Functional Connectivity and Psychometrics as Early Biomarkers for Alzheimer's Disease

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Introduction

Early biomarkers of Alzheimer's Disease (AD) are needed for possible therapeutic intervention (1). Both a high coefficient of variation in the Stroop task and a low correlation value within seed regions of the default mode network (DMN) have been associated with AD (2, 3). Moreover, recent evidence indicates that high variability in Stroop performance in healthy older adults can later predict the onset of AD (4). In the present study we investigated the relationship between psychometrics (the Stroop task) and blood oxygen level dependent resting state functional connectivity magnetic resonance imaging (BOLD-fcMRI).

Methods

Both neuropsychometric and neuroimaging data were acquired in 102 participants who were cognitively normal as assessed by the the clinical dementia rating (CDR) (CDR=0). Participants were divided according to their coefficient of variance (COV) on the Stroop task performance using previously defined criteria (top 15%, middle 70%, and bottom 15%). We examined BOLD-fcMRI at 3T (Siemens) using conventional seed-based analyses of the DMN (5, 6). An analysis of variance (ANOVA) was utilized to assess possible differences in neuropsychometric and neuroimaging measures.

Results

Subjects within the various groups did not differ in regards to age (p=0.43), sex (p=0.71), or education (p=0.64). We observed significant differences between subjects with high and low COV subjects within the DMN using BOLD fc-MRI. Observed differences were greatest within connections between the posterior cingulated cortex/precuneus (PCC) and the anterior cingulate gyrus ($r_{low\ COV}$ = .53; $r_{highCOV}$ = .32; p < .05) (Figure 1).

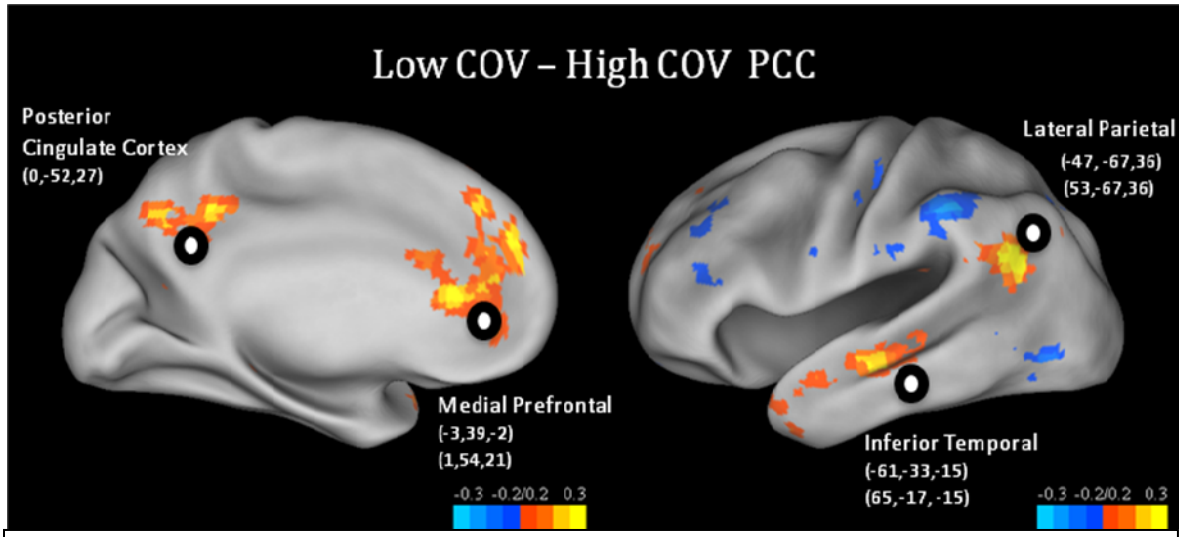

Figure 1. Difference image between cognitively normalparticipants (CDR=0) with low (n=15) and high coefficient of variation (COV) on the Stroop test. Using the posterior cingulated cortex as a seed region significant differences were seen within default mode regions (including the medial prefrontal cortex) between the two groups.

Conclusions

Hubs of the DMN are believed to be involved in mind wandering and the construction of mental simulations used during the processes of remembering and imagining. Our results suggest a possible correlation between psychometric changes and alterations in the DMN as a possible early biomarker for individuals at risk for developing AD. Ongoing longitudinal studies are underway to further examine the predictive power of this relationship between neuropsychological variability (Stroop COV) and the DMN using BOLD-fcMRI.

References

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