

Atypical finding of brain Tc-99m-ECD SPECT imaging in herpes simplex encephalitis

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Lesions in acute herpes simplex encephalitis (HSE) have been reported to show decreased uptake of Tc-99m ethyl cysteinate dimer (ECD). A patient with acute HSE displaying a lesion in the left temporal lobe was evaluated by means of Tc-99m ECD single-photon emission computed tomography (SPECT). Dynamic SPECT images indicated regionally increased uptake of tracer in the ipsilateral temporal lobe in early phases, followed by slight washout of Tc-99m ECD from the lesion. Static SPECT images revealed increased tracer uptake in the same region. MRI later demonstrated that the HSE lesion involved the whole cortex of the temporal lobe on the affected side. These findings suggest that acute HSE lesions do not always exhibit hypoactivity on static Tc-99m ECD SPECT, and that dynamic Tc-99m ECD SPECT may help physicians diagnose acute HSE.

Key words: herpes simplex encephalitis, Tc-99m ECD, dynamic SPECT

INTRODUCTION

HERPES SIMPLEX ENCEPHALITIS (HSE) is known for its confusing clinical symptoms, often severe brain lesions, and poor prognosis. With recent progress in neuroimaging techniques and chemotherapy, however, early diagnosis and appropriate treatment of HSE have become possible, and the severity of sequelae has been reduced.^{1,2}

Focal hyperactivity of the temporal lobe has been considered a hallmark of acute HSE on brain single-photon emission computed tomography (SPECT) with Tc-99m hexamethylpropylene amine oxime (HMPAO).^{3–6} In contrast, it has been reported that lesions in HSE show decreased uptake of Tc-99m ethyl cysteinate dimer (ECD), which is not helpful for early diagnosis.^{7–10}

In this article, we describe a patient with acute HSE who demonstrated an atypical finding of increased tracer uptake in the temporal lobe on static Tc-99m ECD SPECT.

We also compare the results of static SPECT, dynamic SPECT, and magnetic resonance imaging (MRI) for the same patient.

CASE REPORT

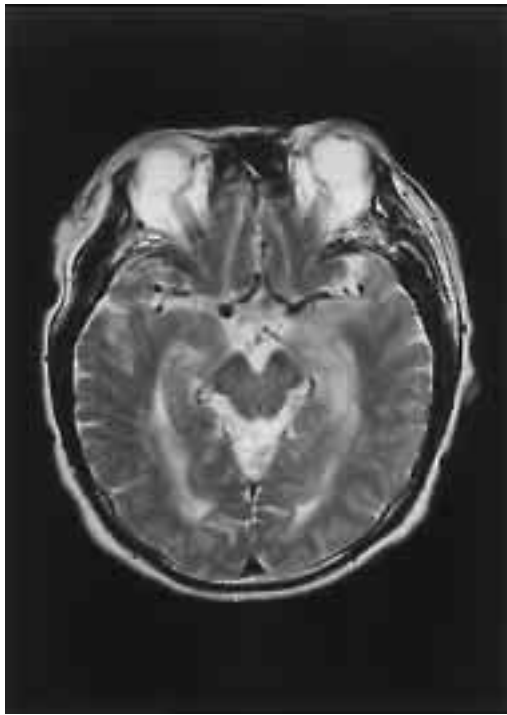
A 73-year-old male developed fever, intermittent vomiting, confusion and generalized tonic-clonic seizures over the course of a few days. His past medical history was unremarkable. On admission, neurologic examination demonstrated sensory aphasia. MRI performed 3 days after the onset of the symptoms revealed a mass lesion in the left mediotemporal lobe (Fig. 1A). The left lateral temporal cortex also exhibited slightly abnormal intensity. Subsequent electroencephalography exhibited periodic high-amplitude sharp waves in the left temporo-parietal region, although no seizure was observed. Brain SPECT images were obtained on the same day to further evaluate a possible diagnosis of HSE.

SPECT studies were performed with a ring-type SPECT scanner, a Headtome-SET080 (Shimadzu Corp., Kyoto, Japan). The in-plane and axial spatial resolution obtained with an all-purpose and a high-resolution collimator was 13 and 12 mm, respectively, and 26 and 21 mm,

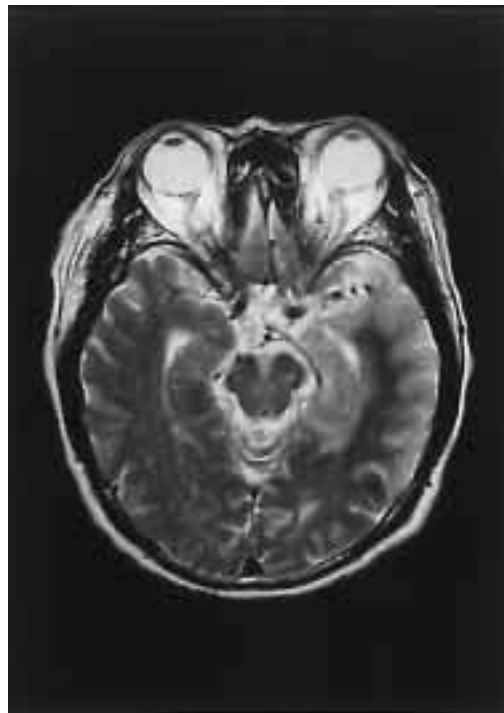
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A



B

Fig. 1 A: T2-weighted MRI image performed 3 days after the onset of the symptoms reveals an area of hyperintensity in the left mediotemporal lobe. The left lateral temporal cortex also exhibits slightly hyperintensity. B: T2-weighted MRI image two weeks after the onset of the symptoms reveals extension of the lesion to the whole cortex of the left temporal lobe.

respectively. The patient received an intravenous bolus injection of 740 MBq Tc-99m ECD. At the same time, dynamic scanning with an all-purpose collimator began and continued for 300 s, producing five scans with a scan-time duration of 60 s each. Static SPECT imaging with a high-resolution collimator started 10 min after injection of the tracer. Tomographic data were obtained continuously over a 20 min period.

Dynamic images showed marked hyperactivity in the left temporal lobe in the first scan (60 s postinjection), with slightly decreased activity of Tc-99m ECD in the same region, thereafter (Fig. 2). Static SPECT images showed hyperactivity in the left temporal lobe (Fig. 3).

After SPECT studies, the patient was treated with acyclovir. Polymerase chain-reaction studies confirmed herpes simplex virus infection. Follow-up MRI two weeks after the onset of symptoms revealed extension of the lesion to the whole cortex of the left temporal lobe (Fig. 1B). The patient made a good recovery except for residual sensory aphasia.

DISCUSSION

SPECT has been advocated as a sensitive and rather specific tool for the early diagnosis of HSE.³⁻⁶ In the acute stage of HSE, angiitis causes vascular dilatation, resulting

in an increase in blood flow.⁸ With Tc-99m HMPAO, researchers noted increased tracer uptake within 4 weeks after clinical onset, even before any lesions appeared on CT or MRI.^{7,9} On the other hand, HSE lesions have exhibited decreased uptake of Tc-99m ECD in all previously reported cases.⁷⁻¹⁰ Tc-99m ECD is metabolized rapidly in the brain, via a specific enzymatic pathway, to a polar complex that is retained in the brain.¹¹ Given this retention mechanism, the distribution of Tc-99m ECD may reflect not only perfusion but also the metabolic status of brain tissue.¹¹ Decreased uptake of Tc-99m ECD in the HSE lesions on static SPECT images may be due to slow or absent de-esterification secondary to brain damage,⁷⁻⁹ but static Tc-99m ECD SPECT in the present case demonstrated hyperactivity in the lesion, contrary to previous observations. It is reported that super-early images of dynamic Tc-99m ECD SPECT demonstrate hyperemia in areas with irreversible brain damage.¹² The subsequent decrease of Tc-99m ECD activity on later images is caused by the activity of cytosolic enzyme and the severity of blood-brain barrier breakdown due to brain damage.¹³ In the present case, dynamic Tc-99m ECD SPECT images on admission revealed marked initial hyperactivity followed by slight washout of Tc-99m ECD in the left temporal lobe. MRI eventually showed that the HSE lesion had extended to the whole cortex of the same

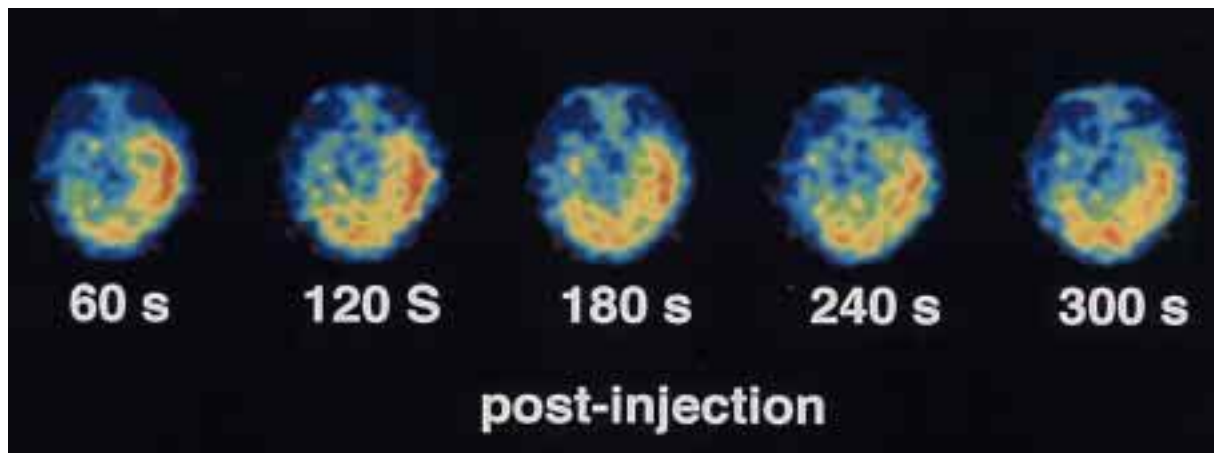


Fig. 2 Dynamic Tc-99m ECD SPECT images obtained 3 days after the onset of the symptoms reveal marked hyperactivity in the left temporal lobe immediately after tracer injection, followed by a subsequent slight decrease in tracer activity.

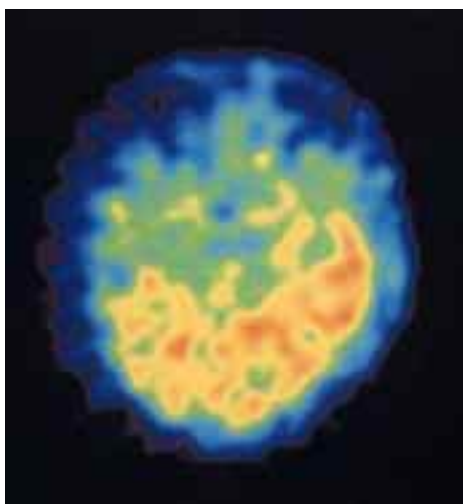


Fig. 3 Static Tc-99m ECD SPECT image obtained 3 days after the onset of the symptoms demonstrates increased tracer accumulation in the left temporal lobe.

lobe. These findings suggest that the whole left temporal lobe was hyperperfused and slightly damaged but still enzymatically active when the SPECT study was performed, and thus displayed hyperactivity on static Tc-99m ECD SPECT.

Our case involves several issues regarding SPECT findings. First, static Tc-99m ECD SPECT imaging started 10 min after injection of the tracer and showed hyperactivity in the lesion. Nevertheless, the findings in dynamic SPECT images revealing washout of tracer over time suggest that static Tc-99m ECD SPECT might show iso- or hypoactivity in the lesion when the data acquisition was started later. Second, while we performed SPECT studies 3 days after the onset of the symptoms, SPECT studies in previous reports demonstrating decreased uptake of Tc-

99m ECD in HSE lesions were performed 2 to 4 weeks after clinical onset.^{8–10} These findings suggest that uptake of Tc-99m ECD in HSE lesions may depend on the stage of HSE.

In our case, although seizure did not occur during SPECT imaging, electroencephalography exhibited epileptic discharges in the affected hemisphere. Therefore, hyperperfusion due to not only angiitis but subclinical seizure also may cause focal hyperactivity on Tc-99m ECD SPECT.

Although our observations are limited to only one case, they suggest that acute HSE lesions do not always exhibit hypoactivity on static Tc-99m ECD SPECT. Additional studies are required to confirm this finding, but dynamic Tc-99m ECD SPECT may enable the early diagnosis of HSE at least as well as static Tc-99m HMPAO SPECT.

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