Probable Brain Abscess Presenting as a High Uptake Lesion on Thallium-201 Single Photon Emission Computed Tomography

—Case Report—

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Abstract

A 61-year-old male presented with a brain abscess manifesting as high fever and generalized convulsion attacks. Magnetic resonance (MR) imaging disclosed a ring-like enhanced lesion in the parietal lobe. Thallium-201 single photon emission computed tomography (201Tl SPECT) images demonstrated a high uptake lesion with a 201Tl uptake index on the early image of 2.21, which suggested malignant disease. The washout ratio was 0.73. His symptoms and the ring-like enhanced lesion on MR images disappeared after 2 months of antibiotic treatment. The final diagnosis was brain abscess, despite the 201Tl SPECT findings. 201Tl SPECT washout ratio may be a better indicator of brain abscess than uptake index.

Key words: brain abscess, magnetic resonance imaging, single photon emission computed tomography, thallium-201 uptake index, washout ratio

Introduction

Ring-like enhanced mass lesion on computed tomography or magnetic resonance (MR) imaging may be caused by malignant glioma, metastatic brain tumor, or brain abscess. The differential diagnosis is sometimes difficult, but gallium-67 (67Ga) scintigraphy, fluorine-18 fluorodeoxyglucose (18F-FDG) or carbon-11 methionine positron emission tomography (PET) can be used to establish the correct diagnosis.2,3,5,6

Thallium-201 single photon emission computed tomography (201Tl SPECT) was developed as a diagnostic tool for myocardial infarction, but 201Tl also accumulates in neoplasms, especially malignant ones.1,3,6,8,9 In contrast, 201Tl accumulates only in traces in abscess or necrosis.3,6,8,9 The sensitivity and specificity of 201Tl SPECT are higher than those of 67Ga scintigraphy and 18F-FDG PET.3,5 Therefore, 201Tl SPECT is the ideal diagnostic modality for neoplasms including brain tumor. 201Tl SPECT has previously demonstrated brain abscess as a low uptake lesion.3,8 However, we describe a case of brain abscess presenting as a high uptake lesion on 201Tl SPECT.

Case Report

A 61-year-old male presented with generalized convulsion attacks. He had a history of poorly controlled diabetes mellitus. He had had high fever 10 days previously. On admission, his erythrocyte sedimentation rate indicated the presence of inflammation. MR imaging showed a right parietal mass lesion, which appeared as a low-intensity signal on the T1-weighted image, a high-intensity signal on the T2-weighted image, and as ring-like enhancement with gadolinium (Fig. 1). Computed tomography revealed a heterogeneous density lesion. Four-vessel angiography revealed capillary injection around right
The results indicated the diagnosis of a brain abscess, but a malignant lesion could not be denied, so $^{201}$Tl SPECT was performed.

$^{201}$Tl SPECT images were taken 5 minutes (early image) and 4 hours (late image) after intravenous administration of 111 MBq of $^{201}$Tl chloride (Fig. 2). The ratio of the mean counts/pixel in the lesion to the mean counts/pixel in the contralateral homologous region (L/C ratio or $^{201}$Tl uptake index) on the early image was 2.21. The ratio of the mean counts/pixel in the lesion on the early image to the mean counts/pixel in the lesion on the late image (L/E ratio or washout ratio) was 0.73. The $^{201}$Tl uptake index of brain abscess is reported as about 1.0, so that we thought this value was too high to confirm the diagnosis of brain abscess.

However, he still had high fever and poorly controlled diabetes mellitus, so we decided to treat him for these conditions first instead of biopsy or radical operation. He was given imipenem/cilastatin (1 g daily) intravenously. Follow-up MR imaging was performed 3 weeks after the first MR imaging study, and showed that the size of the ring-like enhanced lesion was reduced (Fig. 3 left). This was 2 weeks after beginning the antibiotic treatment. MR imaging showed the lesion had almost disappeared after another 6 weeks of antibiotic treatment (Fig. 3 right). His symptoms had also disappeared. To prove that his symptoms and neuroradiological findings were not due to systemic infection and intracerebral hemorrhage, further MR imaging was performed.
one month after the disappearance of the ring-like enhanced area, which showed no hemosiderin rings (Fig. 4). Therefore, our final diagnosis was brain abscess.

Discussion

201Tl uptake is frequently evaluated using the L/C ratio (lesion uptake/contralateral region uptake ratio or 201Tl uptake index).2,7,8,11 The cut-off value to distinguish malignant from benign lesions is about 2.0 (range 1.5–2.5).2,7,8,11 The L/C ratio for abscess is 1.0.3,8 In contrast, the value in our case was 2.21. The difference of 201Tl uptake index between previous reports and ours might come from the difference of their inflammatory stages. In general, early uptakes of any radioisotope tracer are affected by local blood flow. Acute abscess may be likely to have higher uptakes.

Recently, the importance of the late image count/early image count ratio (L/E ratio or washout ratio) has been established. Malignant lesions have a L/E ratio of over 1.0.9 The L/E ratio in our case was 0.73. Therefore, the L/E ratio was more helpful in our case than the 201Tl uptake index.

201Tl SPECT is a useful modality for the diagnosis of malignant diseases. However, evaluation of both 201Tl uptake index and the L/E ratio is necessary.

References


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