What is the relationship between BOLD fMRI and functional MRS in aging and MCI?

https://www.neurodegenerationresearch.eu/survey/what-is-the-relationship-between-bold-fmri-and-functional-mrs-in-aging-and-mci/

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Research Abstract

Project Summary Our memory changes as we age. Age-related memory decline in and of itself

represents a significant public health impact, but cognitive decline – and in particular memory decline – has been shown to be an important risk factor for Alzheimer's Disease (AD). Examining neurocognitive aging will help us better characterize pathological and non-pathological changes in the brain throughout the lifespan and identify preclinical markers for cognitive decline. The goal of this proposal is to develop and compare a novel method of brain imaging, functional magnetic resonance imaging spectroscopy (fMRS) with the more traditional BOLD functional magnetic resonance imaging (MRI) techniques in healthy aging and mild cognitive impairment (MCI). BOLD fMRI has been used extensively to study differences in neural activity associated with aging and MCI, but it has limitations that may be critical to our interpretation of these data. In particular, the neuro-vasculature coupling ratio (M) is altered in aging, such that age-related changes in BOLD measures may not be due to age-related changes in underlying neural activity, but in vasculature instead. Here, we propose an altogether different approach in fMRS that has the added advantage of providing a measure that may be might be more directly linked to neural activity than the link we have with blood flow. We will develop a novel fMRS technique that will collect metabolite data while participants engage in various cognitive tasks. The fMRS signal will more directly measure cellular activity, energetics, and markers of cellular structure and loss in the aging brain. In particular, excitation and inhibition will be dynamically measured during a memory task by quantifying glutamate, glutamine and GABA while simultaneously measuring BOLD fMRI at the same location. Together, these measurements will allow us to examine the relationship between BOLD fMRI and metabolics and how these are altered with aging and early dementia. It will also give us the opportunity to test whether any of several tasks can serve as an age-invariant baseline in BOLD fMRI tasks as well as to help us more directly link human data and memory decline to the neurobiological models from the rodent. They will also give us the opportunity to explore biomarker / behavioral relationships and to further our understanding of changes in cellular structure related to aging.

Further information available at:

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