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## Abscess formation within a cerebellar metastasis: Case report and literature review

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## ABSTRACT

**INTRODUCTION:** The managements of brain abscesses and brain tumors including brain metastases differ greatly, especially in terms of surgical procedures. Therefore, differentiating between the two is essential for assuring optimal treatment. However, on rare occasion, these two lesions coexist. Only five cases with both a brain tumor and an abscess have thus, far been reported. We experienced a patient with a brain abscess within a cerebellar metastasis.

**CASE PRESENTATION:** A middle-aged man receiving treatment for bile duct cancer presented with headache and nausea. Computed tomography (CT) and magnetic resonance (MR) imaging revealed two lesions, one in each cerebellar hemisphere. Although these lesions appeared to be brain metastases, the right lesion showed high intensity on diffusion-weighted images (DWI), and magnetic resonance spectroscopy (MRS) findings suggested an abscess. Surgical puncture of the lesion identified it as a brain abscess histologically, and we thus, administered antibiotics. However, since the lesion grew, we performed a second surgery for removal, which histopathologically the lesion to be a well-differentiated adenocarcinoma. The final diagnosis was an abscess within a cerebellar metastasis.

**DISCUSSION/CONCLUSION:** Modern diagnostic tools such as DWI and MRS are reportedly reliable for differentiating brain tumors from brain abscesses, though they are not specific in cases with both lesions. The present case highlights the importance of considering coexisting diseases prior to surgery when we encounter a lesion which has the imaging characteristics of both a tumor and an abscess. The patient may have a better outcome if, preoperatively, surgeons take into consideration the possibility of the coexistence of a brain tumor and a brain abscess.

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## 1. Introduction

The management of intracranial tumors differs greatly from that of abscesses, including the operative procedure. Therefore, precise preoperative discrimination between these two lesions is of great importance [1]. Because neuroimaging and the clinical picture cannot always differentiate between a brain abscess and a necrotic cyst within a brain tumor, preoperative differentiation remains challenging, and numerous reports have described approaches to accurately differentiating between cystic brain metastasis and brain abscess, based on comparisons of pre-operative images and post-operative histological findings [1–5].

If a lesion possesses the imaging characteristics of both a tumor and an abscess, it is necessary to conduct tissue sampling during surgery for pathological and microbiological testing, which can distinguish a brain metastasis from an abscess and thereby ensure the

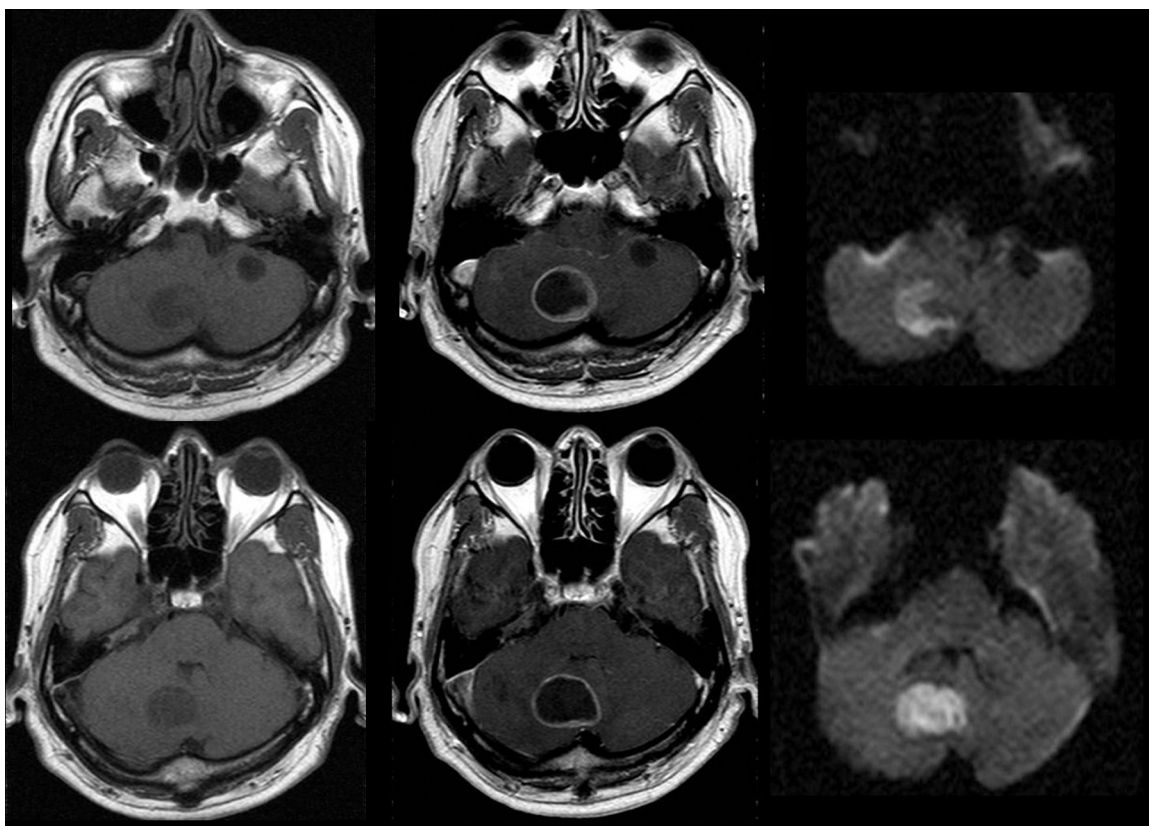
most appropriate therapeutic course. However, five reported cases had abscesses within metastatic brain tumors, and these required multidisciplinary and comprehensive strategies using both anti-cancer chemotherapy and antibiotics [6–9].

A brain abscess within a brain neoplasm is a small entity. There are only about 20 cases of abscesses associated with intracranial tumors in the literature [6–25]. However, this combination is generally fatal. Treatments for combined conditions in cases with the imaging characteristics of both a tumor and an abscess should not be delayed. Early diagnosis facilitates early treatment employing surgical management and antibiotic administration. We report a case harboring a brain abscess within a metastatic brain tumor. The relevant literature is also reviewed.

## 2. Case presentation

Two years prior to the current presentation, a 56-year-old man had been admitted to our neurosurgical department with nausea accompanying an intraventricular hemorrhage which was treated conservatively. During this short hospital stay, an aortic aneurysm

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**Fig. 1.** MR images on admission demonstrating two different types of lesions in each cerebellar hemisphere. The right lesion shows ring enhancement with gadolinium and hyper-intensity on DWI, whereas, the left lesion does not. Left: T1-weighted images, center: T1-weighted images with gadolinium, right: diffusion-weighted images.

and bile duct cancer were revealed, and he underwent open abdominal surgery on two subsequent occasions. As the bile duct cancer metastasized to the lung and abdominal lymph nodes, adjuvant ambulant oral chemotherapy (TS-1; tegafur, gimestat, and otastat potassium at a molar ratio of 1:0.4:1) was administered.

The patient had presented with feelings of bodily instability, an indication of truncal ataxia. Computed tomography (CT) and magnetic resonance (MR) imaging revealed two cystic lesions, one in each of the cerebellar hemispheres (Fig. 1). The small lesion in the left hemisphere had a cystic pattern with hypo-intensity on T1-weighted images and hyper-intensity on T2-weighted images, but showed neither surrounding edema nor any ring enhancement with gadolinium. The other, larger, lesion was in the right hemisphere and was heterogeneous on T2-weighted imaging. This lesion showed surrounding edema, which was accompanied by ring enhancement with gadolinium.

Initially, we considered these lesions to be metastases, but the right lesion showed high intensity on diffusion-weighted images (DWI) (Fig. 1), raising the possibility of a brain abscess. MR spectroscopy revealed elevated lactate, slightly elevated amino acids (0.9 ppm), and a relatively low choline peak, which also suggested an abscess (Fig. 2). Although laboratory studies were unremarkable in terms of indicators of infection, the patient had received five operative treatments in the prior 30 years including left frontal craniotomy due to trauma and recent abdominal surgeries which also raised the possibility of a brain abscess.

To relieve the neurological symptoms and obtain a diagnosis, we performed echo-guided aspiration of the right lesion. After surgical puncture, we identified a viscid purulent exudate. We canceled the craniotomy for lesion removal and instead inserted a drainage tube. Pathological examination of the exudate indicated large numbers of inflammatory cells but no malignant cells were detected

after Papanicolaou staining, and the exudate was thus, confirmed to indicate an abscess (Fig. 2). Because microbiological tests including anaerobic cultures were negative, we commenced intravenous administration of broad-spectrum antibiotics.

However, the lesion wall gradually grew over a period of two months, necessitating lesion extirpation. The lesion was relatively hard with numerous fine feeding arteries, and the histopathology indicated a well-differentiated adenocarcinoma (Fig. 3). Taking these observations together with the initial findings, we diagnosed the lesion as an abscess within a cerebellar metastasis. Subsequently, we performed stereotaxic radiosurgery on the tumor cavity, and resumed anticancer drug administration. There was significant symptomatic relief of ataxia, and the patient was discharged from our hospital three months after admission with a Karnofsky performance status of 100%. The left lesion was not diagnosed pathologically and remained unchanged in size, but the number of cysts gradually increased in the following months, suggesting metastatic tumors. Ultimately, stereotaxic radiosurgery was also performed on these lesions.

### 3. Discussion

The coexistence of a brain abscess and a brain tumor is rare except for intrasellar lesions where direct extension of microbial flora from the sinuses occasionally results in this complication. We reviewed the global medical literature related to brain tumors in association with abscesses using MEDLINE and found 20 reports in English, excluding those associated with trauma and neurosurgical procedures [6–25]. The clinical characteristics of these cases and our case are outlined in Table 1. Other reported tumors associated with an abscess were 12 gliomas, five meningiomas, and five brain metastases.

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