Homotopic Connectivity as a Biomarker of Alzheimer's Disease

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Cognitive impairment is a common, non-specific early presenting symptom in neurodegenerative diseases, including Alzheimer's disease (AD). A biomarker differentiating AD-related cognitive impairment would be advantageous. In AD, beta-amyloid plaques and tau tangles characteristically aggregate in the brain's temporal lobe, disrupting normal cognitive functioning such as memory. Homotopic connectivity, as measured by resting-state functional Magnetic Resonance Imaging (rs-fMRI), quantifies how the measured blood oxygen level-dependent (BOLD) signal, indicative of spontaneous neural activity, is similar in mirrored left-right brain hemisphere regions. Using data from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database, this project investigated homotopic connectivity in a population with and without pathological beta-amyloid burden to determine if AD was associated with a disruption in the temporal lobe's homotopic connectivity. Demographics, cognitive data, MRI scans, amyloid status, and tau burden were obtained from the ADNI database. rs-fMRI connectivity for 50 homotopic regions was quantified using the CONN toolbox and custom Matlab scripts. All statistical analyses were performed in SPSS. Study results indicated that homotopic connectivity is a robust connectivity measure in a healthy control population (mean $r > 0.7$). Compared to amyloid-negative controls, homotopic connectivity was significantly decreased within temporal lobe regions for the amyloid-positive groups. Homotopic connectivity correlated to cognitive function and inversely to tau burden. Findings from this work support homotopic connectivity as a potential neuroimaging biomarker for Alzheimer's disease and, most notably, a sensitive biomarker even before the manifestations of symptoms.