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Abstract 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.

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 anticancer 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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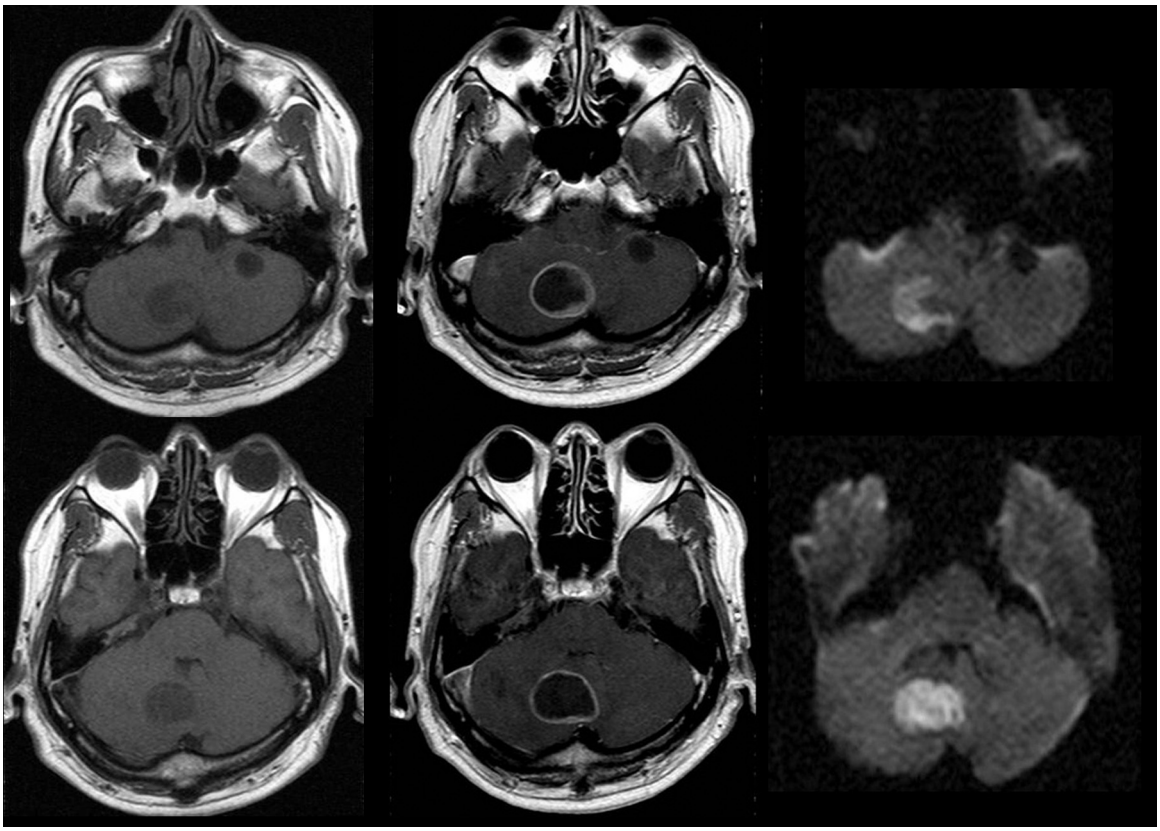

Fig. 1. MR images on admission demonstrating two different types of lesions in each cerebellar hemisphere. The right lesion shows ring enhancement with gadolinium and hyper-intensity on DWI, whereas, the left lesion does not. Left: T1-weightedimages, center: T1-weighted images with gadolinium, right: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

Table 1
Clinical summary of abscesses associated with brain tumors.

Author	Year	Age/sex	Tumor	Region	Symptom	Organism	Means of spread	Outcome
Sharma et al. [20]	1986	32/M	High-grade glioma	Temporal	Elevated intracranial pressure	*Salmonella typhi*	Bacteremia	Favorable
Rodriguez et al. [9]	1986	28/M	Metastatic carcinoma	Parietal	Fever, headache, nausea	*Salmonella enteritidis*	Bacteremia	–
Noguerado et al. [18]	1987	78/M	High-grade glioma	Occipital	Aphasia, hemiplegia	*Salmonella enteritidis*	Bacteremia	Death
Ichikawa et al. [12]	1992	46/F	High-grade glioma	Frontal	Aphasia, fever, hemiplegia	*S. aureus*	Bacteremia	Favorable
Shimomura et al. [21]	1994	64/F	Meningioma	Parasagittal	Fever	*B. oralis*	Bacteremia	Favorable
Ng and Lozano [8]	1996	79/F	Metastatic carcinoma	Posterior fossa	Nausea, truncal ataxia	*Haemophilus parainfluenza*	Bacteremia	Death[b]
Nassar et al. [17]	1997	2/M	Ependymoma	Posterior fossa	Meningitis	Unidentified	Meningitis	Death
		78/F	Meningioma	Parasagittal	Hemiplegia	*E. coli*	Bacteremia	Death[b]
Eisenberg et al. [11]	1998	78/F	Meningioma	Parasagittal	Hemiplegia	*Proteus mirabilis*	Bacteremia	Moderately disabled
Sarria et al. [19]	2000	58/F	High-grade glioma	Frontal	Hemiplegia, meningitis	*Salmonella enteritidis*	Bacteremia	Death
Bansal et al. [10]	2001	11/F	Glioma	Parieto-occipital	Seizure	*Pseudomonas aeruginosa*	Bacteremia	Death
Yeates et al. [24]	2003	38/F	Meningioma	Convexity	Seizure	*B. fragilis*	Bacteremia	Favorable
Kovacic et al. [6]	2004	66/M	Metastatic carcinoma	Posterior fossa	Nystagmus, gait disturbance	*P. acnes*	Bacteremia	Death
		72/M	Metastatic carcinoma	Posterior fossa	Headache, gait disturbance	*S* spp.	Bacteremia	Death[b]
Mohindra et al. [16]	2004	9m/M	Ependymoma	Posterior fossa	Vomiting, fever	*Enterobacter aerogenes*	Bacteremia	Death
		35/M	Low-grade glioma	Posterior fossa	Nystagmus, vomiting, headache	Unidentified	Bacteremia	Favorable
		42/M	Medulloblastoma	Posterior fossa	Elevated intracranial pressure	Unidentified	Bacteremia	Favorable
Lind et al. [15]	2005	78/F	Meningioma	Anterior falx	Personality change	*Citrobacter koseri*	Bacteremia	–
Young et al. [25]	2005	38/M	Meningioma	Sphenoid ridge	Headache, fever	[a]spp.	Bacteremia	Favorable
Kalita et al. [14]	2008	57/F	High-grade glioma	Occipital	Monoparesis	*S. aureus*	Bacteremia	Favorable
Tsai et al. [22]	2008	52/M	Low-grade glioma	Temporal	Aphasia	*S. aureus*	Bacteremia	Favorable
Moiyadi and Shetty [7]	2010	36/F	Metastatic carcinoma	Frontal	Elevated intracranial pressure	*A. baumannii*	Unknown	Favorable
Jho et al. [13]	2011	53/M	High-grade glioma	Temporal	Headache, hemiplegia, aphasia	*A. iwofii, P* spp., [a]spp.	Bacteremia	Favorable
Tsugu et al. [23]	2012	45/M	High-grade glioma	Temporal	Elevated intracranial pressure	*Bacilli* spp.	Bacteremia	Favorable
Present case	2012	58/M	Metastatic carcinoma	Posterior fossa	Truncal ataxia	Unidentified	Bacteremia	Favorable

F: female, M: male, m: month, A: Acinetobacter, B: Bacteroides, E: Escherichia, P: Propionibacterium. S: Staphylococcus. spp.: species.

[a] Streptococcus.

[b] Neurologically favorable just after surgery, but died due to systemic disease.

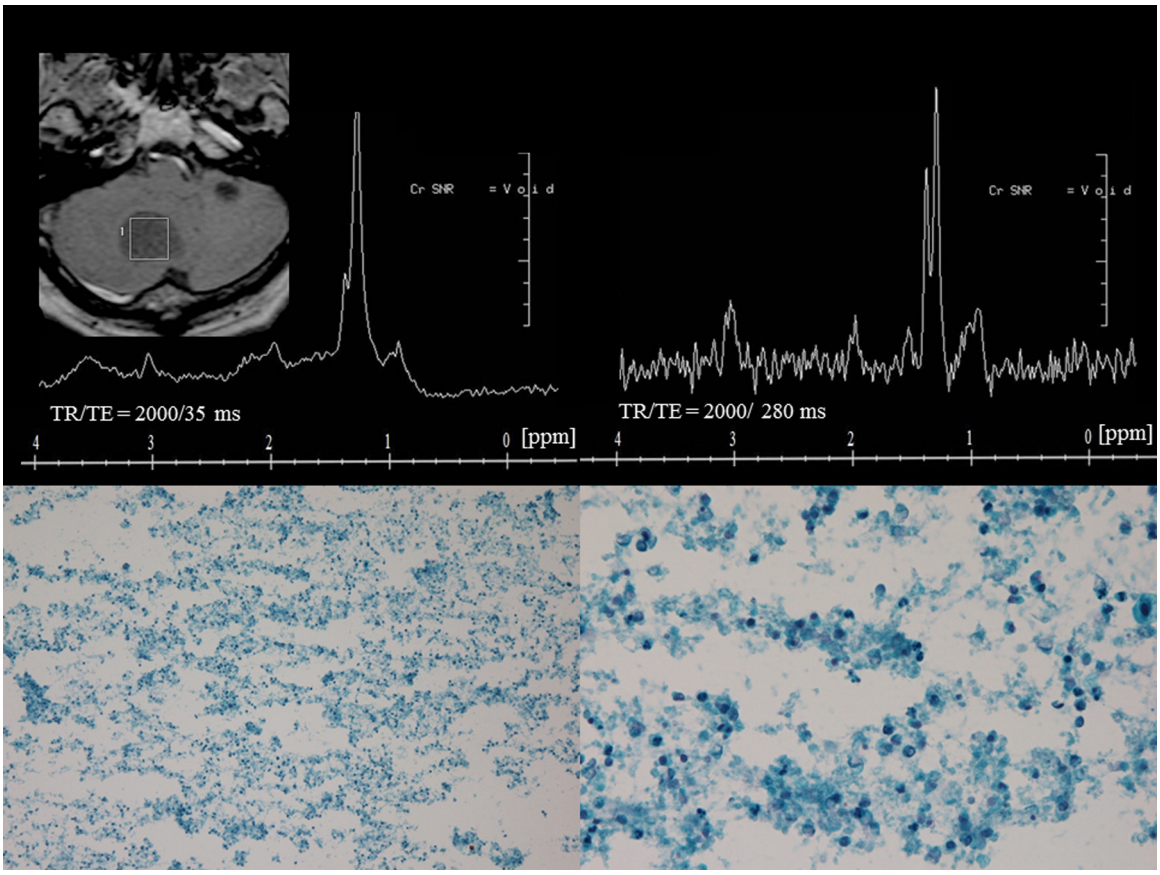

Fig. 2. Upper: MR image showing slightly elevated amino acids (0.9 ppm) and a relatively low choline peak. Lower: pathological examinations of the exudate showing a collection of inflammatory cells (left: Papanicolaou stain × 10; right: Papanicolaou stain × 200).

The first report in the global literature of a brain abscess within a brain metastasis described an embryonal carcinoma plus seminoma in the testis with brain metastases, complicated by a *Salmonella* brain abscess [9]. The reported cases of abscess formation within a brain metastasis all had different primary lesions and infectious organisms, and due to the coexistence of a brain abscess and brain metastasis being uncommon, most of these cases were diagnosed unexpectedly after lesion removal, fluid drainage, or post-mortem examination. It may be important to consider this combined pathology in cases with the imaging characteristics of both a tumor and an abscess [6–9].

Except for direct extension of microbial flora, the pathogenesis of abscess formation within a brain tumor is considered to be related to deterioration of the systemic immune system and the blood–brain barrier [12,16,18]. Ichikawa et al. reported an intratumoral abscess with hematoma and speculated that steroid therapy, the absence of the blood–brain barrier, and poor nutrition promoted abscess formation via sepsis following phlebitis [12]. Five of the reported cases of abscess formation within a brain metastasis were regarded as having a secondary infection of a pre-existing cerebellar metastasis via hematogenous bacterial emboli from an infected site or sepsis [6,8,9]. In the present case, the patient presumably had the potential for immunodeficiency due to the chemotherapy, and this could have allowed abscess formation in a cerebellar metastasis with no blood–brain barrier.

The preferred treatment is complete surgical removal of both the tumor and the intracranial infection. Targeted antibiotic therapy for an appropriate duration is also essential [14,26]. Modern diagnostic tools such as DWI and MR spectroscopy are reportedly reliable for differentiating brain abscesses from brain tumors, including brain metastasis, and these modalities were found to be useful in our current case [3–5]. However, if preoperative differentiation is difficult and complete removal is considered during a second surgical operation, it may be sufficient to initially drain the abscess content to relieve symptoms, followed by tissue culture. If pus or abscess fluid is evident during complete removal, the postoperative course could become unstable during hospitalization, due to widespread pyogenic meningitis, ventriculitis, and/or sepsis. Therefore, preoperative preparation is important whenever the coexistence of an abscess and a brain neoplasm is a possibility.

In cases with high-grade glioma and metastatic brain tumors, further oncotherapy is frequently necessary [13,14,23]. Chemotherapy and radiotherapy are beneficial for brain neoplasms. However, the risk/benefit ratio of the concomitant immunosuppressive effect is unclear. As the patient's immunity is compromised, the risk of infection is increased. Therefore, chemotherapy and radiotherapy could be used to treat residual or recurrent tumor progression after ensuring that there are no signs of infection. In the present case, we resumed chemotherapy to treat lymph node metastasis eight weeks after surgery when the patient had no signs of intracranial infection.

The pathophysiological processes underlying the coexisting abscess and metastasis were unknown in our patient, but immunodeficiency due to the immunosuppressive agent given for cancer treatment and his medical history of numerous surgeries could have contributed to this diagnosis. This case highlights the importance of considering intratumoral abscesses. If we encounter a brain tumor with the imaging characteristics of both tumors and abscesses, differentiation between the two is especially important due to the different management methods for such lesions. However, we should also consider the treatment of cases with both conditions. Acquiring tissue from the lesions for both

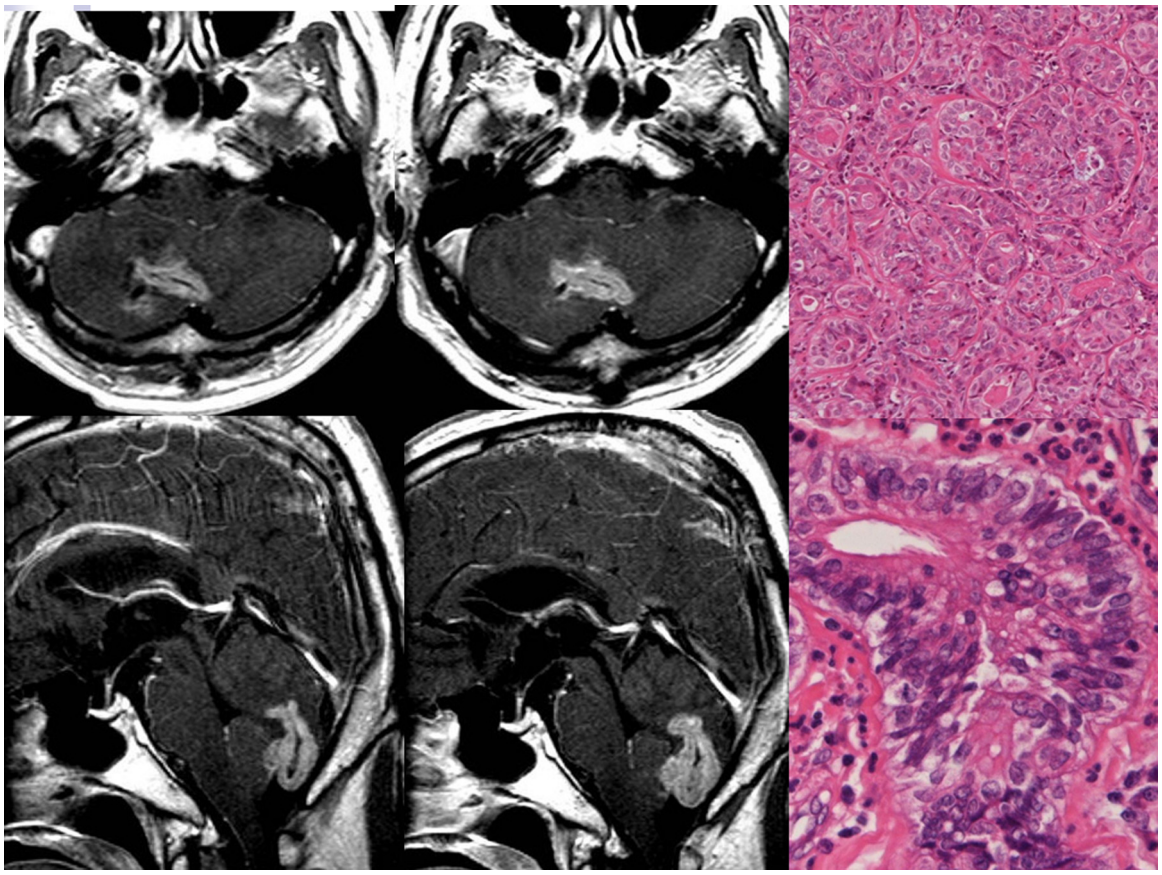

Fig. 3. Right lesion showing progression over two months; pathological examinations after the second surgery confirmed well-differentiated adenocarcinoma. Left: T1-weighted images with gadolinium three weeks after surgery (upper: axial images, lower: sagittal images). Center: T1-weighted images with gadolinium eight weeks after surgery (upper: axial images, lower: sagittal images). Right: pathological examinations after the second surgery (upper: hematoxylin–eosin stain × 10, lower: hematoxylin–eosin stain × 200).

pathological and microbiological examinations to differentiate a brain tumor from an abscess is useful, and preoperatively considering the possible coexistence of both with appropriate preparations could improve the patient's outcome.

4. Conclusion

This case highlights the importance of considering the coexistence of two diseases prior to surgery. Preoperatively considering the possibility that a brain tumor and a brain abscess may coexist, when we encounter cases with imaging characteristics of both lesion types, may improve treatment outcomes.

Conflict of interest

All authors have nothing to declare about this.

Funding

All authors have nothing to declare about this.

Ethical approval

Authors had obtained patient's consent on paper, and this case report fulfills ethicalapproval.

Author contribution

Yukihiro Goto: surgeon of the patient, data collection, writing paper. Toshihiko Ebisu: surgeon of the patient, data analysis and interpretation. Katsuyoshi Mineura: concept and design.

Consent

Authors had obtained patient's consent on paper. Medical information about the patient in this case report had completely changed to anonymous patient. This case report does not obtain personally identifiable information. Information has been kept strictly base on the compliance of information management about medical record in Kyoto Prefectural University Graduate School of Medicine. Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal upon request.

Guarantor

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References

[1] P. Shetty, A. Moiyadi, G. Pantvaidya, S. Arya, Cystic metastasis versus brain abscess: role of MR imaging in accurate diagnosis and implications on treatment, J. Cancer Res. Ther. 6 (2010) 356–358.
[2] T. Ebisu, C. Tanaka, M. Umeda, M. Kitamura, S. Naruse, T. Higuchi, et al., Discrimination of brain abscess from necrotic or cystic tumors by

diffusion-weighted echo planar imaging, Magn. Reson. Imaging 14 (1996) 1113–1116.
[3] D. Fertikh, J. Krejza, A. Cunqueiro, S. Danish, R. Alokaili, E.R. Melhem, Discrimination of capsular stage brain abscesses from necrotic or cystic neoplasms using diffusion-weighted magnetic resonance imaging, J. Neurosurg. 106 (2007) 76–81.
[4] S. Grand, G. Passaro, A. Ziegler, F. Esteve, C. Boujet, D. Hoffmann, et al., Necrotic tumor versus brain abscess: importance of amino acids detected at 1H MR spectroscopy – initial results, Radiology 213 (1999) 785–793.
[5] C.H. Toh, K.C. Wei, S.H. Ng, Y.L. Wan, C.P. Lin, M. Castillo, Differentiation of brain abscesses from necrotic glioblastomas and cystic metastatic brain tumors with diffusion tensor imaging, Am. J. Neuroradiol. 32 (2011) 1646–1651.
[6] S. Kovacic, G. Bunc, I. Krajnc, Abscess formation within cerebellar metastatic carcinoma – report of two cases and review of the literature, Wien Klin Wochenschr 116 (Suppl. 2) (2004) 60–63.
[7] A. Moiyadi, P. Shetty, Abscess in a metastasis, J. Neurosurg. 112 (2010) 474–475.
[8] W.P. Ng, A. Lozano, Abscess within a brain metastasis, Can. J. Neurol. Sci. 23 (1996) 300–302.
[9] R.E. Rodriguez, V. Valero, C. Watanakunakorn, Salmonella focal intracranial infections: review of the world literature (1884–1984) and report of an unusual case, Rev. Infect. Dis. 8 (1986) 31–41.
[10] S. Bansal, R.K. Vasishta, A. Pathak, V.N. Jindal, V.K. Khosla, A.K. Banerjee, Cerebral abscess with astrocytoma, Neurol. India 49 (2001) 91–93.
[11] M.B. Eisenberg, R. Lopez, A.E. Stanek, Abscess formation within a parasagittal meningioma. Case report, J. Neurosurg. 88 (1998) 895–897.
[12] M. Ichikawa, Y. Shimizu, M. Sato, K. Imataka, A. Masuda, Y. Hara, et al., Abscess within a glioblastoma multiforme – case report, Neurol. Med. Chir. (Tokyo) 32 (1992) 829–833.
[13] D.H. Jho, K. Spiliopoulos, T.D. Stein, Z. Williams, Concomitant presentation of a glioblastoma multiforme with superimposed abscess, World Neurosurg. 75 (2011) 126–131.
[14] O. Kalita, M. Kala, H. Svebisova, J. Ehrmann, A. Hlobilkova, R. Trojanec, et al., Glioblastoma multiforme with an abscess: case report and literature review, J. Neurooncol. 88 (2008) 221–225.
[15] C.R. Lind, K. Muthiah, A.P. Bok, Peritumoral citrobacter koseri abscess associated with parasagittal meningioma, Neurosurgery 57 (2005) E814.
[16] S. Mohindra, R. Gupta, S. Mohindra, S.K. Gupta, B.D. Radotra, Posterior-fossa intra-tumoural abscess: a report of three patients and literature review, Br. J. Neurosurg. 18 (2004) 556–560.
[17] S.I. Nassar, F.S. Haddad, F.S. Hanbali, N.V. Kanaan, Abscess superimposed on brain tumor: two case reports and review of the literature, Surg. Neurol. 47 (1997) 484–488.
[18] A. Noguerado, J. Cabanyes, J. Vivancos, E. Navarro, F. Lopez, T. Isasia, et al., Abscess caused by *Salmonella enteritidis* within a glioblastoma multiforme, J. Infect. 15 (1987) 61–63.
[19] J.C. Sarria, A.M. Vidal, R.C. Kimbrough 3rd, Salmonella enteritidis brain abscess: case report and review Salmonella enteritidis brain abscess: case report and review, Clin. Neurol. Neurosurg. 102 (2000) 236–239.
[20] S. Sharma, A. Raja, P.G. Shivananda, Isolation of *Salmonella typhi* from brain tumor – a case report, Indian J. Med. Sci. 40 (1986) 233–235.
[21] T. Shimomura, S. Hori, K. Kasai, H. Okada, Meningioma associatedwith intratumoral abscess formation-case report, Neurol. Med. Chir. (Tokyo) 34 (1994) 440–443.
[22] T.H. Tsai, Y.F. Hwang, S.L. Hwang, C.H. Hung, C.W. Chu, B.K. Lua, et al., Low-grade astrocytoma associated with abscess formation: case report and literature review, Kaohsiung
[23] A. Tsugu, T. Osada, J. Nishiyama, M. Matsumae, Glioblastoma associated with intratumoral abscess formation. Case report, Neurol. Med. Chir. (Tokyo) 52 (2012) 99–102.
[24] K.E. Yeates, W. Halliday, J. Miyasaki, H. Vellend, S. Straus, A case of 'circling seizures' and an intratumoral abscess, Clin. Neurol. Neurosurg. 105 (2003) 128–131.
[25] J.P. Young, P.H. Young, Meningioma associated with abscess formation – a case report, Surg Neurol. Neurol. 63 (2005) 584–585.
[26] G. Garvey, Current concepts of bacterial infections of the central nervous system. Bacterial meningitis and bacterial brain abscess, J. Neurosurg. 59 (1983) 735–744.