Amyloid imaging using the radioligand [^{18}F]AV-45 (Florbetapir F-18)

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Abstract

Purpose: To quantitatively evaluate the fibrillar ß-amyloid burden in patients with probable Alzheimer's disease (AD), mild cognitive impairment (MCI), and frontotemporal lobar degeneration (FTLD), as well as in healthy controls (HCs), using ^{18}F-AV-45 (florbetapir) positron emission tomographic (PET).

Methods: ^{18}F-AV-45 PET was performed on 21 patients with probable AD (9 men, 12 women; Mini-Mental State Examination (MMSE) score, 22 ± 5.0 points; mean age, 70±10 years), 12 patients with MCI (7 men, 5 women; MMSE score, 25 ± 4.0 points; mean age, 68±7.0 years), 10 patients with FTLD (8 men, 2 women 2; MMSE score, 25 ± 2.0 points; mean age, 68 years), and 7 HCs (4 men, 4 women, mean age, 73±11 years). Dynamic PET was performed from 0 to 90 min after tracer injection (370 MBq), and time-activity curves were constructed. Standardized uptake value (SUV) and cortex-to-cerebellum SUV ratio (SUVRs) were calculated for cortical (frontal, temporal, parietal, and occipital lobes) and non-cortical (putamen, thalamus, and pons) regions of interest.

Results: In patients with AD, MCI, FTLD and in HCs, the cortex-to-cerebellum SUVR plateaued within 40 min of ^{18}F-AV-45 administration. In the 10-min period from 50 to 60 min after tracer injection, the cortex-to-cerebellum SUVR was 1.39–1.48 for patients with AD, 1.34–1.40 for patients with MCI, 0.96-1.13 for patients with FTLD and 1.13–1.35 for HCs. In HCs, SUVR were higher for white matter than for gray matter; however, for patients with AD, SUVR were higher for gray matter than for white matter. In the frontal, parietal, and temporal regions, the SUVR was greater in patients with AD than in HCs. In all four cortical regions, the SUVR was significantly greater for patients with AD than for patients with FTLD. In the frontal and parietal regions, the SUVR was significantly higher for patients with AD than for patients with MCI. In the occipital regions, the SUVR was similar in patients with AD and MCI and HCs. No significant difference was observed in the cortical retention of amyloid of all cortical regions for all subjects. SUVR in the occipital lobe tended slightly high value for MCI, HC, and FTLD. Among patients with AD and MCI, the SUVR of all cortical regions was similar in apolipoprotein Eε4 (APOE-ε4) carriers and ε4 non carriers. A follow-up PET study performed within 3 months showed no correlation between SUVRs and regional cerebral blood flow (rCBF) in the cortical regions in patients with MCI (n = 3) or patients with AD (n = 4).

Conclusion: SUVR evaluated 50–60 min after ^{18}F-AV-45 administration showed significant differences between patients with AD and patients with FTLD and HCs. SUVR were highest for patients with AD, lowest for patients with FTLD, and intermediate for patients with MCI. The SUVR in the frontal, parietal, and temporal regions was lower in HCs than in patients with AD, whereas the SUVR in the frontal region was higher in HCs than in patients with FTLD. There was no evidence of amyloid retention in the brain of patients with typical FTLD. However,_cortical atrophy might have had an effect on these results. These results suggest that ^{18}F-AV-45 PET may be effective for predicting the risk of AD in patients with MCI, discriminating between AD dementia and non-AD dementia, and selecting targets for anti-amyloid therapy.