DISCRIMINATION BETWEEN NORMAL CONTROLS AND PRECILINCAL ALZHEIMER'S DISEASE USING QUANTITATIVE BRAIN SPECT WITH OSEM RECONSTRUCTION

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Objectives: We investigated the role of quantitative brain SPECT in discriminating between normal and converter populations in preclinical Alzheimer's disease (AD). **Methods:** 16 normal controls (mean age = 69 years, Clinical Dementia Rating CDR = 0.0), at both baseline and follow-up at least 2 years later, and 11 subjects (74 years) with questionable AD at baseline (CDR = 0.5) who later developed AD on follow-up (converters) were examined. A T1-weighted SPGR MRI (GE, Signa) and a 99mTc-HMPAO SPECT study (20 ± 1 mCi, CERASPECT) were performed in each case. SPECT studies (120 projections, 128x128) were acquired in 13 energy windows [80-156 keV] and corrected for scatter using a generalized linear multi-window correction. SPECT data were reconstructed first using OSEM (6 subsets, 8 it) to allow registration to MRI. MRI scans were registered to the SPECT data and segmented to yield accurate attenuation maps that were used for attenuation compensation in a second reconstruction while modeling attenuation, intrinsic detector resolution and geometric collimator response in the projector/backprojector of the OSEM algorithm. 6 subsets were used and 10, 15, 20 and 25 iterations performed. Brain perfusion was examined in structures identified on segmented MRI data in each patient using brain SPECT. Perfusion differences between the 2 populations in the cingulum and entorhinal cortex (left,right) were assessed by discriminant analysis, which yielded for each subject a likelihood ratio of preclinical AD. From these, areas under the ROC curve for discrimination were obtained using a fitting program (ROCKIT). **Results:** Significant differences in 99mTc uptake were observed between the 2 populations for all iterations. However, the performance in separating the 2 groups of patients was best for n=15 it in the cingulum (A_z =0.825, $p<0.05$) and entorhinal cortex (A_z =0.703, $p<0.05$). **Conclusion:** Our results suggest that optimal performance in this quantitative discrimination task can be achieved with about 15 iterations of the OSEM algorithm.

Area under discriminant ROC curve for 5 OSEM iterations

Az (std error)	10 iterations	15 it	20 it	25 it
cingulum (left,right)	0.780 (0.107)	0.825 (0.094)	0.785 (0.108)	0.747 (0.112)
Entorhinal cortex (left,right)	0.665 (0.113)	0.703 (0.111)	0.700 (0.105)	0.604 (0.121)