Magnetic Resonance Imaging of Brain Abscess With Hemorrhage: Implications for the Mechanism of Hemorrhage

—Case Report—

Yuzo TERAKAWA, Toshihiro TAKAMI, Toru YAMAGATA*, Toshio SAITO*, and Naruhiko NAKANISHI*

Department of Neurosurgery, Osaka City University Graduate School of Medicine, Osaka; *Department of Neurosurgery, Higashisumiyoshi Morimoto Hospital, Osaka

Abstract

A 68-year-old woman presented with an extremely rare brain abscess associated with old and acute hemorrhages manifesting as gradual onset of symptoms of headache and fever. Magnetic resonance imaging clearly visualized the hemorrhage as heterogeneously hyperintense on diffusion-weighted imaging, concentric hypo-isointense on T1-weighted imaging, and homogeneously hyperintense with a hypointense rim on T2*-weighted imaging. T1-weighted imaging with contrast medium revealed a well-enhanced cyst wall. In spite of treatment with antibiotics, the neurological status of the patient deteriorated due to expansion of the abscess and perifocal edema. Needle aspiration of the cyst yielded bloody purulent fluid. The magnetic resonance imaging findings indicate that neovascularization of the cyst wall is involved in the mechanism of hemorrhage in brain abscess. Careful follow-up examinations are recommended in patients with brain abscess to detect warning signs of neurological deterioration.

Key words: brain abscess, hemorrhage, magnetic resonance imaging

Introduction

Hemorrhage is extremely rare in brain abscess, but is not uncommon in cystic neoplasms. Only nine cases of brain abscess with hemorrhage have been reported, including cases with specific associations such as acquired immunodeficiency syndrome, Fallot's tetralogy, and in the neonate. Computed tomography (CT) can usually establish the diagnosis of brain abscess, but not the differential diagnosis of brain abscess with hemorrhage from hemorrhagic neoplasm. Some patients have undergone unnecessary surgery under a misdiagnosis of malignant glioma with hemorrhage. Magnetic resonance (MR) imaging is very useful for the diagnosis of intracranial abscess, but brain abscess with hemorrhage may mimic hemorrhagic neoplasms.

Here, we report a case of brain abscess with features of both chronic and acute hemorrhages that were clearly demonstrated by MR imaging, which has implications for the differential diagnosis of brain abscess with hemorrhage.

Case Report

A 68-year-old woman presented with gradual onset of symptoms of headache and fever. Her past history was unremarkable. One week before admission, she developed headache and fever after having undergone tooth extraction of the left upper molar. On admission, her body temperature was 37.9°C and neurological examination revealed mildly disturbed consciousness and paraphasia. Laboratory examination found a white blood cell count of 8680/mm³ and a slight increase in C-reactive protein to 4.8 mg/dl, but no other abnormal blood findings.

CT disclosed a cystic lesion with perifocal edema in the left temporal region (Fig. 1A). The cystic lesion contained an area of high density, suggestive of intracystic hemorrhage. The cyst wall was slightly enhanced after administration of contrast medium. MR imaging showed the cystic lesion as heterogeneously hyperintense on diffusion-weighted imaging,
Fig. 1 A: Computed tomography (CT) scan showing a cystic mass lesion with hemorrhage in the left temporal region. B: CT scan on the 8th hospital day demonstrating enlargement of the cystic mass lesion and perifocal edema. C: CT scan obtained 6 weeks after surgery showing improvement in the abnormal density area.

Fig. 2 A: Diffusion-weighted magnetic resonance (MR) image revealing a heterogeneously hyperintense cystic lesion. B: T1*-weighted MR image showing a very hypointense rim suggesting old hemorrhage alongside the cyst wall. C: T1-weighted MR image showing a hypo–isointense area. D: T1-weighted MR image with contrast medium showing well-defined enhancement of the cyst wall.

Fig. 3 Photograph showing bloody purulent fluid obtained from the cyst by needle aspiration.

Hemorrhagic Brain Abscess

The differential diagnosis included hemorrhagic neoplasm such as malignant glioma or metastatic brain tumor, but intravenous infusion of antibiotics was started under a diagnosis of possible brain abscess. On the 8th day after admission, the level of consciousness of the patient deteriorated and she became drowsy. Emergency CT showed no additional hemorrhage but enlargement of the cystic lesion with perifocal edema (Fig. 1B). The patient underwent emergency surgery for aspiration of the cystic lesion. Needle puncture of the lesion was performed successfully under ultrasonography guidance. Bloody purulent fluid was aspirated (Fig. 3). Gram staining of the specimen revealed clusters of Gram-negative bacilli. Anaerobic culture yielded abundant growth of Prevotella and Peptostreptococcus species.

Following surgery, intravenous infusion of antibiotics was continued for 6 weeks. Her neurological condition gradually improved to normal. CT obtained about 6 weeks postoperatively revealed remarkable improvement in the abnormal density area in the left temporal lobe (Fig. 1C).

Discussion

The introduction of MR imaging has simplified the differential diagnosis of brain abscesses from other cystic lesions. Diffusion-weighted MR imaging usually shows brain abscesses as hyperintense, whereas brain tumors appear as hypointense. However, diffusion-weighted MR imaging may show certain stages of hemorrhage as hyperintense, so special attention should be paid to the diagnosis of cystic lesions in the presence of hemorrhage, as hyperintensity would not necessarily indicate brain abscess. More recently, brain abscesses with hemorrhage have been distinguished from hemorrhagic brain
tumors, especially gliomas, by MR spectroscopy,14 although it was not obtained in our case.

The exact mechanism of hemorrhage in brain abscess is not fully understood, but may involve destruction of newly formed, fragile blood vessels in the abscess wall.4,9,13,14 Such vessels are distorted due to increased intracranial pressure and so may rupture.12 Alternatively, the surrounding vessels may fail to thrombose as the abscess expands and could bleed.4 Both these mechanisms entail cyst enlargement as a critical factor. Free radicals are also a possible cause of damage to the fragile vasculature.9 MR imaging of brain abscess with hemorrhage is rarely reported.14 In our case, T1-weighted imaging with contrast medium revealed a well-enhanced cyst wall, suggesting the presence of vascularization in the cyst wall. Further, T2*-weighted images demonstrated a hypointense rim alongside the cyst wall. This MR imaging finding supports the hypothesis that neovascularization of the cyst wall is responsible for the hemorrhage, although no histological findings were available in our case. Our case also implies the importance of factors other than abscess enlargement, as the abscess expanded but did not bleed during our patient's hospital stay.

The clinical course in the present case was very unusual. In spite of improvement in laboratory data, and administration of appropriate antibiotics based on bacterial culture, the neurological status of the patient deteriorated due to expansion of the abscess and perifocal edema. Although decrease in the size of abscess is often not obvious for 6 to 8 weeks if only antibiotics are used,3 the present case emphasizes the need to manage brain abscesses with caution even if antibiotics seem effective. Therefore, careful neuroimaging follow up is recommended for patients with brain abscess, and early surgical intervention may be required because of the risk of neurological deterioration.

References


Address reprint requests to: Yuzo Terakawa, M.D., Department of Neurosurgery, Osaka City University Graduate School of Medicine, 1–4–3 Asahi-machi, Abeno–ku, Osaka 545–8585, Japan.

e-mail: terakawa@msic.med.osaka-cu.ac.jp