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(G) Exploring the relationship between glucose metabolism and intrinsic functional connectivity in behavioral variant frontotemporal dementia using hybrid PET/MRI

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Functional connectivity (FC) has a high energetic demand as demonstrated by hybrid [18F]-Flurodeoxyglucose (FDG) PET and resting state functional MRI (rsfMRI) studies (Tomasi et al., 2013). Regional Homogeneity (ReHo), a rsfMRI local connectivity metric, displays the strongest correlation with metabolism in healthy brain (Aiello et al.,2015), which is reduced in Alzheimer's (AD), potentially indicating a bioenergetic effect (Marchitelli et al., 2018). However, vascular dysfunction associated with AD can also have an effect on the phenomenon of reduced coupling. To explore the involvement of a bioenergetic mechanism, we examined changes in this coupling in another form of dementia called behavioral variant frontotemporal dementia (bvFTD) without notable vascular impairment.

A total of 16 bvFTD patients and 16 healthy controls underwent FDG-PET and rsfMRI scans. Preprocessing of rsfMRI data was completed using SPM12 and connectivity maps (ReHo) were generated with REST toolbox. FDG images were processed using in-house MATLAB scripts, and later compared between groups to examine metabolic changes. To study the relationship between connectivity and metabolism, a voxel-wise correlation analysis was performed between FDG and ReHo maps over whole-brain gray matter, followed by the comparison of mean correlation between groups (2 sample t-test; $p<0.05$, corrected for multiple comparisons). The entire process was repeated in key regions associated with bvFTD pathology.

Hypometabolism was found in prominent frontotemporal regions in bvFTD, consistent with literature. Significant positive correlations were observed between FDG and ReHo in all subjects, which however was diminished in bvFTD on a whole brain level as well as in disease specific regions such as anterior insula, orbitofrontal cortex and dorsolateral prefrontal cortex.

Reduced functional/metabolic coupling support the role of insufficient energy production causing disrupted neuronal communication. Considering bvFTD does not have notable vascular dysfunction unlike AD, the results support the bioenergetic role behind disrupted connectivity in dementia.

Keyword-1

PET

Keyword-2

MRI

Keyword-3

Dementia

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