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MEG networks organization is related to white matter integrity

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Purpose/Introduction

Many studies have assessed the characterization of anatomical or functional connectivity in mild cognitive impairment (MCI), however it is still unknown how they are related in the course of the pathology. Here we integrate the analysis of magnetoencephalographic (MEG) data with white matter (WM) integrity quantification from diffusion weighted imaging (DWI), to asses whether the damage in the WM tracts disrupt the organization of the functional networks.

Subjects and Methods

The sample comprised 88 subjects divided into 52 healthy-elderly and 36 amnestic MCI (aMCI). MCI were diagnosed with Petersen criteria [**1**].

DWIs were acquired on a GE 1.5T MRI scanner. 25 diffusion directions with b=1000mm/s^2. Fractional anisotropy (FA) images were obtained from DTI. Subsequent analyses were performed in SPM8. FA images were realigned to an FA template from MNI space, then smoothed and averaged for obtaining a group template. Each subject FA was co-registered to its group template and smoothed. FA in both groups was compared through a voxel based analysis (VBA).

MEG recordings consisted of 3 minutes closed eyes resting state in an *Elekta Neuromag* system. Non-artifacted trials (4s) were filtered in 5 frequency bands. Phase Locking Value [2] was computed between sensors and averaged across trials. Two graph metrics (normalized clustering ^C and normalized characteristic path length ^L [**3**]) were obtained for the PLV networks. These parameters indicate how far is the network organization from a random state. We studied dependency between these metrics and FA in the aMCI group through a General Linear Model (GLM).

Results

VBA. HE subjects showed higher FA in comparison with the aMCI subjects in several brain regions including the medial temporal lobe, cingulum and prefrontal regions (FDR q=0.05).

GLM. For the aMCI we obtained significant correlations between ^C and FA in the cingulum of the hippocampus, anterior thalamic radiation and inferior longitudinal fasciculus in both hemispheres in delta, theta and alpha bands (FDR q=0.01) (Fig. 1).

Discussion/Conclusion

Due to the correlation found between MEG and FA in the aMCI group, we might conclude that the lower the FA in certain brain regions the higher the random the network. These results indicate that these white matter regions may be responsible of a crucial performance of the whole functional networks. We conclude that the relationship between WM impairment and dys-organizaion in functional networks must be considered in the characterization of the pathology.

References

[1]Petersen et al. Arch Neurol (1999)

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