

EEG-based sleep state functional connectivity in Parkinson's disease

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Introduction: Parkinson's disease (PD) is a neurodegenerative disorder characterized by a multisystem involvement, with heterogeneous complex of motor and non-motor symptoms. Among them, sleep disorders represent a common clinical feature in PD. Previous functional connectivity (FC) studies have shown an impairment in functional connectivity (FC) in PD patients in conscious state [1], while FC in sleep state has been scarcely examined. Thus, FC, based on electroencephalography (EEG) registration during polysomnography (PSG), may lead to a deeper understanding of the pathophysiology of this disorder.

Objective: To analyze the differences in FC during the different phases of sleep between PD patients and healthy controls by means of PSG.

Methods: 14 PD patients and 13 healthy controls (HC) were included in this study. The analyses used custom-written scripts on the Matlab platform, combined with high-level functions of Brainstorm toolbox [2]. Study subjects underwent PSG examination, with 8 EEG traces. Then, FC matrices of each subject were calculated in four frequencies (δ - θ - α - β), using weighted phase-lag index (wPLI) [3]. Finally, we compared FC matrices between healthy controls and de novo PD patients through two-samples T-test.

Results: We identified a significant bilateral reduction in FC between fronto-occipital and centro-temporal connections in δ band in slow-wave NREM sleep phase in PD patients compared to HC. On the contrary, a significant increasing in FC between bilateral fronto-temporal and fronto-central links was found in REM sleep in θ frequencies in PD patients compared to HC.

Conclusion: Our study showed that PD is associated with abnormal FC during different phases of sleep. In particular, the reduction in FC in δ band in NREM sleep may be linked to a widespread impairment of different cortical networks. Conversely, the increasing of connectivity in θ frequency band in REM sleep may be associated with REM sleep behavior disorder (RBD).

References:

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