Glioblastoma multiforme metastasis to the axis

Case report

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Extracranial bone metastasis from glioblastoma multiforme (GBM) has rarely been reported in the literature, and most metastatic GBMs are multiple bone metastases. The authors describe the first case of a GBM with metastasis only to the axis. This 42-year-old man presented with a 2-month history of headache, nausea, vomiting, and disorientation. Magnetic resonance imaging demonstrated a right temporal tumor, which was diagnosed as a GBM based on tumor resection. The patient was treated using radiation (6000 cGy) and the intravenous administration of Nimustine hydrochloride. Eighteen months thereafter, he experienced the sudden onset of neck pain. Magnetic resonance studies revealed a tumor in the axis that was diagnosed as GBM based on biopsy procedure.

KEY WORDS • axis • craniocervical venous system • glioblastoma multiforme • metastasis

Case Report

First Admission. In April 2001 this 42-year-old man presented with a 2-month history of headache, nausea, vomiting, and disorientation. Magnetic resonance imaging demonstrated a right temporal tumor, which was diagnosed as GBM based on tumor resection. The patient was treated using radiation (6000 cGy) and the intravenous administration of Nimustine hydrochloride. Eighteen months thereafter, he experienced the sudden onset of neck pain. Magnetic resonance studies revealed a tumor in the axis that was diagnosed as GBM based on biopsy procedure. The patient was treated using the application of 5000 cGy radiation.

Second Admission. In February 2003 the patient had no symptoms, but MR studies demonstrated a recurrence of the tumor on the temporal base (Fig. 1). Subtotal tumor removal was performed, and the patient was treated with the intravenous administration of ifosfamide (1500 mg), cisplatin (30 mg), and etoposide (100 mg) for 5 successive days. This treatment was administered twice every 3 weeks, and the intravenous administration of 600 × 10^6 IU IFNβ was continued once a week after the two courses.

Third Admission. In November 2003 the patient experienced sudden-onset neck pain. Neck neuroimaging displayed an osteolytic body in the axis, and T1-weighted MR images with slight Gd-dimeglumine enhancement revealed an isointense mass (Fig. 2). The intracranial tumor demonstrated reduced intensity. Results of gallium scintigraphy exhibited no accumulation, except for the axis lesion. On November 21 a posterior transpedicle tumor biopsy procedure was performed for diagnosis and occipitocervical fixation with the Olerud Cervical Fixation System (Nord-Opedic AB, Uppsala, Sweden) was performed using anchor screws from C3–6. The tumor was present in the body of the axis and showed no invasion into the anterior longitudinal ligament or dura mater. The tumor was soft and a small portion of it was removed. Histological examination revealed that the nuclei of the tumor cells were polymorphic (Fig. 3) with massive necrosis. Immunohistochemical studies indicated the tumor cells were positive for glial fibrillary acidic protein and negative for epithelial membrane antigen and CAM 5.2. The Ki-67 staining index was 64%. Histological features of this metastatic tumor, including results from immunohistochemical analysis, were not different from those of the primary and recurrent tumor. We made a diagnosis of isolated GBM metastatic to the axis.

The patient was treated using the application of 5000 cGy radiation.

Abbreviations used in this paper: GBM = glioblastoma multiforme; IFNβ = interferon beta; MR = magnetic resonance.
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Radiation in daily doses of 200 cGy to the axis as well as the intravenous administration of ifosfamide (1500 mg), cisplatin (30 mg), and etoposide (100 mg) for 5 successive days. Two courses of this treatment were administered every 3 weeks, and the intravenous administration of \( 6 \times 10^4 \) IU IFN\( \beta \) was continued once a week following the two courses.

**Fourth Admission.** In April 2004 the metastatic tumor invaded the perivertebral soft tissue and vertebral body of the sixth cervical vertebrae from the axis, although the right temporal recurrent tumor had not enlarged. It gradually became impossible for the patient to consume food, and he died on May 30, 2004.

**Discussion**

Extraneural metastases from GBMs are rare and because of the short survival time in patients with these gliomas, they seldom become symptomatic or metastasize.\(^5,8,10,16\) Metastases from GBMs are rare for a number of reasons: the cerebrum does not have a lymphatic system; the intracranial sinuses are enclosed in a dense dural membrane, which makes penetration difficult; intracerebral veins are thin walled and would probably collapse from compression before they could be penetrated by an expanding tumor; and the immunological response of the host organ to glial tumor cells may prevent their growth outside the central nervous system.\(^7,12,14\)

The GBM has exhibited extracranial metastases following stereotactic biopsy, and, in a few cases, it has been reported to occur in the absence of previous craniotomy.\(^1,4,17\) As confirmed on an ultrastructural study, extraneural metastases generally occur after craniotomy, when direct access via the dural vessels to the extrameningial tissue is possible.\(^5,7,9\) Regional lymph nodes, lungs and pleura, bone, and liver are frequent locations of metastatic GBM.\(^3,13,16\) Lymph node metastasis is thought to occur through connections between perineural spaces and lymphatic plexuses.\(^6,13\) It is thought that hematogenous metastasis occurs in other regions. The most common site of GBM metastasis to the
bone is the vertebrae. In metastatic GBM in the vertebrae, these glioma cells enter the Batson plexus, present in the anterior lumbar cord, and are disseminated to the cerebrospinal fluid. The capacity of the Batson plexus to supply the anterior lumbar cord, and are disseminated to the cerebrospinal fluid. The capacity of the Batson plexus to supply

References

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Conclusions

This is the first reported case of an isolated metastasis of GBM to the axis, which may have involved a different metastatic pathway than those previously described.

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