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Intradural Extramedullary Metastases Caused by Systemic Cancer[1]

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Studies have shown that only a small percentage of metastatic lesions arising outside the central nervous system spreads to the spinal subarachnoid space. The MRI findings of the two cases of surgically proven intradural extramedullary metastases from systemic cancer are presented with a review of the literatures. The size of these tumors were more than 2cm. They were ill defined isointense signal lesions in comparison with spinal cord on T1 and T2 weighted image. On proton density image the tumors had more demarcated high signal intensity than the intermediate signal intensity of spinal cord and the lower signal intensity of cerebral spinal fluid. The postcontrast T1 weighted MR images revealed strong contrast enhancement of the mass.

Index Words : Neoplasms, metastases
Spine, MR
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The majority of intradural extramedullary spinal metastases stem from a primary intracranial CNS tumor(1, 2); only a small minority of those originating outside the CNS are confined within the spinal arachnoid space(2, 3, 4). Carcinoma of the lung and breast as well as lymphoma, leukemia, and melanoma may be presented in this fashion. The MRI findings of two cases, in which surgically-proven intradural extramedullary metastases were caused by systemic cancer, are reported.

Case Reports

Case 1.

A 35-year-old woman underwent a left colectomy for colon carcinoma and years later, metastatic adenocarcinoma was found in her left cerebellar hemisphere. She underwent radiotherapy and chemotherapy, and her condition stabilized for two years. She then suffered from newly developed pain in both shoulders, gait disturbance, and a tingling sensation in the right index and middle fingers. T1- and T2-weighted MR images of the spine revealed three irregularly marginated isointense soft tissue masses of various sizes in the intradural extramedullary space from C3 to T1(Fig. 1A, B) and slight high signal masses on proton density images(Fig. 1C); these were associated with elongated high signal intensity in the intramedullary space on T2 weighted images. Postenhanced T1 weighted MRI showed a marked increase in signal intensity of the previously noted soft tissue masses in the anterior and posterior intradural extramedullary spaces(Fig. 1D). The histological appearance was of a metastatic mucus secreting adenocarcinoma.

Case 2.

In a 56-year-old man, back pain and a loss of sensation in his right lower extremity were present for two months. MRI of the spine revealed a 2.3 × 1.3 × 1.0cm sized oval shaped soft tissue mass lesion at T12-L1 with isosignal on T1 and T2 weighted images(Fig. 2A, B), and a slight high signal on proton density images (Fig. 2C). The lesion was located in the right lateroposterior intradural extramedullary space with a left anterolateral displacement of the conus medull-

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aris-cauda equina junction. Hyperintensity was seen on post-gadolinium T1-weighted images(Fig. 2D). Histopathology revealed a metastatic adenocarcinoma. At that time, CT of the chest revealed an irregularly marginated soft tissue mass in the left upper lobe, which was histologically-proven adenocarcinoma.

Discussion

The majority of intradural extramedullary spinal metastases stem from a primary intracranial CNS tumor(1, 2). Occasionally, a malignant tumor outside the CNS will metastasize to the intradural extramedullary space. When intradural metastases from systemic tumors do occur, the most common primary sources are breast and small cell lung carcinoma, and lymphoma.

There are two distinct appearances associated with intradural extramedullary metastases(1, 2, 5). The most commonly observed, arising particularly from primary CNS tumors, is one of multiple small nodules within the spinal subarachnoid space and often related to nerve roots. These nodules may range in size from 1 or 2mm to several cm. However, in our second case, the lesion from lung carcinoma shows a smooth, round, well marginated nodule about 2cm in size; this belongs to

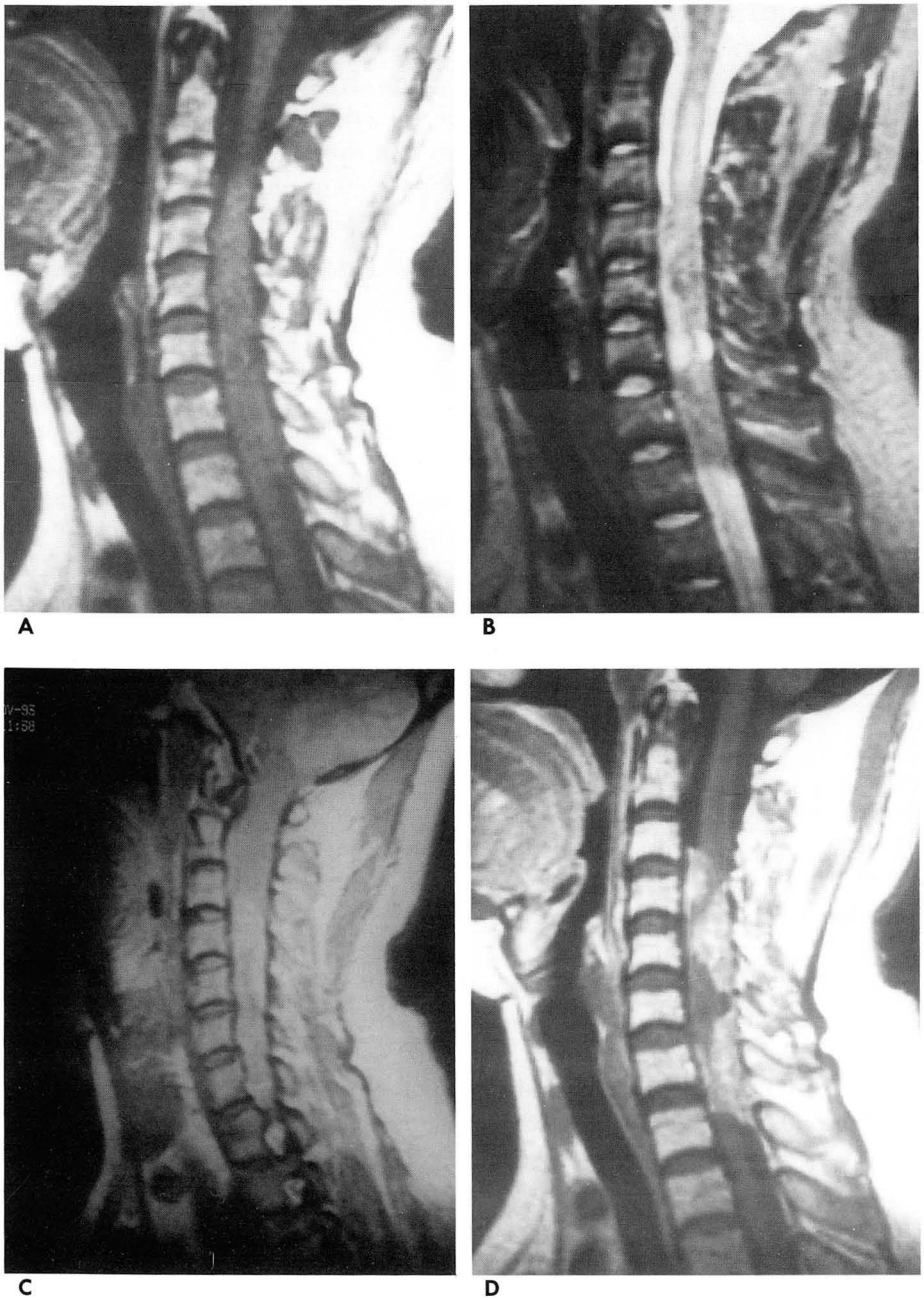

Fig. 1. A. Sagittal T1WI(TR/TE 500/15) shows an ill demarcated isointensity lesion extending from mid C2 to the mid portion of T1.
B. Sagittal T2WI (TR/TE 2200/80) shows irregularly marginated heterogenous signal intensities in the cervical spine.
There is a linear area of hyperintensity in the center of the upper cervical spinal cord which suggests rostral cyst formation above the tumor.
C. Sagittal proton density image (TR/TE 2200/15) shows two various sized high signal masses.
D. Gd-DTPA enhanced T1W sagittal image shows a heterogenous enhancement of the tumor at the level between C3 and C7 in the anterior and posterior intraduaral extramedullary spaces.

the first pattern. The second pattern of spinal involvement with metastatic disease is diffuse leptomeningeal spread. A thin sheet of tumor grows along the leptomeninges covering the spinal cord, nerve roots or dura. The most common metastatic tumors associated with leptomeningeal spread are medulloblastoma in children and breast cancer, lung cancer or lymphoma in adults. The lesion from colon carcinoma, seen in our first case, corresponds to the second pattern.

West(4) described four mechanisms of spread: direct extension; from the blood stream; through the cerebrospinal fluid; and through the lymphatic system. Since the CNS lacks a well-defined lymphatic system, access to the CSF is provided by the hematogenous spread of tumor cells across thin-walled vessels and direct extension through penetration of the meninges by the tumor mass or by epidural metastases. The more abundant distribution of deposits over the posterior aspect of the cord in the lumbosacral region suggests that free-floating tumor cells tend to settle out of the CSF by gravity.

Myelography and CT myelography are superior to noncontrast MR imaging for detecting strings of intradural extramedullary metastases. These lesions are sometimes very small, and detection by MR imaging is difficult because they appear as round or

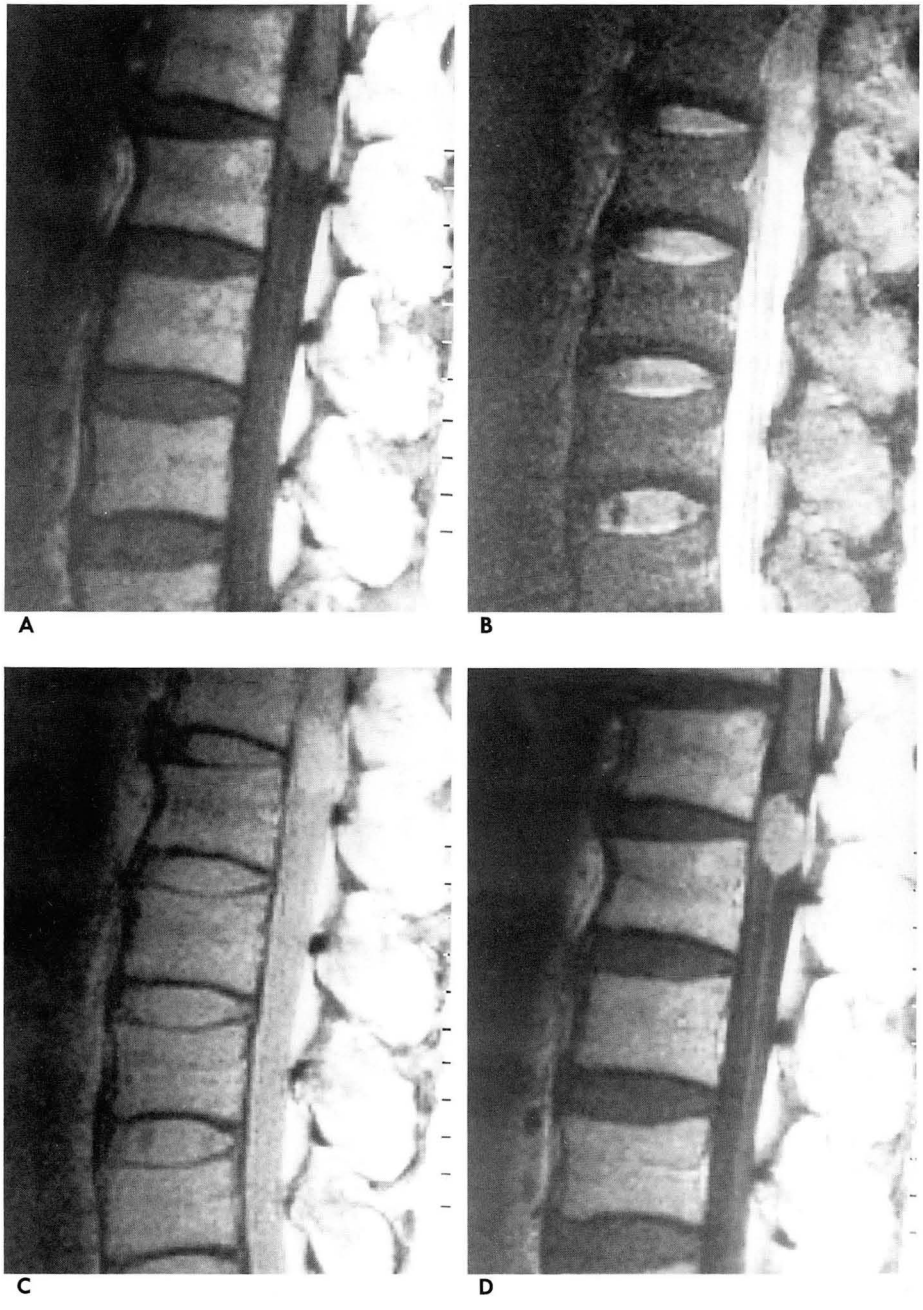

Fig. 2. A. Sagittal T1WI(TR/TE 500/15) shows an oval shaped isointensity lesion in the posterior spinal canal at T12-L1. Below the lesion, at L1 level, the subarachnoid space is enlarged.
B. Sagittal T2WI (TR/TE 2200/80) shows an ill defined heterogenous signal within the lower thoracic spinal canal.
C. Sagittal proton density image (TR/TE 2200/15) shows a 12×22 mm oval shaped high signal intensity lesion at T12-L1.
D. Gd-DTPA enhanced T1W sagittal image shows a marked hyperintense enhancement within the mass that better defines the lesion.

oval isointense areas that are hard to see in the subarachnoid space, even on T2-weighted images(2, 5, 6). T1-weighted images often demonstrate nodular masses of soft tissue signal intensity in the distal thecal sac, or diffuse thickening of the caude equina. T2-weighted images are less helpful not only because of their lower signal-to-noise, but also because of low contrast resolution between tumors and CSF(5). This difficulty is due to several factors : high spinal protein concentration, small size, prolonged T2 of the metastatic nodules, absence of edema, CSF pulsations, and root displacement according to the patient's position. After gadolinium injection, the metastatic nodules enhance quickly and markedly. The efficacy of gadolinium-enhanced MR imaging in detecting these lesions is currently superior to that of myelography or CT myelography(2, 6, 7). Previous reports did not describe a proton density image of intradural extramedullary spinal metastases seeding from a systemic cancer. We found, however, that proton density images as well as gadolinium enhanced T1-weighted images increased the ability of MR to detect leptomeningeal metastases to the spine. On proton density images, high signal intensity of the tumor mass in intradural-extramedullary space can be detected. We think that both a proton density image, and a gadolinium-enhanced T1-weighted image of this lesion are useful.

Primary intradural extramedullary tumors, such as neurofibroma and schwannoma, tend to be nearly isointense or slightly hypointense relative to the spinal cord on T1 weighted images but generally show increased signal intensity on T2 weighted images. Meningiomas are nearly isointense with spinal cord on both T1- and T2- weighted images and show moderate or intense gadolinium enhancement. On T1- and T2-weighted images, intradural extramedullary metastases caused by systemic cancer are isointense signal lesions in comparison with those of the spinal cord. Meningioma cannot be differentiated from the first pattern of intradural extramedullary metastases caused by systemic cancer.

For patients whose clinical signs raise the suspicion of metastases from systemic tumors in the subarachnoid space, proton density and T1-weighted images obtained after gadolinium injection will be sufficient for diagnosis.

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신경계 이외의 전신의 악성종양에서 척추강의 수외경막내 전이암은 매우 드물다. 수술로서 확진된 폐암과 대장암에서 전이된 수외경막내종양 2례를 자기공명영상소견을 중심으로 문헌고찰과 함께 보고하고자 한다. 전이된 종양의 크기는 2cm이상이었고 T1강조영상과 T2강조영상에서 동등신호강도를 보여 척수와 경계가 불분명했으며 양성자 강조영상에서 종양은 척수와 뇌척수액보다 높은 신호강도로 경계가 뚜렷했고, 조영후 T1강조영상에서 매우 조영증강이 잘 되었다.