Abstract #3 | Poster

Anti-correlations between ^{18}F-FDG PET and resting state dynamic functional connectivity: insights into brain network variability

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Introduction

There is increasing interest in understanding the relationship between the brain's metabolic consumption, imaged by ^{18}F-FDG PET, and its functional connectivity (FC) architecture emerging from resting state fMRI studies, which is assumed to partly rely on local glucose metabolism. Correlations between ^{18}F-FDG PET measures and FC in simultaneous recordings have been reported in few studies [1, 2], but without investigating FC temporal variability.

Methods

Simultaneous ^{18}F-FDG PET and resting state fMRI data were acquired in 28 healthy subjects (59.8 ± 10.8 yrs, 14 F) on a Siemens mMR Biograph 3T [1, 2].
Standard uptake value relative (SUVR) to brain's global average was computed from ^{18}F-FDG data; rs-fMRI was acquired for 10 [1] and 7 [2] minutes (TE/TR = 30/2000 ms). Both PET and fMRI scans were registered to T1w images and sampled over the Gordon-Laumann functional atlas [3].
Dynamic FC (Pearson correlation) was computed with a sliding window approach (window size: 30 TRs, step: 1 TR). FC graph metrics were computed for each sliding window: degree (DEG), strength (STR), participation coefficient (PAR), clustering coefficient (CC), betweenness centrality (BC). Coefficients of variation CV% (graph metrics' standard deviation across sliding windows divided by their mean) were computed for each node and averaged across subjects; Pearson correlation with SUVR was computed considering:

1. all ROIs;
2. only network hubs, identified on the average static FC matrix as 15% highest DEG nodes.

Results

We identified statistically significant anti-correlations between nodes' SUVR and CVs% of DEG, STR, CC, BC (ranging from r = -0.30 to -0.50, $p<0.01$), but not with CV% of PAR (Figure 1).
Anti-correlations were stronger when considering only between-network links (r = -0.44 vs. -0.33).
Network hubs, defined according to DEG, had CVs% that were less significantly anti-correlated with SUVR (around r = -0.10).

Conclusion

An unexpected pattern of anti-correlations between ^{18}F-FDG SUVR and FC variability was identified, which was consistent across most graph metrics, implying that the least variable connections are the ones that require more energy.
These results need further investigation, e.g. employing absolute quantification of PET data and alternative dynamic FC methods, as well as validation from a biological and/or computational standpoint.

Affix

References

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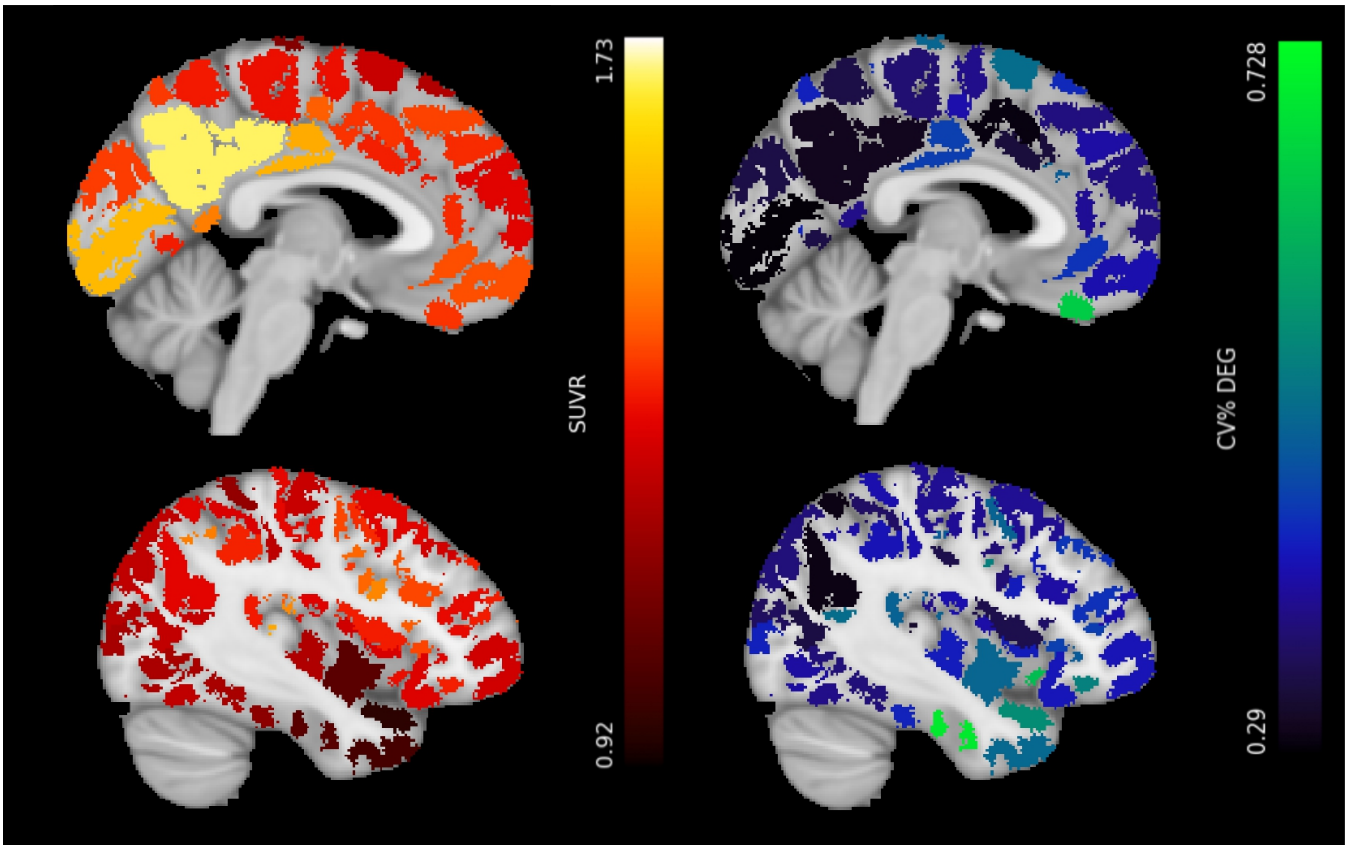

Figure 1 - Pattern of anti-correlated SUVR and CV% of degree
Spatial distribution of SUVR (*left*) and coefficient of variation (CV%) of the degree graph metric (*right*), mapped on the Gordon parcels at the group level. The highest SUVR values (*yellow*) correspond to the lowest CV% values (*dark blue*), according to a statistically significant anti-correlation ($r = -0.43$, $p < 0.01$) found between the two measures. Similar patterns held for the other graph metrics.