Glioblastoma Associated With Intratumoral Abscess Formation
—Case Report—

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Abstract

A 45-year-old man presented with a rare case of glioblastoma associated with intratumoral abscess formation manifesting as headache and vomiting after an appendectomy. Computed tomography and magnetic resonance imaging demonstrated a ring-enhanced lesion mimicking malignant glioma. Craniotomy and tumor removal were performed. Abscess formation within the intra-axial tumor was found intraoperatively. Histological examination revealed glioblastoma with abscess, and the etiological agent was anaerobic Gram-negative bacilli. The suspected route of microbial migration and colonization in this tumor was bacteremia from appendicitis.

Key words: glioblastoma, intratumoral abscess, brain abscess, brain tumor, bacteremia

Introduction

Abscess formation within a brain tumor is uncommon, usually occurring within a pituitary tumor after direct extension from infected paranasal sinuses. Glioma with abscess formation is extremely rare, and few cases have been described. Guidelines for the treatment of gliomas complicated by intratumoral abscesses have thus not been determined. We present a case of abscess formation within a glioblastoma, and discuss the treatment.

Case Report

A 45-year-old man suddenly suffered loss of consciousness for 2 minutes. Computed tomography (CT) at that time revealed no areas of abnormal density (Fig. 1A). About 3 weeks later, he complained of right lower abdominal pain and acute appendicitis was diagnosed. He was treated by appendectomy and cigarette drain insertion. Postoperatively, he developed headache associated with vomiting. Neurological examination was unremarkable, including no neck stiffness. CT revealed an irregularly shaped low density area in the right temporal lobe (Fig. 1B). Magnetic resonance (MR) imaging showed a hypointense area on T₁-weighted imaging and a hyperintense area on T₂-weighted imaging in the right temporal lobe. The wall of the abnormal area was hypointense on T₂-weighted imaging (Fig. 2B), with ring-enhancement by gadolinium on T₁-weighted imaging (Fig. 2A). However, diffusion-weighted MR imaging showed no strong hyperintense lesion in this area (Fig. 2C). Mild leukocytosis (white blood cell count 11,300/μl) with increased levels of C-reactive protein (3.44 mg/dl) were found 7 days after appendectomy. Preoperatively, these findings were considered consistent with malignant
Sixteen days after the appendectomy, craniotomy and removal of the temporal mass were performed. During the operation, histological examination of frozen sections revealed atypical astrocyte proliferation and huge areas of necrosis with neutrophilic infiltration. Therefore, we punctured the center of the mass and aspirated red-grayish material, and culture of this purulent material grew anaerobic Gram-negative bacilli. Intraoperative MR imaging confirmed gross total removal of the mass.

Histological examination revealed focal proliferation of pleomorphic atypical astrocytes and microvascular proliferation with formation of multilayered glomeruloid tufts (Fig. 3A, B). The MIB-1 labeling index was approximately 10% (Fig. 3C). Necrotic foci with neutrophilic infiltration and pseudopalisading were also apparent in the tumor. The histological diagnosis was glioblastoma with abscess formation (Fig. 4). Antibiotic therapy with piperacillin sodium was administered for 4 weeks following surgery. After this treatment, the patient underwent local irradiation with 66 Gy and synchronous temozolomide administration (120 mg/day for 42 days).

The tumor was controlled until 5 months after initial surgery, when marked growth of the residual tumor occurred. The patient underwent additional subtotal tumor resection. Histological examination of the resected specimens showed marked necrotic reactions with foci of neutrophilic infiltration and atypical tumor cells showing en-
larged and hyperchromatic nuclei. This second surgery was followed by chemotherapy using temozolomide (200 mg/m²/day for 5 days every 4 weeks). The residual tumor had partially invaded the right frontal lobe and basal ganglia at 14 months after the initial surgery. The patient died of tumor progression at 21 months after the initial surgery.

**Discussion**

Eleven cases of glioma associated with abscess formation have been reported, including the present patient (Table 1).1,2,3,5,7,9–12 Four cases of abscess occurred within the glioblastoma, including our case.2,3,9 Six cases including our case occurred due to bacteremia.2,3,9,11 Hematogenous spread from distant sources such as thrombophlebitis,2,3 bronchopneumonia,5 and appendicitis is a frequent mechanism of spread for gliomas. Interestingly, 2 of 3 cases following meningitis were ependymoma associated with abscess formation.7,10

The pathogenesis of glioma associated with abscess formation is thought to be related to multiple factors, such as destruction of the blood-brain barrier (BBB), intratumoral necrosis, and tumor bleeding with hematoma.2 Disruption of the BBB due to direct tumor invasion aids the invasion of microbes. Intratumoral necrosis and hematoma acting as a culture medium are also important in the development of abscess. Glioblastoma, which involves failure of the BBB due to direct tumor invasion and the nutritive conditions caused by necrosis and hematoma within the tumor, may induce metastatic abscess by bacteremia.2 Moreover, the BBB and immune system are important in resisting bacterial infection to the brain. Immune compromised patients are at risk for the development of brain abscess. Only 1 patient had no infection recorded in their history that would explain the origin of abscess, but that patient was immunocompromised because of diabetes mellitus and hepatitis B virus-related cirrhosis.12 Long-term steroid treatment and the immunosuppressive effects of glioblastoma probably facilitate infection, resulting in the abscess.9

The major challenge is detection of glioma associated with abscess formation prior to surgery. In previously reported experience with diffusion-weighted imaging, marked homogeneous hyperintensity within the central portion of a ring-enhanced mass suggested brain abscess.4,6 Preoperative suspicion of brain tumor with abscess could be supported by neuroimaging studies (CT, MR imaging), which would reveal sudden increase in size and atypical perifocal edema.3 In our case, diffusion-weighted imaging demonstrated no homogeneous hyperintensity within a ring-enhanced lesion. To explain why no hyperintensity was seen despite the abscess, we speculated that hematoma may have mixed with purulent material because of the reddish color of aspirated material intraoperatively and hyperintensity on fluid-attenuated inversion recovery imaging (data not shown). However, CT revealed sudden development of an irregularly shaped low density area in the right temporal lobe at 3 weeks after initial CT. Brain tumor with abscess might be suspected based on these findings. Nevertheless, the majority of abscesses within a glioma have been accidental findings during surgery.

In the case of gliomas, adjuvant therapy such as chemoradiotherapy is often needed. However, chemotherapy is usually not administered for glioma associated with abscess formation, since such treatment compromises patient immunity and increases the risk of infection recurrence. On the other hand, radiotherapy is beneficial under these conditions due to the antibacterial and anti-inflammatory effects in general. Most cases of abscess within a glioblastoma show poor prognosis despite partial resection and conventional radiotherapy.2,5 A patient with abscess within a glioblastoma remained in good condition following aggressive resection, antibacterial therapy, and radiotherapy.3 In the present case, since gross total removal of the glioblastoma was achieved, the patient first received antibacterial therapy for 4 weeks following surgery, followed by chemoradiotherapy. As a result, the patient survived for 21 months after the initial surgery. In our view, aggressive resection is associated with favorable prognosis even in cases of abscess formation within a glioblastoma.

**Table 1** Reported cases of glioma associated with abscess formation

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Age/Sex</th>
<th>Tumor</th>
<th>Pathogen</th>
<th>Mechanism of spread</th>
<th>Outcome (survival time after surgery)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharma et al. (1986)11</td>
<td>32 yrs/M</td>
<td>malignant astrocytoma</td>
<td><em>Salmonella typhi</em></td>
<td>bacteremia</td>
<td>favorable</td>
</tr>
<tr>
<td>Noguerado et al. (1987)</td>
<td>78 yrs/M</td>
<td>glioblastoma</td>
<td><em>Salmonella enteritidis</em></td>
<td>bacteremia</td>
<td>death</td>
</tr>
<tr>
<td>Ichikawa et al. (1992)2</td>
<td>46 yrs/F</td>
<td>glioblastoma</td>
<td><em>Staphylococcus aureus</em></td>
<td>bacteremia</td>
<td>death (8 mos)</td>
</tr>
<tr>
<td>Nassar et al. (1997)3</td>
<td>2 yrs/M</td>
<td>ependymoma</td>
<td>unidentified</td>
<td>meningitis</td>
<td>death (24 hrs)</td>
</tr>
<tr>
<td>Bansal et al. (2001)3</td>
<td>11 yrs/F</td>
<td>astrocytoma</td>
<td><em>Pseudomonas aeruginosa</em></td>
<td>meningitis</td>
<td>death (3 hrs)</td>
</tr>
<tr>
<td>Mohindra et al. (2004)4</td>
<td>9 mos/M</td>
<td>ependymoma</td>
<td><em>Enterobacter aerogenes</em></td>
<td>bacteremia</td>
<td>death (4 wks)</td>
</tr>
<tr>
<td>Bansal et al. (2004)4</td>
<td>35 yrs/M</td>
<td>astrocytoma</td>
<td>unidentified</td>
<td>?</td>
<td>favorable</td>
</tr>
<tr>
<td>Shankar et al. (2004)5</td>
<td>4 yrs/M</td>
<td>ependymoma</td>
<td><em>Staphylococcus aureus</em></td>
<td>meningitis</td>
<td>favorable</td>
</tr>
<tr>
<td>Kalita et al. (2008)6</td>
<td>57 yrs/M</td>
<td>glioblastoma</td>
<td>unidentified</td>
<td>?</td>
<td>favorable</td>
</tr>
<tr>
<td>Tsai et al. (2008)7</td>
<td>52 yrs/M</td>
<td>astrocytoma</td>
<td><em>Staphylococcus aureus</em></td>
<td>?</td>
<td>favorable</td>
</tr>
<tr>
<td>Present case</td>
<td>45 yrs/M</td>
<td>glioblastoma</td>
<td>Gram-negative bacilli</td>
<td>bacteremia</td>
<td>death (21 mos)</td>
</tr>
</tbody>
</table>

F: female, M: male.
References


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