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Introduction

Neuronal ceroid-lipofuscinosis (NCL) is a progressive, hereditary neurologic disorder of unknown origin. Clinically, NCL is devided into four major subgroups such as infantile, late infantile, juvenile and adult. In late-infantile type, seizures, polymyoclonia, and cerebeller ataxia appear around the age of 2 to 4 years and progressively develop dementia and blindness. Zeman introduced 26 patients of NCL for the first time at 1969, they found atrophy of forebrain in all 13 patients examined and of cerebellum in 11 patients.[1] The cortex was thinned and yellow in color. The principle pathologic feature was excessive accumulation of autofluorescent lipopigments. Diffuse cortical cell loss and fiber atrophy of white matter was noted by neuropathology. X-ray CT showed diffuse cortical and subcortical atrophy in advanced stage of this disorder.[2,3]

Positron emission tomography (PET) with ^{18}F-fluorodeoxyglucose (FDG) have enabled us to determine rCMRglc under non-invasive condition.[4] We examined an FDG-PET at the terminal stage of late-infantile NCL, in order to assess the local cerebral function at such terminal stage.

Case Report

The patient is an 8-year-old girl, second child of healthy parents who are first cousins. Her development was quite normal unit 3 3/4 years when she had generalized convulsions. Then her psychomotor and visual function became gradually deteriorated. At 7 years of age, she was diagnosed as late-infantile NCL because of progressive illness, optic atrophy, flat electro-retinogram, large evoked potentials, and finger-print granules in lymphocytes demonstrated by electronmicroscopy (Fig. 1). At 8 years of age, she did not respond to verbal commands, but only blinked to a loud noise. Her hip and knee joints showed contracture. Her temperature could not be regulated. Her seizures became severe, and eventually myoclonus was constantly observed in waking state. X-ray CT showed severe cortical and subcortical atrophy. At this time, the amplitude of evoked potentials and electroencephalogram became

lowered. The PET scan was performed under induced sleep by intravenous administration of diazepam.

The PET images were obtained using FDG by an ECAT II (Ortec) with a full-width-half-maximum spatial resolution of 17 mm. Mean rCMRglc of unaffected regions in six age-matched patients of partial epilepsy was used for control values.

Results

Figure 2 shows the images of PET with FEG and X-ray in this case. The PET images demonstrated that rCMRglc was markedly lowered in the cortex, however glucose utilization was preserved in caudate nuclei in contrast to the cortex. X-ray CT showed severe cortical and subcortical atrophy. The rCMRglc for six areas were displayed in Figure 3. Mean rCMRglc was 4.7 mg/100 g/min. The rCMRglc in caudate nuclei, thalamic area, cerebellum and frontal, temporal and occipital cortices were 5.6, 3.7, 5.0, 4.0, 5.0, and 4.6 mg/100 g/min, respectively. The reference ratio represents the local CMRglc devided by the mean CMRglc. Figure 4 shows that the reference ratio was higher in caudate nuclei (1.21), and lower in frontal cortex (0.85) than that of control values.

Discussion

PET study in this disorder has not been reported in the previous literature. This study revealed that main feature of PET image in the terminal stage of NCL was diffuse hypometabolism with relative preservation in caudate region.

Farkas et al. demonstrated that rCMRglc were significantly lower than that of controls as much as 35-45 % below[5] in Alzheimer's disease. However, Foster et al. showed that individuals with disproportionate failure of language function had marked diminished metabolism in left frontal, temporal and parietal cortex, and with memory failure had no significant metabolic asymmetry in cortical regions.[6]

Metter et al. described that glucose metabolisms were strikingly reduced in Alzheimer's disease and mildly to moderately reduced in Parkinson's disease, whereas in Huntington's disease, major metabolic depression was found only in caudate nuclei. And they used reference ratio to evaluate region-to-region relationships on cerebral glucose metabolism, and described that profiles of reference ratios were essentially the same across disease states, except in Huntington's disease with markedly decreased in caudate nuclei, and in Alzheimer's disease with an elevation in the occipital cortex.[7]

In our patient, rCMRglc were diffusely decreased except for caudate nuclei, and profile of reference ratio showed significant elevation in this area and reduction in frontal cortex. Foster et al. described that overall glucose utilization was depressed an average of 20 % by intravenous diazepam.[8] Even though our study was performed under induced sleep by one

shot of intravenous diazepam, these profound reduction to about half of control values of CMRglc seems to be significant because CMRglc at caudate nuclei was fairly preserved. So relatively high CMRglc in caudate nuclei in contrast to cerebral cortex may correspond to myoclonus which persisted until the terminal stage of this disorder.

References

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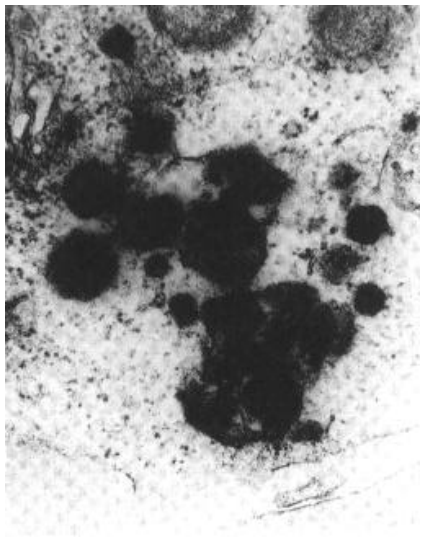

Fig. 1. Finger-print granules in lymphocyte by electronmicroscopy.

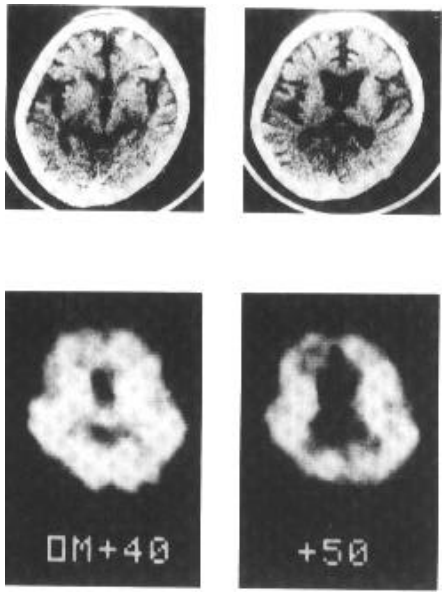

Fig. 2. The images of PET with FDG and X-ray CT of this case on the level of Om +40 and Om +50.

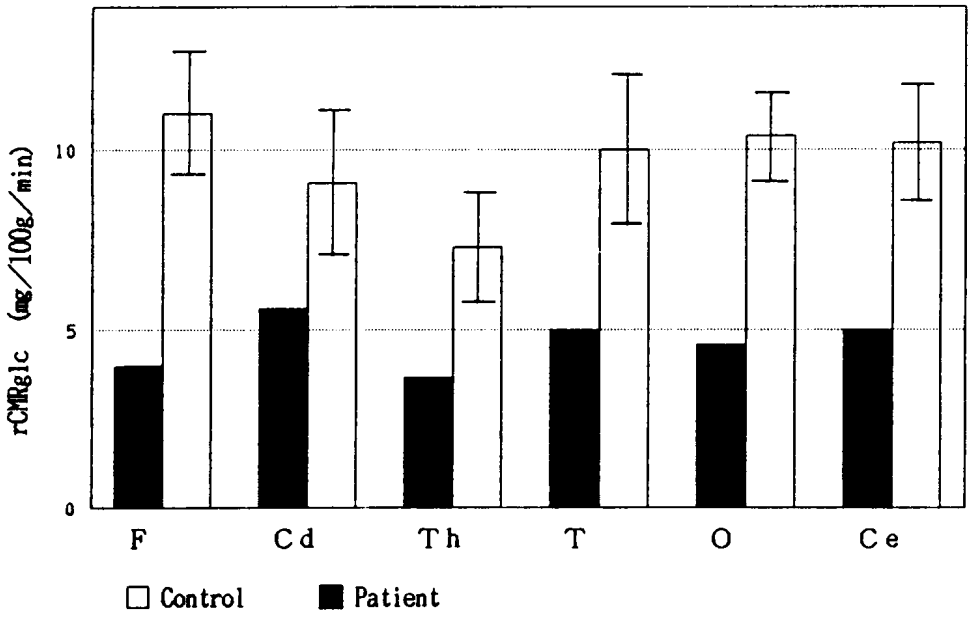

Fig. 3. Regional cerebral metabolic rate for glucose at six different areas. F, frontal; t, temporal; O, occipital cortex; Cd, caudate nuclei; Th, thalamic area; Ce, cerebellum. Error bars represent 1 SD.

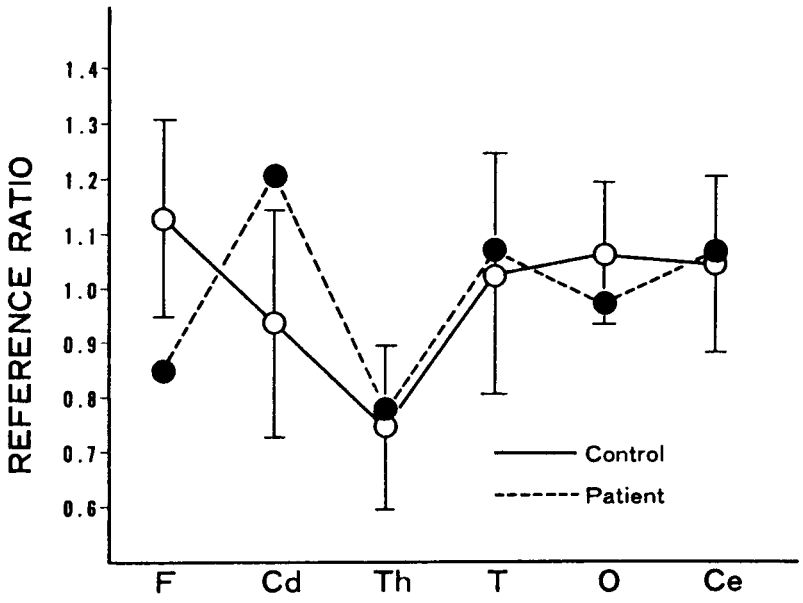

Fig. 4. Local reference ratio of six different areas.