

Neuroimaging / Optimal neuroimaging measures for tracking disease progression

Self-reported quality of sleep is related to frontoparietal network connectivity in mild cognitive impairment

Lorenzo Pini¹ | Alexandra MV Wennberg¹ | Micaela Mitolo² |
Francesca Meneghello² | Francesca Burgio² | Carlo Semenza¹ | Annalena Venneri³ |
Dante Mantini² | Antonino Vallesi¹

¹ University of Padova, Padova, Italy

² IRCCS Fondazione Ospedale San Camillo,
Venice, Italy

³ University of Sheffield, Sheffield, United
Kingdom

Correspondence

Alexandra MV Wennberg, University of
Padova, Padova, Italy.

Email: amvwhenberg.unipd@gmail.com

Abstract

Background: Sleep has been identified as a modifiable factor involved in both the development and progression of Alzheimer's disease (AD). Previous findings have suggested that poor sleep may be associated with increased risk of AD. Conversely, higher quality of sleep may slow progression of pathophysiological mechanisms in mild cognitive impairment (MCI) through functional connectivity reorganization of neural networks underlying higher cognitive functions.

Method: In clinic, 38 MCI patients and 38 age-matched controls completed structural magnetic resonance imaging (MRI), resting-state functional MRI (rs-fMRI), and a cognitive test battery, covering memory, executive functions, and language. The Sleep Continuity in Alzheimer's Disease Scale (SCADS) was used to assess sleep quality. Patients were stratified into "good" (n=20) and "poor" (n=18) sleepers, using the median SCADS score as a cut-point. Default mode (DMN) and left and right frontoparietal (FPN) networks were reconstructed through an independent component analysis approach. Differences in network connectivity across MCI groups were investigated with non-parametric inference using FSL randomize (n=5000 permutations), corrected at a threshold-free-cluster enhancement level of $pFWE < 0.025$. Grey matter and sex were inserted as covariates in the analysis. The same model was implemented to investigate associations between connectivity and cognition in MCI. Finally, between-network connectivity was assessed through partial correlation with sex as covariate.

Result: MCI good sleepers showed increased FPN connectivity compared to MCI poor sleepers. Increased FPN connectivity was positively associated with language performance in the former group. Finally, we found a positive coupling connectivity between DMN and FPN and between left and right FPN in MCI good sleepers, while this pattern was disrupted in MCI patients with lower quality of sleep.

Conclusion: These findings suggest a relationship between sleep quality and FPN connectivity in MCI, highlighting possible sleep-induced compensatory mechanisms. Future studies in larger samples using longitudinal methods and objective measures of sleep will be necessary to confirm this finding. However, these results further support the concept that better sleep may be protective on the pathway to AD.