the reported radiation tolerance of the spinal cord (45 Gy in 2 Gy fractions), radiation myelopathy in this setting is an apparently infrequent occurrence. This may be attributable to repair of sublethal radiation damage between courses and/or the generally short survival of patients receiving repeat irradiation compared to the latency of radiation myelopathy. In addition, some radiation oncologists have argued that spinal cord tolerance has been defined too conservatively and probably is closer to 60 Gy in 2 Gy fractions.

Re-irradiating SCC by conformal radiotherapy or intensity-modulated radiotherapy has been tried. After re-treatment, overall local control was 95%, pain relief and neurological improvement were achieved in 80% and 42% respectively. No clinically substantial late toxic effects were seen.

**Radiation Toxicity**

Transient radiation-induced myelopathy is a relatively uncommon result of radiation treatment of the spinal cord. It is characterized by Lhermitte’s sign particularly when radiation treatment is delivered to the cervical region. It usually develops 1 to 6 months after radiation therapy and gradually subsides over the next 2 to 6 months. Corticosteroids have been suggested to be beneficial in this situation, although it may resolves spontaneously. Severe symptoms may respond to carbamazepine and gabapentin.

Delayed-radiation myelopathy is a rare but serious late effect from radiation treatment of the spinal cord. The diagnosis is based on the presence of several criteria such as the presence of a spinal cord segment treated by radiation, correlation of the neurologic deficits with the segment of cord irradiated, and the exclusion of other pathology that would explain the neurologic deficit. Myelopathy related to radiation tends to be progressive with time and permanent in nature. Although no treatment has conclusively been shown beneficial for delayed radiation myelitis, corticosteroids seem to delay the progression of radiation myelitis for a short period of time. Other treatments have been used including heparin, coumadin and hyperbaric oxygen.
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References