Summary metrics to assess Alzheimer disease-related hypometabolic pattern with 18F-FDG PET: head-to-head comparison.

Abstract:
In the recently revised diagnostic criteria for Alzheimer disease (AD), the National Institute on Aging and Alzheimer Association suggested that confidence in diagnosing dementia due to AD and mild cognitive impairment (MCI) due to AD could be improved by the use of certain biomarkers, such as (18)F-FDG PET evidence of hypometabolism in AD-affected brain regions. Three groups have developed automated data analysis techniques to characterize the AD-related pattern of hypometabolism in a single measurement. In this study, we sought to directly compare the ability of these three (18)F-FDG PET data analysis techniques--the PMOD Alzheimer discrimination analysis tool, the hypometabolic convergence index, and a set of meta-analytically derived regions of interest reflecting AD hypometabolism pattern (metaROI)--to distinguish moderate or mild AD dementia patients and MCI patients who subsequently converted to AD dementia from cognitively normal older adults. One hundred sixty-six (18)F-FDG PET patients from the AD Neuroimaging Initiative, 308 from the
Network for Efficiency and Standardization of Dementia Diagnosis, and 176 from the European Alzheimer Disease Consortium PET study were categorized, with masking of group classification, as AD, MCI, or healthy control. For each AD-related (18)F-FDG PET index, receiver-operating-characteristic curves were used to characterize and compare subject group classifications. The 3 techniques were roughly comparable in their ability to distinguish each of the clinical groups from cognitively normal older adults with high sensitivity and specificity. Accuracy of classification (in terms of area under the curve) in each clinical group varied more as a function of dataset than by technique. All techniques were differentially sensitive to disease severity, with the classification accuracy for MCI due to AD to moderate AD varying from 0.800 to 0.949 (PMOD Alzheimer tool), from 0.774 to 0.967 (metaROI), and from 0.801 to 0.983 (hypometabolic convergence index). The 3 tested techniques have the potential to help detect AD in research and clinical settings. Additional efforts are needed to clarify their ability to address particular scientific and clinical questions. Their incremental diagnostic value over other imaging and biologic markers makes them easier to implement by other groups for these purposes.

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