Gliomatosis Cerebri Involving the Lumbosacral Spinal Cord

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Abstract

We report a 35-year-old man with gliomatosis cerebri, of which fluid-attenuated inversion-recovery (FLAIR) and T2-weighted magnetic resonance (MR) images revealed diffuse and high signal intensity areas in the bilateral cerebral hemispheres, bilateral middle cerebellar peduncles, cerebellum and lumbosacral spinal cord. Malignant features were not detected by 123I-IMP SPECT, 201Tl SPECT, 18F-fluorodeoxyglucose PET or MR spectroscopy. Histopathological examination of biopsy specimens from the right frontal lobe demonstrated diffuse infiltration of neoplastic cells with relative preservation of the underlying cytoarchitecture. Gliomatosis cerebri demonstrating a lumbosacral spinal cord lesion on MR images is rare and thus this case is important from the aspect of the differential diagnosis of spinal cord lesions.

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Key words: gliomatosis cerebri, pathology, spinal cord, MRI, MRS, PET

Introduction

Gliomatosis cerebri (GC) is a rare form of primary brain tumor. In the new WHO classification of primary brain tumors, GC is classified in the category of neuroepithelial tumors of uncertain origin and characterized by a diffusely infiltrating neoplasm with relative preservation of the underlying cytoarchitecture. This tumor involves more than two lobes, and often extends to infratentorial structures and even to the spinal cord (1–4).

Although 9% of GC cases involve the spinal cord (1), the spinal cord lesion is seldom seen radiographically (5). We herein report a case of GC, MR images of which demonstrated the lumbosacral spinal cord lesion with swelling in addition to lesions of the bilateral cerebral hemispheres and bilateral middle cerebellar peduncles.

Case Report

A 35-year-old man had been well until January 1998, when he began to notice a gait disturbance. The symptom progressed gradually and he was admitted to the Department of Neurosurgery of a local state hospital in July 1998. MR images demonstrated lesions of the cerebrum, cerebellum and lumbosacral spinal cord. A clinical diagnosis of multiple sclerosis was made, and betamethasone and cyclophosphamide were administered, however symptoms worsened. In addition, he developed headache and a scotoma of a right eye, and was admitted to our department in November 1998. Neurological examinations revealed papilledema, gaze nystagmus, muscle weakness and areflexia of the lower extremities, steppage gait, and sensory disturbance of vibration in the left lower extremity. Examinations of cerebrospinal fluid (CSF) including cytology were normal except for high initial pressure (370 mmH2O). Fluid-attenuated inversion-recovery (FLAIR) and T2-weighted MR images disclosed diffuse high signal intensity areas in the bilateral cerebral hemispheres, bilateral middle cerebellar peduncles extending to the cerebellum and lumbosacral spinal cord with swelling (Figs. 1A and B). There were no lesions in the medulla oblongata or cervicothoracic spinal cord. Slight gadolinium enhancement was observed only in the leptomeninges of the lumbosacral spinal cord (Fig. 1B). Remarkable changes of the MR images were not detected in comparison with the images taken by the other hospital. 123I-IMP SPECT, 201Tl SPECT and 18F-fluorodeoxyglucose PET showed normal to low accumulation of radiopharmaceuticals in the lesions. MR spectroscopy in the lesions of the right frontal lobe and bilateral occipital lobes showed no elevation of the choline/creatinine ratio (Cho/Cr) nor choline/N-acetylaspartate ratio (Cho/NAA) (Fig. 1C). A clinical diag-

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Figure 1. (A) Fluid-attenuated inversion-recovery (FLAIR) MR images on admission. MR images demonstrate diffuse and high signal intensity areas in bilateral cerebral hemispheres and in bilateral middle cerebellar peduncles extending to the cerebellum. (B) MR images on admission. A markedly swollen lesion is hypointense on T1-weighted image (left) and hyperintense on T2-weighted image (middle) in the lumbar spinal cord. There are no lesions in the thoracic spinal cord. Leptomeningeal enhancement is observed only in the lumbar spinal cord (right). (C) MR spectroscopy of right frontal lobe lesion on admission. There was no pronounced increase in Cho/Cr and Cho/NAA ratios. Cho: choline, Cr: creatine, NAA: N-acetylaspartate. (D) MR spectroscopy of the right frontal lobe lesion at deterioration. There is a significant increase in Cho/Cr and Cho/NAA ratios.

nosis of multiple sclerosis was made and the patient was started with steroid therapy again, which led to transient improvement of symptoms. However, headache and muscle weakness of the left lower extremity soon worsened, and somnolence and vomiting appeared in January 1999. Furthermore, urinary retention appeared in February 1999. MR images at this point revealed no pronounced changes, but MR spectroscopy showed significant elevation of Cho/Cr and Cho/NAA levels in the right frontal lobe lesion (Fig. 1D). The position of volume of interest on the second MR spectroscopy was almost identical to that on the first MR spectroscopy. Open brain biopsy was performed from the deep white matter of the right frontal lobe. Histopathological examination of the specimens revealed infiltration of
We reported a case of histologically established GC. MR Internal Medicine Vol. 42, No. 7 (July 2003) 18F-fluorodeoxyglucose PET (7) nor SPECT (8) have encephalopathies and multiple sclerosis is necessary. Neither tis, lymphoma, subacute sclerosing panencephalitis, leuko-specific and differential diagnosis from ischemia, encephali-intensity area (6). However, changes on MR images are non-demonstrate diffuse infiltration of this tumor as a high signal specific (2-4). FLAIR and T2-weighted MR images clearly symptoms are variable and radiologic findings are nonspe-cific (2-4). Immunohistochemical examinations showed that apparent atypical cells were negative for leukocyte common antigen, glial fibrillary acidic protein, S-100 and CD68, and that MIB-1 labeling index including normal cells was 3.4%. Two days after surgery, the patient developed status epilepticus. Despite treatments with antiepileptics, his condition deteriorated and died in March 1999. Autopsy was denied by the family.

**Discussion**

We reported a case of histologically established GC. MR images demonstrated lesions in the bilateral cerebral hemispheres, in the bilateral middle cerebellar peduncles extending to cerebellum and in the lumbosacral spinal cord. The initial symptom was gait disturbance perhaps caused by spinal cord lesion, however the primary site of tumor was unknown. Precedence of the spinal cord symptom might be due to more limited space of spinal canal than intracranial space. Differentiation of GC from other diseases was delayed because the lumbosacral spinal cord lesion was not reported as a typical radiographic finding of GC, and the patient died without treatment for the GC itself.

Antemortem diagnosis of GC is difficult because the symptoms are variable and radiologic findings are nonspecific (2-4). FLAIR and T2-weighted MR images clearly demonstrate diffuse infiltration of this tumor as a high signal intensity area (6). However, changes on MR images are nonspecific and differential diagnosis from ischemia, encephali-tis, lymphoma, subacute sclerosing panencephalitis, leukoencephalopathies and multiple sclerosis is necessary. Neither 18 F-fluorodeoxyglucose PET (7) nor SPECT (8) have demonstrated specific changes and thus do not contribute to the differential diagnosis, as in the present case. Only 13 C-methionine PET has been reported to be useful for detecting malignancy of GC because of the high accumulation in tumors shown as hot spots (9, 10). MR spectroscopy provides some significant information in the diagnosis of brain lesions. Elevated Cho/Cr and Cho/NAA levels are recognized as spectroscopic patterns of neoplastic brain lesions, supposedly caused by a decrease of NAA reflecting a decrease or displacement of neurons by the tumors (11), and an increase of Cho reflecting an increased membrane turnover and increased cellularity (12, 13). A recent study reported that MR spectroscopy of eight patients with GC also showed neoplastic patterns and that the histopathologic grade of GC was correlated with the extent of Cho/NAA level (14). In the present case, MR spectroscopy showed no neoplastic patterns on the first examination, although elevated Cho/Cr and Cho/NAA levels were demonstrated on the second examination. The change of Cho/Cr and Cho/NAA levels might be due to accelerated anaplasia, higher cellularity or some difference in the position of volume of interest. It is important to note that GC does not always show spectroscopic patterns of neoplastic brain lesions. Consequently, radiographic images and MR spectroscopy is useful for a possible diagnosis, but brain biopsy is essential for definitive antemortem diagnosis as described previously (3, 4).

There are several case reports of GC involving the spinal cord (5, 15-19). In those cases, it was difficult to distinctly separate the symptoms of the brain lesion and those of the spinal cord lesion, but the salient clinical feature caused by the spinal cord lesion seems to be muscle weakness and GC involving the spinal cord is occasionally misdiagnosed as motor neuron disease (18, 19). The present case also showed muscle weakness with mild sensory disturbance. A point of interest in the present case is the lumbosacral spinal cord lesion and absence of lesions in the cervicothoracic spinal cord on MR images. To our knowledge, there are only four other cases of GC demonstrating a spinal cord lesion on MR images (5, 15-17). These cases showed a high signal intensity area in the spinal cord from cervical to thoracic or lumbar levels on T2-weighted MR images. One case showed leptomeningeal enhancement (5) and another case showed diffuse enhancement of the arachnoid space (17). Postmortem examination was carried out in three cases and widespread infiltration was demonstrated in the spinal cords (5, 16, 17). Furthermore, it was reported in one case that the spinal cord lesion was neither due to dissemination via the CSF nor multicentric origin but due to infiltration along the nerve fiber tracts (5). In the present case, it is uncertain whether the spinal cord lesion was the result of infiltration, dissemination, multicentric origin or another pathogenesis because the spinal cord was unavailable for neuropathological examination. However, normal findings of the cervicothoracic spinal cord on MR images could not deny the possibility of infiltration throughout the spinal cord, since MR images are reported to underestimate the extent of GC (20, 21). In the

![Figure 2. Biopsy specimen from the deep white matter in the right frontal lobe. Pleomorphic and atypical cells infiltrate diffusely into the white matter (HE stain, bar=100 μm).](image-url)
present case, leptomeningeal enhancement was weakly observed in lumbosacral spinal cord on enhanced MR images, but the cytology of CSF was negative. Leptomeningeal enhancement has frequently been described in case reports of GC. Comparison with postmortem findings of those cases has indicated that the enhancement is correlated pathologically with dense tumor infiltration (5, 22). Cytology of CSF is generally negative in GC (2).

Both the spinal cord lesion and the first finding of MR spectroscopy hampered early brain biopsy, which had led to an early diagnosis. This case is important from two aspects: the differential diagnosis of spinal cord lesions and the suggestion that GC does not always show spectroscopic patterns of neoplastic brain lesions.

References


