

Serial Cerebral Perfusion Imaging in a Case with Herpes Simplex Encephalitis

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ABSTRACT. To evaluate cerebral blood flow, single photon emission computed tomographies (SPECTs) were serially performed in a case with herpes simplex encephalitis (HSE). Increased accumulation of N-isopropyl-I-123-p-iodoamphetamine (I-123-IMP) and Tc-99m-hexamethylpropyleneamine oxime (Tc-99m-HM-PAO) were noticed in the acute phase, and continued for seven weeks after the onset of the disease. In the third week, regional cerebral blood flow (rCBF) was estimated with I-123-IMP SPECT, and rCBF showed a high value in the affected temporal and occipital lobes of 60 to 70 ml/100 g/min (normal value; 40-50 ml/100 g/min), reflecting high accumulation of the tracer. After the twelfth week, when chincial symptoms and laboratory data had improved, the increased accumulation of these tracers was converted to a decreased accumulation.

Key words: herpes simplex encephalitis — cerebral perfusion imaging

It has been reported that herpes simplex encephalitis (HSE) shows an increased accumulation of cerebral perfusion imaging agents in the affected lesion in the acute phase of the disease, and that this increased accumulation of tracers becomes a decreased accumulation in a later phase.^{1,2,3)} We performed serial cerebral perfusion imaging in a case with HSE, and measured regional cerebral blood flow.

CASE REPORT

A 50-year-old man complained of loss of appetite and nausea on April 12, 1990. On April 16, he was admitted to our hospital because of general convulsions and a decreased level of consciousness. On admission, X-CT revealed no abnormality. On April 18, T2 weighted MRI showed a high intensity area in the base of the right temporal lobe. On April 25, a spinal tap was performed because of a continuously decreasing level of consciousness and a rising fever, the tap showed increased cell counts, mainly mononucleocytes, in cerebrospinal fluid. As these findings indicated that he was suffering from

viral encephalitis, on April 26, administration of anti-viral agents was started. In a follow-up study, antibody titers against herpes simplex virus-1 in serum and cerebrospinal fluid were significantly elevated. N-isopropyl-I-123-p-iodoamphetamine (I-123-IMP) single photon computed tomography (SPECT) was performed a total of six times; on the 15th and 20th days, and during the 5th week, 7th week, 12th week and 16th week. On the second I-123-IMP SPECT, regional cerebral blood flow (rCBF) was measured using the arterial blood sampling method.^{4,5)} During the week of the disease, SPECT using Tc-99m-hexamethylpropyleneamine oxime (Tc-99m-HM-PAO) was performed. The first I-123-IMP SPECT, obtained on April 27, showed markedly increased accumulation of the tracer in the right temporal and occipital lobes (Fig. 1). The conventional X-CT, obtained on the same day, revealed a low density area in the right temporal lobe with an artifact due to the temporal bone. On the second I-123-IMP SPECT, obtained on May 2, rCBF was measured (Fig. 2). Increased rCBF, which was 60 to 70 ml/100 g/min, (normal value; 40-50 ml/100 g/min), was observed in the affected right temporal and occipital lobes. On the other hand, slightly decreased rCBF was observed in the left cerebral hemisphere and the right frontal lobe. Tc-99m-HM-PAO SPECT, performed five days after the second I-123-IMP SPECT, showed almost the same image as I-123-IMP SPECT. During the fifth and seventh weeks, increased uptake of I-123-IMP was observed in the affected lesion. MRI, performed during the eighth week of the disease, showed contrast enhancement and a large high intensity area on a T2 weighted image in the affected lesions. During the

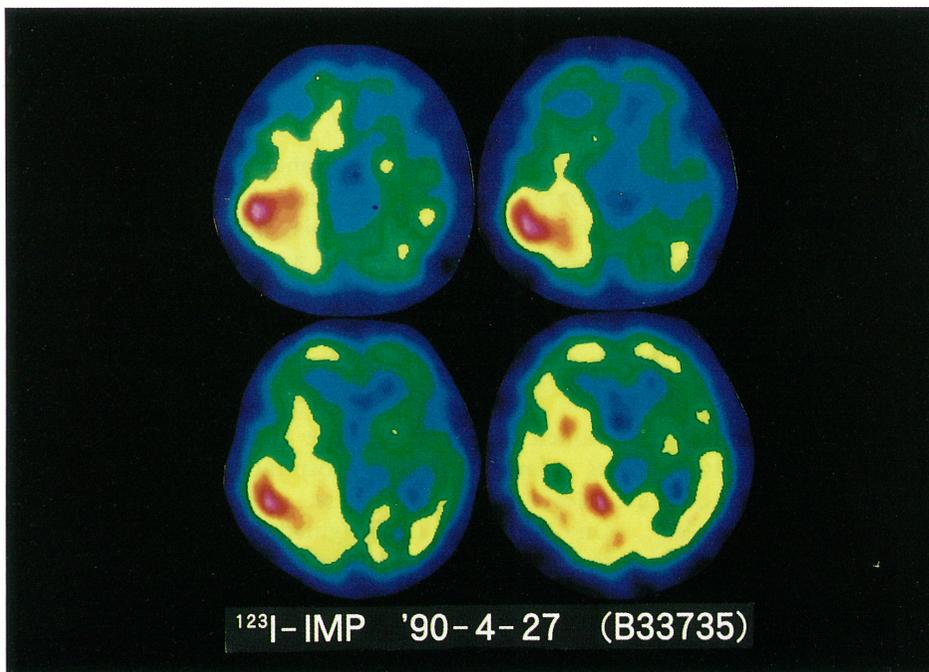


Fig. 1. I-123-IMP SPECT on April 27 (15th day)

Increased uptake was observed in the right temporal and occipital lobes.

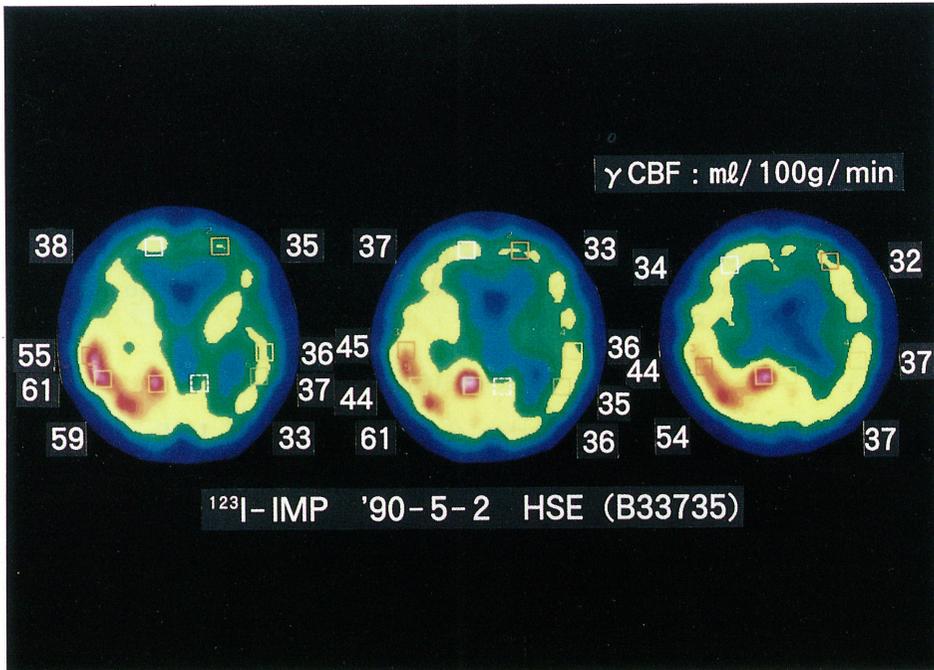


Fig. 2. rCBF on May 2 (20th day)
Increased rCBF was detected in the affected lesion.

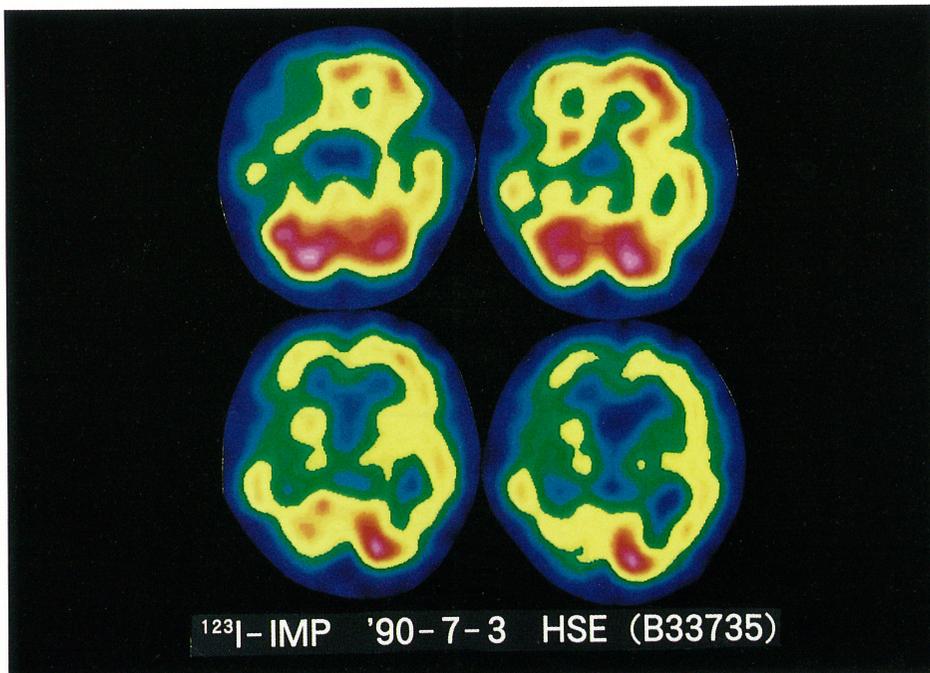


Fig. 3. I-123-IMP SPECT on July 3 (12th week)
The increased accumulation in the lesion during acute phase was converted to a decreased accumulation.

twelfth week, the uptake of I-123-IMP in the right temporal and occipital lobes decreased (Fig. 3). MRI carried out two weeks before, revealed large high intensity areas in the right temporal and occipital lobes on T2 weighted images. During the sixteenth week, decreased uptake of I-123-IMP in the affected lesions continued. MRI findings on the same day were almost the same as the previous scan. I-123-IMP uptake ratio, which was determined by dividing the lesional RI uptake counts by the contralateral cerebral hemispheric RI uptake counts, was serially studied (Fig. 4). The I-123-IMP uptake ratio was high in the acute phase, but the high uptake ratio of more than 1.6 became a low uptake ratio during the 12th week. In addition, the RI uptake ratio correlated with cell counts in cerebrospinal fluid.

DISCUSSION

It has been reported that during the acute phase of HSE there is an increased accumulation of cerebral perfusion imaging agents, after which the high uptake becomes a decreased uptake.^{1,2,3)} Increased accumulation of these tracers has also been reported to appear between the fourth and eleventh day after the onset,^{1,2)} and to continue for eight weeks.^{2,3)} In our present case, an increased uptake of the tracers was observed in the right temporal and occipital lobes on the fifteenth day, and it continued for seven weeks. This finding of a significantly increased uptake on the fifteenth day and twentieth day after the onset was useful in the early detection of the affected lesions. Although the precise mechanism of the increased accumulation of the cerebral perfusion agents was not clear, it was suspected that it reflected increased cerebral blood flow in the affected lesions because of the presence of cerebral inflammation.

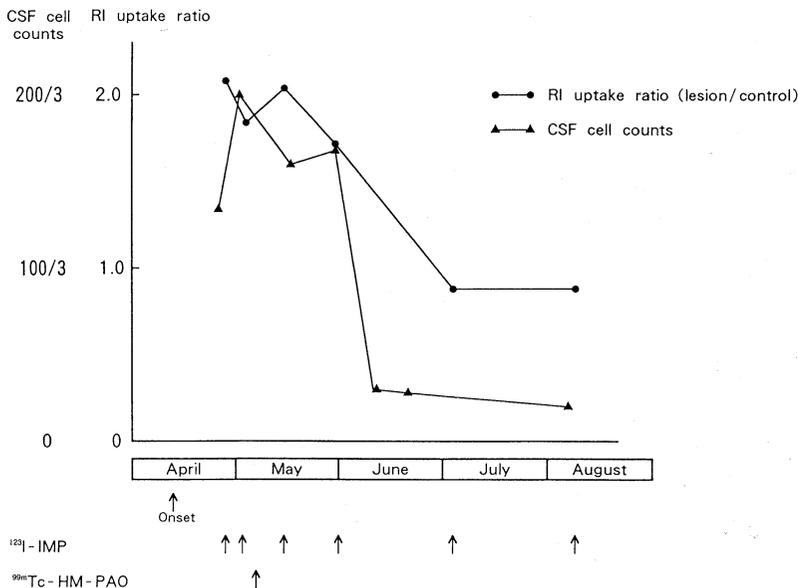


Fig. 4. The time course of the RI uptake ratio and laboratory findings of CSF

Increased accumulation of these tracers was continuously shown in the lesion, and there was no epileptic discharge on EEG. Therefore, it is suspected that there was little possibility that the increased uptake was due to the epileptic focus caused by the encephalitis. Decreased accumulation has been shown at a later stage.^{1,2,3)} The increased uptake in the present case also converted to a decreased uptake during 12th week after the onset. It is suspected that the decreased uptake represented hypoperfusion due to the damage of neuronal cells and reduced metabolism¹⁾.

In the present case with HSE, not only imaging evaluation but also quantitative measurement of rCBF using arterial blood sampling on I-123-IMP SPECT was performed. The affected lesion showed hyperperfusion of rCBF of 60 to 70 ml/100 g/min, which was significantly higher than the normal range of 40 to 50 ml/100 g/min. On the other hand, the slightly decreased rCBF in the left cerebral hemisphere and the right frontal lobe might represent mildly reduced cerebral perfusion due to increased intra-cranial pressure.

The I-123-IMP uptake ratio correlated with the laboratory data of CSF for HSE. After June 10, when the patient's consciousness level improved, the CSF cell counts markedly decreased. During the twelfth week, RI uptake ratio decreased to lower than 1.0. This finding led us to suspect that the decreased uptake of I-123-IMP reflected the disappearance of inflammation. Thus, the degree of I-123-IMP uptake in the affected lesion seemed to correlate with the degree of cerebral inflammation. Therefore, we believe that brain perfusion imaging may be useful not only in the early detection of HSE but also in the assessment of the activity of encephalitis.

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