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Relationship between cortical thinning and cortical FDG hypometabolism in individuals with progressive MCI and AD

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Abstract

The prevailing theory of the development and progression of Alzheimer disease (AD) is that functional changes precede structural changes in the brain. Although patterns of FDG hypo metabolism and cortical atrophy have been shown to generally support this theory, few studies have directly compared them. Therefore, we developed a cortical surface framework for an integrated analysis of cortical thickness FDG-PET data.

We included 4 groups of subjects from the ADNI cohort: cNC–controls with no risk factor, pMCI–progressive MCI to AD, sMCI–MCI stable, and AD. Cortical thickness was measured by Free Surfer, and co-registered FDG-PET values were projected on the Free Surfer surface. We computed z-scores for thickness and FDG-uptake at each surface vertex, and then computed correlation and T-tests between the z-scores. All analyses were performed within each group separately, accounting for age, gender, education, and FDR adjusted.

In pMCI and AD, frontal, temporal and parietal regions showed similarly severe thinning and FDG-hypo metabolism – positive correlations, non-significant T-scores. In pMCI, hypo metabolism was more severe than thinning in many regions – positive T-scores, and thinning was more severe than hypo metabolism in many others – negative T-scores. In AD, this pattern is different: hypo metabolism was more severe than thinning in relatively few regions while thinning was more severe than hypo metabolism in many.

Our findings suggest that the cortical hypo metabolism-atrophy relationships vary by brain region and that while in pMCI cortical thinning can be accompanied by functional compensation, in AD this compensation may have resulted in more extensive areas of neuronal loss compared to hypo metabolism.

Biography

Lei Wang received his Ph.D. in Engineering Sciences from Harvard University. He did his post-doctoral work on Computational Anatomy with Dr. Michael Miller at Washington University in St. Louis. Dr. Wang's research focuses on developing neuroimaging biomarkers for neuropsychiatric diseases including schizophrenia and Alzheimer disease. He applies tools of mathematics, engineering and computer science to the analysis of structural MRI, functional MRI and histological neuroimaging datasets. He has published more than 80 peer reviewed journal papers, and serves as journal, grant and program project editorial and review board member.

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