J. Korean Soc Ther Radiol Oncol 2001;19(4):353~358

Intramedullary Spinal Cord Metastasis : A Report of Two Cases and a Review of the Literature

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Intramedullary spinal cord metastases (ISCM) account for only 3.4% of symptomatic metastases to the spinal cord. The survival of patients with ISCM is characteristically short, often no longer than 2 months, due to a rapid neurologic deterioration and the presence of widespread metastases, including metastases to the brain. We report two cases of ISCM arising from primary sphenoid sinus carcinoma and primary lung cancer along with a review of the literature. The case of ISCM from the primary sphenoid sinus is the third case of secondary syringomyelia due to ISCM in the world literature, and ISCM from the primary lung cancer is the first case reported in Korea. One case showed a slow progression of symptoms and a longer survival (26 months after the radiotherapy to the spine), and the other showed a rapid deterioration of symptoms with a shorter survival. More effective palliation can be achieved if the disease is diagnosed at an early stage when the neurologic deficits are still reversible.

Key Words : Spinal cord metastasis, Intramedullary, Radiotherapy

The literature on intramedullary spinal cord metastasis (ISCM) consists of episodic case reports on a small number of patients[1~8] and autopsy studies.[9, 10] Previously we have reported a case of ISCM arising from primary sphenoid sinus carcinoma in Korea.[4] ISCM account for only 3.4% of symptomatic metastases to the spinal cord.[7] The survival of patients with ISCM is characteristically short, often no longer than 2 months, due to a rapid neurologic deterioration and the presence of widespread metastases, including metastases to the brain.[5, 6, 9]

Since we have recently identified another case of ISCM arising from primary lung cancer, we report this case along with further follow-up data of the previously reported case and a review of the literature. The difference in the lengths of survival in two cases is also discussed.

Case Reports

1. Case 1

A 64-year-old man was diagnosed with undifferentiated carcinoma of the sphenoid sinus by trans-sphenoidal biopsy on August 19, 1993. His presenting symptoms were sudden diplopia and headache. Since the mass could not be removed surgically, the neurosurgeon referred him to the Department of Therapeutic Radiology for palliative radiation therapy (RT). His symptom improved after RT to the tumor mass.

Twenty-two months after the initial diagnosis, he experienced a sudden pain in his knee and low back pain that radiated to the left leg. On his revisit, the neurosurgeon recommended an magnetic resonance imaging (MRI) study. However, the patient refused it. One month later, 25 months after the diagnosis of sphenoid sinus carcinoma, he again experienced a severe low back pain radiating to both legs for one week, rapidly progressive upper back pain, paraparesis, and painful urinary retention for 3 days. Neurologic examination revealed paraparesis and hyperesthesia below the T3 level. MRI of the thoracic spine revealed an intramedullary spinal cord mass at the levels of T3 and T4 accompanied with syringomyelia (Fig. 1). He was treated with steroids and palliative RT (40 Gy/ 20 fractions to the C7-T7 spinal levels). The patient's voiding difficulty disappeared after 10 Gy of RT, and his paraparesis soon improved. He could walk with a cane after RT. He died of metastatic disease 26 months after the beginning of RT to the spine

Submitted September 14, 2001 accepted November 6, 2001
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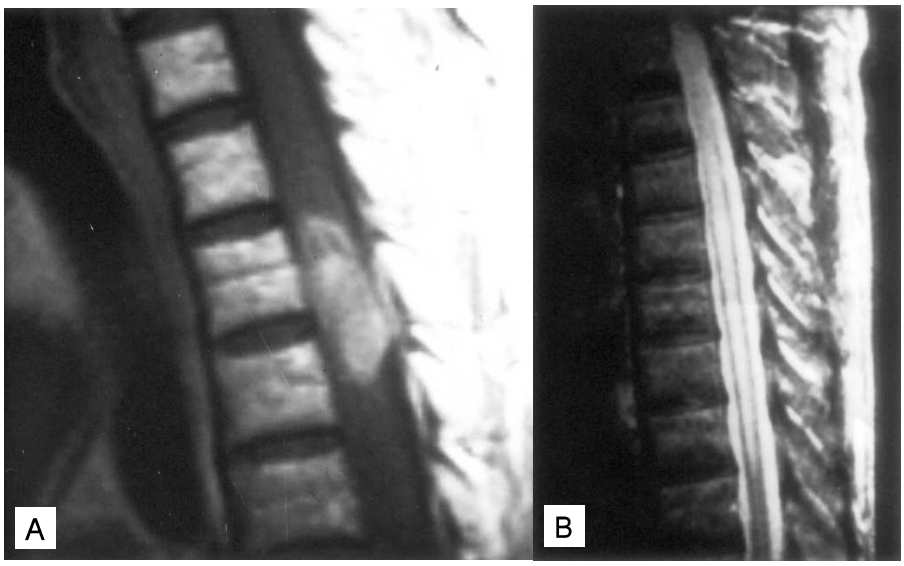

Fig. 1. A) Gd-enhanced sagittal T1-weighted MR image revealed strongly enhanced intramedullary spinal cord mass at the levels of T3 and T4 in Case 1. **B)** T2-weighted sagittal MR image showed enlarged spinal cord with central high signal intensity in the mid-thoracic area suggesting syringomyelia in Case 1.

(November 10, 1997).

2. Case 2

A 69-year-old man complained of left hemiparesis for 2 days, which was followed by rapidly progressive paraparesis and paresthesia below the L1 dermatome level. He was previously diagnosed with squamous cell carcinoma of the lung by bronchoscopy on December 29, 1999. Computerized axial tomography (CT) of the chest revealed obstruction of the left upper lobar bronchus with resultant obstructive pneumonitis (Fig. 2). The left pulmonary artery was encased by an extension of the primary lesion. Multiple mediastinal lymphadenopathies were also seen. On bronchoscopic examination, total obstruction of the left upper lobe bronchus and circumferential narrowing of the basal segmental bronchus were found.

Between January 17 and February 11, 2000, he was treated with a dose of 50 Gy in 25 daily fractions of 2 Gy using the limited thoracic field. The patient experienced blurred vision and impaired memory at the end of thoracic RT. No abnormal findings were observed on careful ophthalmologic examinations. On February 13, left hemiparesis suddenly developed, and brain metastasis was suspected. CT of the brain revealed hemorrhagic metastases in right occipital area (Fig. 3). Two days later, paraparesis developed and was accompanied by sensory impairment and inability to defecate and void. MRI revealed an intramedullary mass lesion of the spinal cord at the level of T12 with a dense enhancement on post-Gadolinium (Gd) imaging (Fig. 4). A tremor developed in both lower extremities one week after the paraparesis had developed. RT was administered to the whole brain and the T11-L1 spinal areas. The dose to the

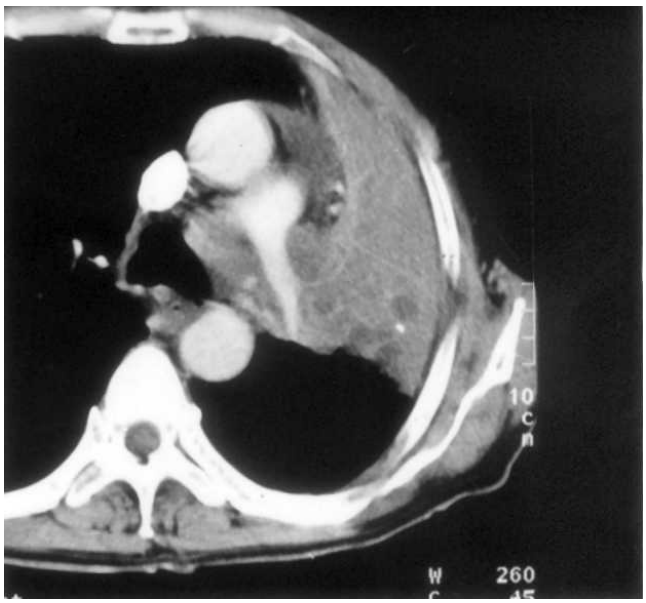

Fig. 2. CT of the chest showed obstruction of the left upper lobar bronchus with resultant obstructive pneumonitis in Case 2.

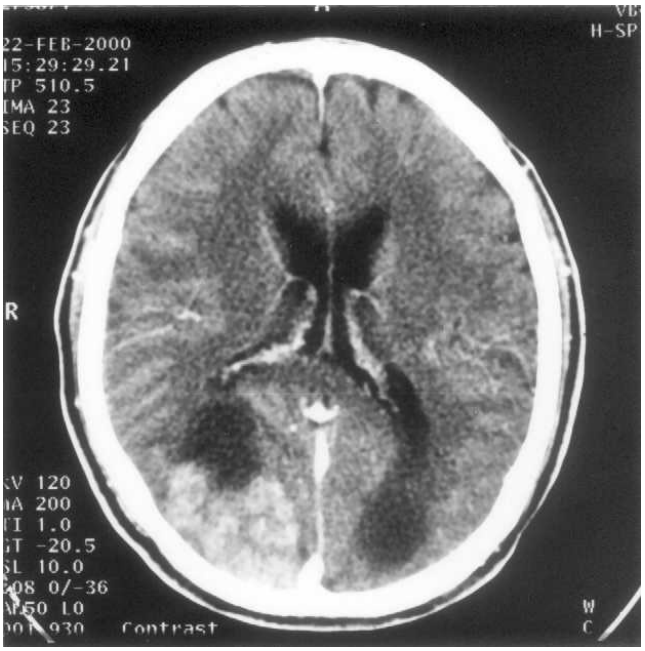

Fig. 3. CT of the brain showed hemorrhagic metastases in right occipital area in Case 2.

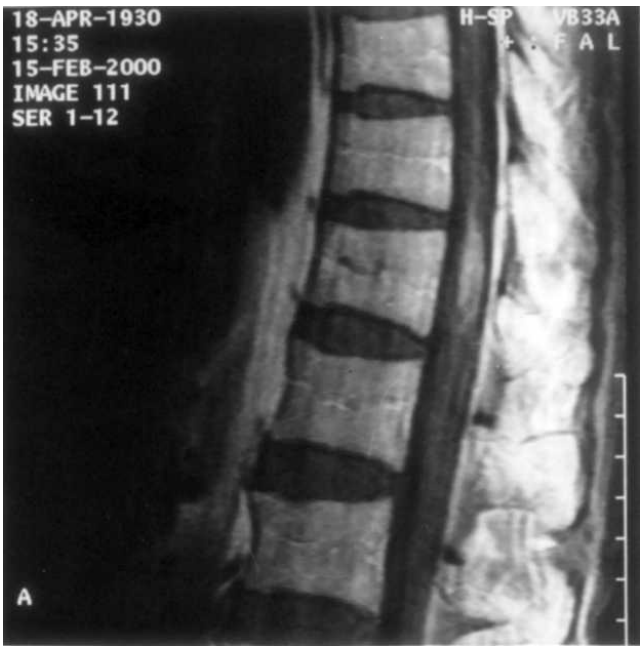

Fig. 4. MRI revealed an intradural intramedullary mass lesion of the spinal cord at the level of T12 with a dense enhancement on post-Gd imaging in Case 2.

T11-L1 spines was 18 Gy/9 fractions, and that to the whole brain was 9 Gy/3 fractions. The tremor was not controlled, and was very upsetting the patient. There was no change of the neurologic signs after RT. The RT was interrupted as the patient wanted to quit the treatment, and he died of brain metastasis one month after the diagnosis of ISCM.

Discussion

Intramedullary spinal cord metastasis (ISCM) is an unusual cause of myelopathy. In Edelson's series, intramedullary metastases accounted for only 6 of 175 (3.4%) symptomatic metastases to the spinal cord.[7] According to the retrospective autopsy studies of patients with systemic cancer, the percentage of patients with metastases to the central nervous system (CNS) ranged from 18.3 to 24.4%. The percentage of ISCM ranged from 0.9 to 8.5% of all cases with CNS metastasis and from 0.9 to 2.1% of all cancer cases, with postmortem examination of the brain and spinal cord (Table 1).[9~12] The diagnosis of ISCM in the past was elusive. Therefore, many reported cases were diagnosed in postmortem examination. The cases in the Table 1 are all autopsy cases. ISCM seems to have been diagnosed much less frequently than expected. Gd-enhanced MRI has revolutionized the diagnosis of spinal cord lesions.[14~16]

Syringomyelia is defined as CSF dissection through the ependymal lining to form a paracentral cavity. The syringomyelia occurring with an ISCM diagnosed during life time has been reported rarely.[4, 17, 18] The discussion about the syringomyelia was written in the previous report.[4]

The mode of tumor spread to the spinal cord is not clear. Three mechanisms have been suggested.[7] The first mechanism is a spread via direct arterial seeding. Eighty percent of patients with intramedullary metastasis have a primary or metastatic pulmonary neoplasm. Since the tumor should reach the lung first in order to seed through the arterial system, these findings support this hypothesis. The second is a tumor spread via the vertebral venous system. These thin-walled veins extend from the pelvis to the cranial venous sinuses and carry blood from the neuraxis to the systemic circulation. They can act as bypasses for the portal, caval, and pulmonary veins, and the flow through them reverses if thoracoabdominal pressure increases. In this way, tumor cells can leave the chest, abdomen, or pelvis and enter the vertebral system without passing through the lungs. The third potential way of spread to the spinal cord is a tumor spread by direct extension from nerve roots or craniospinal fluid (CSF) via intraspinal perineural sheaths into the spinal cord. ISCM in the second case seems to have resulted from the

Table 1. Summary of Frequency of Intramedullary Spinal Cord Metastasis in the Literature[9, 11~13)]

Feature	Meyer & Reah	Chason, et al	Hashizume & Hirano	Costigan & Winkelman
total autopsies	24,229	–	11,362	7,330
cancer cases, †with postmortem examination of brain & spinal cord	–	1,096	433	627
cases with metastases to CNS‡	212	200 (18.3%)	95 (22.0%)	153 (24.4%)
cases with intramedullary spinal metastasis	2	10	5	13
as % of all patients with cancer		0.9%	1.2%	2.1%
as % of all patients with CNS metastasisas	0.9%	5.0%	4.2%	8.5%

*This table was quoted from the Table 4 of the study by Costigan and Winkelman.
†Cancer includes sarcoma but excludes lymphoma and leukemia, except in the study by Hashizume and Hirano, which includes malignancies without further definition.
‡The proportion of the patients with central nervous sytem (CNS) metastasis to patients with cancer undergoing postmortem examination of brain and spinal cord appears in parentheses.

Table 2. The Distribution of Intramedullary Metastases by Tumor Type

Site of origin or histology	Costigan & Winkelman	Okamoto, et al.*	Edelson, et al.	Schiff & O'Neill	Grem, et al
lung	11 (85%)	80 (51%)	4 (44%)	19 (48%)	27 (49%)
non-small cell type	7	15	–	7	13
small cell type	4	22	–	12	14
unknown	–	43	4	–	–
breast	1	24	–	5	8
melanoma	1	12	1	2	2
lymphoma	–	10	4	3	7
colon/rectum	–	7	–	2	4
kidney	–	6	–	2	3
adrenal gland	–	3	–	–	–
gastrointestine	–	2	–	–	–
thyroid	–	2	–	–	–
head and neck	–	1	–	–	3
sarcoma	–	1	–	–	–
uterus	–	1	–	–	–
unknown primary	–	6	–	3	1
others	–	2	–	4	–
Total	13	157*	9	40	55

*In the study by Okamoto, et al, these 157 cases have been collected from the English literature.

first hypothesis (via direct arterial seeding), and the mode of tumor spread in the first case is not clear.

Carcinoma of the lung is the most common tumor of non-neurogenic origin metastasizing to the spinal cord, accounting for 44~49% in some series[5, 7, 8)] or 51~85% in others (Table 2).[9, 10)] In a study by Grem et al., breast carcinoma was found to be the second most common.[5)] Lymphoma, melanoma, colorectal carcinoma, Hodgkin's disease, and head and neck carcinomas are other primary malignancies reported.[5~10)] In the study by Okamoto, et al, the 157 cases have been collected in the English language literature and were not their own cases. Also, in the study by Grem, et al, the 50 cases were added from the literature. In two cases reported here, the origins of the tumors were the sphenoid sinus and the lung.

The most common site of intramedullary metastases of non-CNS origin is the thoracic cord followed by the cervical cord.[9)] In our two cases, both metastases involved the thoracic cord.

The presenting symptoms were pain and/or weakness. Neurologic status deteriorated rapidly in a period of days to weeks in the majority of patients.[5)] Both epidural and intramedullary metastases can be complicated by a rapid deterioration in neurologic status. In cases of intramedullary tumors, this may be caused by edema, hemorrhage, rapid tumor growth, or infarction of the cord secondary to a

vascular compromise. This rapid clinical progression correlates with tumor necrosis, which is a pathological sign of rapid growth of a neoplasm. In our cases, a full neurologic deficit developed within 3 months and within a week in Case 1 and Case 2, respectively. Asymmetry of motor dysfunction suggests an intramedullary tumor.[5] When intramedullary disease occurs in the cervical region, weakness often appears first in one upper extremity. This is followed by ipsilateral lower extremity weakness, and later, by weakness of the contralateral upper extremity.

The pathologic diagnosis of ISCM is not usually performed because of known pathologic diagnosis from the primary tumor and poor prognosis. The clinical diagnosis can be made by clinical course and the radiologic studies. MRI has become the main method of diagnosing intramedullary lesions because of its noninvasiveness, lack of bone artifacts, capability of imaging in any plane, and accurate and detailed visualization of normal pathologic anatomy of the spine and spinal cord. The contribution of MRI to the diagnosis of intramedullary tumors of the spine is not restricted to the demonstration of an expanded spinal cord, but also includes the recognition of intratumoral cystic degeneration, necrosis, hemorrhage, and adjacent edema based upon signal variability that cannot be revealed by other procedures.[14~16] Jayasundera et al. discussed the role of fluorodeoxyglucose positron emission tomography (FDG PET) in the detection of an asymptomatic ISCM.[19]

No prospective trials of treatment for ISCM have been performed until now. As a consequence, recommendations for treatment are based only on anecdotal experiences.[2, 5, 8] RT combined with corticosteroid administration remains the therapeutic modality of choice.[5] RT is effective in ISCM, but only if it is administered early, before paraplegia supervenes.[1] Thus, the timely diagnosis and treatment are mandatory. ISCM is often multifocal rather than solitary. Therefore, whole-cord rather than local spinal irradiation should be administered, if possible. In a study by Winkelman, et al, six spinal cord metastases of three patients, whose primary tumors were breast cancer, small cell lung cancer, and mixed follicular and papillary thyroid carcinoma, were treated with radiation alone.[1] RT halted the progression of neurologic symptoms, improved pain and paresthesia, afforded recovery of lost motor function in four of the five metastases, and restored or preserved the ability to walk in three of the five. The effect of the treatment was not short-lived, but lasted as long as the patients survived.

Survival of patients with ISCM is characteristically short, often no longer than 2 months, due to a rapid neurologic deterioration and to the presence of widespread metastases, including those to the brain.[6] In a study of 40 patients with ISCM, the median survival was 4 months for patients receiving RT and 2 months for patients not receiving RT.[8] Our two cases differed both in their origins of the tumor and in their lengths of survival. Case 1 showed a slow progression of symptoms and a longer survival. Case 2 showed a rapid deterioration of symptoms with shorter survival.

In conclusion, we described two cases of ISCM with their clinical courses. More effective palliation can be achieved if the disease is diagnosed at an early stage when the neurologic deficits are still reversible.

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국문 초록

척수내 전이암

- 2례 보고 및 문헌고찰 -

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척수내 전이암은 암환자에서 매우 드문 합병증으로 증상이 있는 척수 전이암 중 3.4%정도를 차지한다고 보고된 바 있다. 척수내 전이암 환자의 생존 기간은 매우 짧아서 2개월 이내인 경우가 대부분인데 그 이유는 신경학적으로 빨리 악화되고 뇌전이를 포함하여 여러 곳에 전이암이 동반되기 때문이다. 국내 문헌상 척수내 전이암에 대한 보고가 거의 없고 저자들이 경험한 두 증례는 서로 다른 임상 경과를 보였기에 문헌 고찰과 함께 보고하는 바이다. 원발암이 접형동암인 환자에서 척수내 전이암으로 인해 이차성 척수공동증을 동반한 증례는 세계 문헌상 세번째 증례이다. 한 증례는 증상이 서서히 진행되었고 척수에 방사선치료를 시행한 후 생존기간이 26개월이었고, 다른 증례는 증상이 매우 빠르게 진행되었고 생존기간이 훨씬 짧았다. 척수내 전이암도 신경학적 증상이 가역적인 상태에서 조기 진단이 내려진다면 더욱 효과적인 증상완화를 기대할 수도 있다.

핵심용어 : 척수내 전이암, 방사선치료