Right temporal lobe glioblastoma presenting in the left orbit

Case report

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Dissemination of gliomas outside the central nervous system without preceding neurosurgery is a rare phenomenon. Glial neoplasms presenting as bone lesions are even more rare. A case of glioblastoma multiforme (GBM) with initial presentation in the orbit following a single generalized seizure is described. Signs of intracranial hypertension resulted from subarachnoid tumor invasion. The patient was treated with whole-dose radiation therapy but survived for only 6 months following the initial presentation. An autopsy revealed a right temporal GBM with extensive subarachnoid spread and invasion in the left orbit and skull base. The literature on dissemination of primary tumors of the brain is reviewed.

KEY WORDS • glioblastoma multiforme • leptomeningeal gliomatosis • metastasis • orbit

Gliarial neoplasms only rarely invade the subarachnoid space or metastasize via the CSF. Moreover, it is highly unusual for glial tumor cells to infiltrate the dura and subsequently invade adjacent structures. In this case report we describe a GBM located in the right temporal lobe, with extensive subarachnoid spread and invasion of the left orbit. The literature on extracerebral dissemination of gliomas is also briefly discussed.

Case Report

History. This 46-year-old man was admitted to our Department of Neurology after a single generalized epileptic seizure. Three months before admission the patient had suffered from a single period of blurred vision on the left side. Since that time he had experienced headaches, nausea, and vomiting.

Examination. On admission we observed bilateral papilledema and protrusion of the left eye with absent corneal reflex. Computerized tomography scanning of the brain and orbit demonstrated a destructive lesion in the sphenoid bone on the left side. There was an abnormal extracerebral hyperintensity in the right cavernous sinus and in the left orbit. The left optic nerve appeared to be thickened (Fig. 1 left), but no intracerebral lesion was seen at that time. Angiographic studies demonstrated no abnormalities. Repeated lumbar punctures revealed increased intracranial pressure (37–48 cm H₂O). Analysis of the CSF showed elevated levels of total protein (up to 7.7 g/L) and an increased cell count. Results of cytological examination of the CSF were consistent with chronic inflammation, and no malignant cells were found. A biopsy sample was obtained from the lesion in the left sphenoid bone by a lateral orbitotomy. Histopathological studies demonstrated neoplastic astrocytic cells invading between bone spiculae (Fig. 2). The cells expressed glial fibrillary acidic protein, and ultrastructural investigation revealed intermediate filaments.

The patient’s headache worsened and he suffered from vertigo and diplopia; the papilledema in his left eye worsened as well. There were no signs of meningeal irritation. On T₂-weighted magnetic resonance imaging intracerebral hyperintensity was revealed in the right temporal lobe, which was compatible with a primary brain tumor and a lesion in the right cavernous sinus with extension to the cerebellopontine cistern. There was a bilateral lesion in the sphenoid bone with extension into the left orbit (Fig. 1 right). The nature of the lesion in the right cavernous sinus was verified by results of a second biopsy procedure. Histopathological examination revealed anaplastic glial cells...
Right temporal lobe GBM

Fig. 1. Left: Computerized tomography scan of the brain and orbit demonstrating a destructive lesion in the sphenoid bone on the left side. There is an abnormal extracerebral hyperintensity in the right cavernous sinus and in the left orbit. The left optic nerve appears to be thickened. Right: Axial T1-weighted magnetic resonance image demonstrating intracerebral hyperintensity in the right temporal lobe, compatible with a primary brain tumor and a lesion in the right cavernous sinus with extension to the cerebellopontine cistern. There is a bilateral lesion in the sphenoid bone with extension into the left orbit.

with an appearance similar to those seen in the initial biopsy samples.

Treatment and Outcome. Because of decreased consciousness and persistent headaches with persisting elevated intrathecal pressure, a lumboperitoneal shunt was placed. Adjuvant radiation therapy was administered, with a total dosage of 60 Gy. The patient refused further treatment with systemic chemotherapy and died 6 months later due to tumor progression.

An autopsy revealed a GBM in the right temporal lobe with extensive subarachnoid invasion. The dura covering the bones of the skull base had been invaded. The major wing of the right sphenoid bone and the right petrous bone had been eroded and invaded by the tumor, and the cavernous sinus was filled with tumor tissue. There was extensive tumor seeding along the ependyma of the ventricles and also in the subarachnoid space around the optic nerves and the spinal cord. The intracerebral tumor mass was remarkably less dense in comparison with the tumor cell density in the subarachnoid space. No metastases were found.

Discussion

In this case, the tumor had invaded the meninges and entered the sphenoid bone. Direct extension into bone in cases of malignant glioma is very unusual. Russell and Rubinstein discerned two categories of bone invasion in GBMs. The first group consists of tumors spreading superficially over the convexity, with invasion in frontal and parietal bones. The second, relatively less common category includes GBMs located in the temporal lobe and involving the medial structures of the middle fossa. Yet another mode of dissemination described by others occurs along the olfactory nerves, with destruction of the cribriform plate, and entering the orbit, ethmoid, or nasal cavity, in the presence of GBM located in the frontal lobe. Occasionally, cases with tumor invasion into the external auditory canal or sella turcica have been recorded.

Fig. 2. Photomicrograph showing neoplastic astrocytes between bone lamellae. Many of these cells have long cell processes. Staining for glial fibrillary acidic protein yielded strong cytoplasmic immunoreactivity. Corresponding with these findings, ultrastructural investigation of the cells revealed many intermediate filaments. H & E, original magnification × 25.
Dissemination of glial tumor cells beyond the subarachnoid space is very uncommon. In most of these cases, the primary lesion is a primitive neuroectodermal tumor or GBM, but oligodendrogliomas are also known to disseminate outside the neuraxis. In a study reviewing 630 patients with anaplastic glioma, extraneuronal metastases were found in only one case. Most metastases of primary brain tumors are found following craniotomy; besides direct invasion into skull bones, metastasizing of gliomas to bones is found in a minority of cases, and comparatively more metastases are seen in cases of primitive neuroectodermal tumors than in GBMs.

Interesting hypotheses regarding the reasons glial tumors rarely metastasize have been developed. The relatively small size of primary intracerebral tumors at clinical presentation may account for lack of metastatic potential. Another reason may be that patients generally do not live long enough to develop metastatic disease. Furthermore, the relatively underdeveloped lymphatic system of the cerebrum may account for the paucity of tumor spread. Recent attention has been drawn to the interaction of glial tumor cells and their microenvironment, focusing on matrix-degrading proteases, extracellular matrix components, and cell adhesion molecules. The results of cell culture studies have indicated that proteins in the meningeal extracellular matrix inhibit the growth while inducing the differentiation of malignant glial cells. With more knowledge about all the factors responsible for intracerebral glial tumor invasion, their role in the rare cases that spread outside the neuraxis may be elucidated as well.

Conclusions

Malignant gliomas rarely metastasize or invade skull bones. In such cases, careful radiological investigation may reveal a primary intracerebral tumor.

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