—Photogravure—

Amyloid Positron Emission Tomography Imaging for the Differential Diagnosis of Alzheimer's Disease

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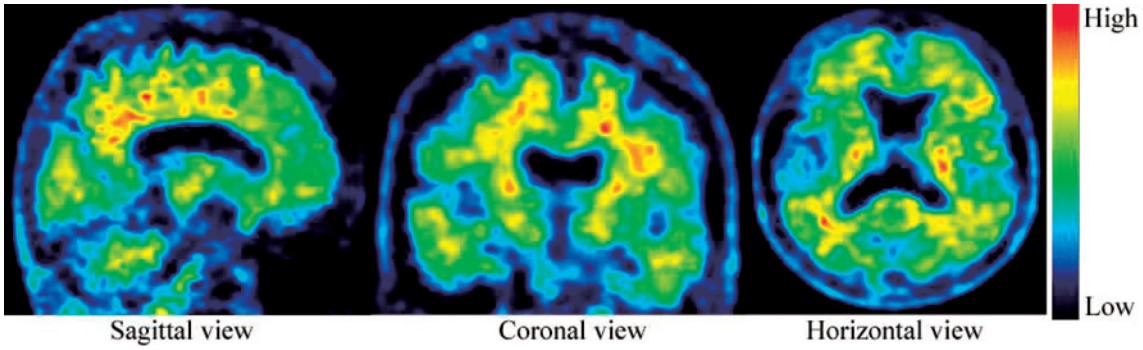

Fig. 1

On the basis of the beta-amyloid cascade theory of Alzheimer's disease (AD), in which beta-amyloid leads to the neurodegeneration that triggers the course of AD, the early detection of beta-amyloid has become important for the diagnosis of AD. In April 2012, the U.S. Food and Drug Administration approved [^{18}F]florbetapir[1], a positron emission tomography (PET) ligand, for the differential diagnosis of other types of dementia from AD[2]. Unfortunately, [^{18}F]florbetapir has not yet been approved by Japan's Pharmaceutical and Medical Devices Agency, although we have been performing amyloid PET studies with [^{18}F]florbetapir since April 2010.

Here we present amyloid PET images produced with [^{18}F]florbetapir. Both patients were suspected of having AD on the basis of their symptoms. Patient A was a 71-year-old woman with cognitive impairment (Mini-Mental State Examination [MMSE][3] score of 23). Because magnetic resonance imaging (MRI) of the brain showed no abnormality, and morphometrical analysis with the Voxel-based Specific Regional analysis system for Alzheimer's Disease (VSRAD)[4] showed no significant atrophic changes in the hippocampus (z-score, 0.97), she was suspected of having early AD. Then, PET was performed to examine amyloid accumulation (**Fig. 1**). The result of amyloid PET for patient A was interpreted as being positive for beta-amyloid. The diagnosis of AD was based on the combination of symptoms and the results of amyloid PET imaging. During follow-up the patient's cognitive performance gradually declined.

Patient B was a 74-year-old woman with depression and cognitive impairment (MMSE of 24). Brain MRI showed no abnormality. The Geriatric Depression Scale score was 13. The atrophic changes in the hippocampus were evaluated with MRI and VSRAD (z-score 1.04). She was also suspected of having early AD, and amyloid PET was performed (**Fig. 2**). In contrast to those in patient A, the results of amyloid PET in patient B ruled out the possibility of AD, and depression was diagnosed. After a 1 month of treatment, her cognitive performance had improved (MMSE of 29).

Beta-amyloid appears to accumulate gradually over 10 to 20 years before symptoms of dementia appear[5]. The increased levels of accumulated beta-amyloid detected with [^{18}F]florbetapir might be a marker of preclinical AD[6]. Although the clinical symptoms of patient B were similar to those of patient A, amyloid PET indicated that

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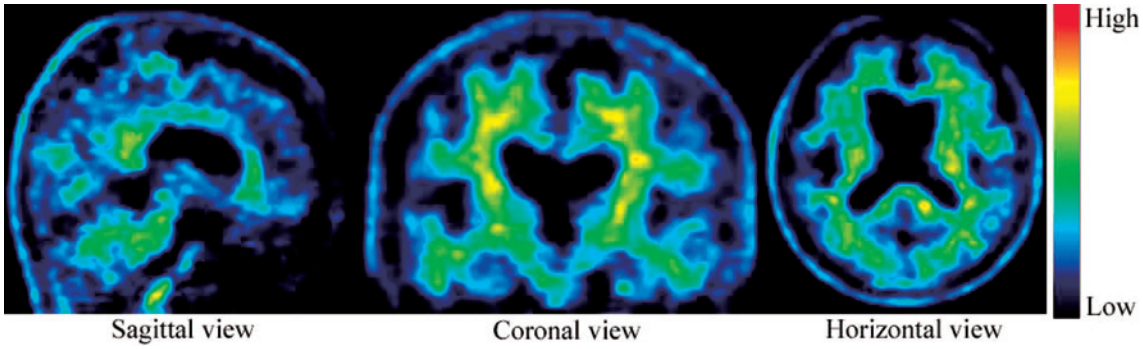

Fig. 2

patient A had early AD, whereas patient B did not. Amyloid PET imaging, as a biomarker of AD, was useful for the differential diagnosis of AD. Amyloid PET imaging might be used to predict the treatment outcome based on the amyloid pathology.

Fig. 1 PET images from patient A. The degree of beta-amyloid accumulation was visualized with color-coded scale. These images show the significant increase in beta-amyloid accumulation in the medial orbital frontal, temporal, anterior, and pesterior cingulate, and parietal lobes and the precuneus. Visual assessment by means of global rating assessment was grade 3 (moderate to high), which is defined as "nearly all cortical areas show clearly increased activity compared with the cerebellum, and most cortical regions have activity similar to the activity in white matter."

Fig. 2 PET images from patient B. The degree of beta-amyloid accumulation was visualized with color-coded scale. These images do not show the significant increase of beta-amyloid accumulation in cortical regions. Visual assessment by means of global rating assessment was grade 0 (none), which is defined as "no definite increased cortical gray matter retention of compound above cerebellum levels is present, white matter activity is clearly greater than cortical activity, and a characteristic white matter pattern is seen."

References

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