Poster Session P2 - Diagnosis and Disease Progression - Neuroimaging
Monday, July 19, 2004

Abstract: P2-167

Citation: NeuroBiology of Aging, Volume 25, Number S2 , July 2004, Page 273

Patterns of Cerebral Hypoperfusion in Alzheimer's Disease and Mild Cognitive Impairment Measured with Arterial Spin Labeled MRI

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Background: PET and SPECT studies of early and preclinical Alzheimer's dementia (AD) suggest that functional changes in specific brain regions may precede dementia onset. Arterial spin labeled perfusion MRI (ASL-MRI) is a fast, repeatable, and noninvasive technique that uses endogenous arterial blood water as a tracer to measure regional perfusion on conventional MR scanners. Given the coupling between metabolism and perfusion in the cortex, ASL-MRI may detect similar functional changes to PET and SPECT while offering several advantages over these modalities. **Objective(s):** To determine if ASL-MRI detects regional cerebral hypoperfusion in AD and mild cognitive impairment (MCI) consistent with results from previous FDG-PET and HMPAO-SPECT studies. A correction for partial volume effects (PVE) was included to determine if group differences in perfusion are independent of underlying cortical grey matter atrophy, a prominent feature of AD on structural MRI. **Methods:** Twenty AD subjects, 18 MCI, and 23 cognitively normal (CN) subjects were studied with pulsed ASL-MRI as well as a 3D T1-weighted sequence. Perfusion images were coregistered to T1-weighted images, corrected for PVE using information from the T1-weighted image to determine the tissue content of perfusion voxels, and normalized to a disease specific template. Voxel-based analyses of group perfusion differences, with and without corrections for PVE, were performed using SPM'99. **Results:** The AD group showed significant (cluster-level corrected $p < 0.05$) regional hypoperfusion in the parietal lobes, posterior cingulate gyri, and prefrontal cortices when compared with controls even after accounting for PVE. The MCI group did not show statistically significant regional hypoperfusion relative to the CN group but there was a trend ($p = 0.095$) towards hypoperfusion in the inferior left parietal lobe, the region of greatest significance in the AD group. **Conclusions:** ASL-MRI measures regional hypoperfusion in AD in similar brain regions to those seen in FDG-PET and HMPAO-SPECT studies on similar populations and this hypoperfusion persists after accounting for underlying cortical gray matter atrophy. ASL-MRI, coregistered with structural MR, is a useful tool for the functional characterization of AD and may be useful for early detection of this disease.