SENSORIMOTOR NETWORK REWIRING IN PATIENTS WITH MILD COGNITIVE IMPAIRMENT AND ALZHEIMER'S DISEASE

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Introduction. A "nonlinear" trajectory of memory-related brain activations over the course of prodromal Alzheimer's disease (AD) has been shown, including a phase of medial temporal lobe (MTL) "hyperactivation" in early mild cognitive impairment (MCI), followed by a decreased MTL activation at later stages of the disease. We interrogated brain functional changes in AD and amnestic MCI (aMCI) to assess whether they represent a "specific" disease-related pattern or solely reflect a diffuse neuronal network rewiring. To this end, we investigated the brain motor network, which is known to be relatively spared by AD pathology, assessing the relation between structural damage and functional activations during the performance of a simple motor task in patients with aMCI and AD.

Methods. Dual-echo, 3D T1-weighted, diffusion tensor magnetic resonance imaging (DT MRI), and functional MRI (fMRI) during the performance of a simple motor task with the dominant right-hand, were acquired from 10 AD patients, 15 aMCI patients, and 11 healthy controls. Normalised brain volumes (NBV), volumes of the hippocampi, as well as normal appearing white matter (NAWM) mean diffusivity (MD) and fractional anisotropy (FA), and grey matter (GM) MD were measured. Analyses of fMRI activations and effective connectivity were performed using the Statistical Parametric Mapping software.

Results. fMRI showed that aMCI patients had a decreased recruitment of the left (L) inferior frontal gyrus compared to controls, while they showed an increased recruitment of L postcentral gyrus and head of caudate nucleus, and a decreased recruitment of the cingulate motor area (CMA) compared with AD. Analysis of effective connectivity revealed an abnormal connectivity between L SMC, head of L caudate nucleus and CMA in both patient groups. fMRI metrics were correlated with the extent of hippocampi damage in aMCI, and with the overall GM damage in AD.

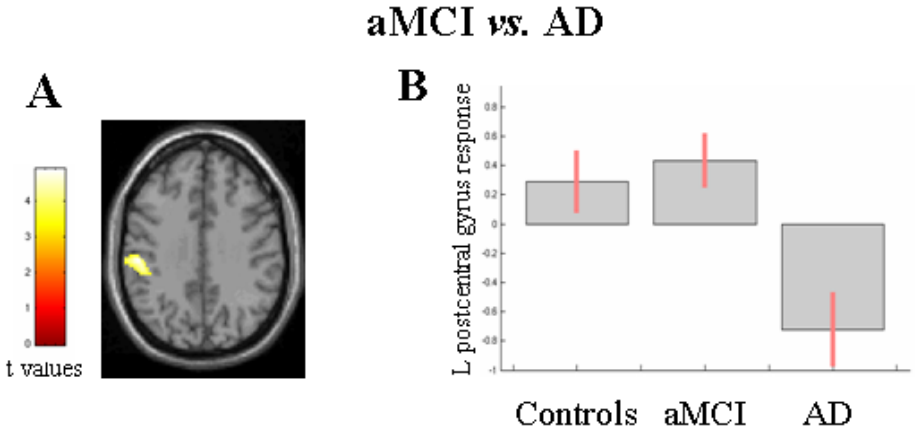

Figura: Comparison between patients with aMCI and AD during the performance of a simple motor task with the right hand (random effect analysis, ANOVA, $p<0.05$, after small volume correction). A) Compared with AD, aMCI patients had an increased recruitment of the L postcentral gyrus. B) Signal plots detected in the three groups of subjects in the L postcentral gyrus.

Conclusions. Our study provides additional support for the hypothesis of a "nonlinear" trajectory of fMRI activations over the course of AD. While in the early phase of the disease the increased recruitment of the cortex seems to be driven by the loss of volume in the hippocampi, in patients with overt dementia it is likely the consequence of a non-specific neuronal network rewiring, generically associated to brain tissue damage.