Intrinsic Activity and Cognition in Parkinson Disease Assessed by Simultaneous fMRI/EEG

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Country

USA

Title of project or programme

Intrinsic Activity and Cognition in Parkinson Disease Assessed by Simultaneous fMRI/EEG

Source of funding information

NIH (NINDS)

Total sum awarded (Euro)

€ 1,536,377.98

Start date of award

01/09/2016

Total duration of award in years

5

The project/programme is most relevant to:

Parkinson's disease & PD-related disorders

Keywords
Research Abstract

Cognitive impairment is the most disabling non-motor feature of Parkinson Disease (PD) and causes the greatest degree of caregiver distress. The large majority of patients with PD will eventually suffer cognitive impairment, and although treatment of motor parkinsonism has improved, cognitive impairment has proven more difficult to treat. When cognitive impairment appears, it tends to have a profile of more affected and less affected domains that suggests

differential regional cortical involvement. Measurement of cognitive performance through neuropsychological tests tells us what functions are impaired but not why. A better understanding of the causes of impairment would help identify therapeutic targets for cognitive symptoms. This would lay the groundwork for developing biomarkers of brain (patho)physiology that would advance the goal of precision medicine for treatment of PD. This project exploits the discovery that regional spontaneous cortical activity measured by fMRI at rest has a spatial structure that includes the same cognitive networks identified during tasks. These “intrinsic networks” are altered in PD and many other diseases, providing an important physiological connection between brain structure and cognitive function. We have developed fMRI-based methods for sensitively quantifying differences in intrinsic networks and shown that networks differ in people with PD and controls. Although fMRI has good spatial resolution, because of hemodynamic delay it lacks temporal resolution. Therefore, differences in networks observed in PD may reflect differences in timing, or dynamics, that we cannot measure at the temporal resolution of fMRI. We want to integrate our innovative framework with a complementary modality, electroencephalography (EEG), which helps us to distinguish differences in spatial extent and timing of networks. Recently, we have shown a systematic relationship between intrinsic network activity and the time course of an attention network task that is different in PD and controls. This link between intrinsic networks and task-related activity allows us to ask how intrinsic network activity relates to cognition in PD. We hypothesize that alterations to networks that support attention and memory are specifically related to cognitive performance in these domains in PD, and that temporal information from EEG will help to resolve this. We will test this hypothesis by simultaneously acquiring fMRI data (for high spatial localization of network structure) and electroencephalography (EEG) data (for high temporal resolution) in subjects with PD and controls, as we pursue the following specific aims: (1) Analyze and compare intrinsic activity from PD and controls obtained at rest. (2) Analyze and compare intrinsic activity from PD and controls during a covert visuospatial attention task with and without a memory load. (3) Analyze trajectories of longitudinal change.

Lay Summary
Cognitive impairment in PD is an increasingly important limitation on quality of life with that is difficult to treat. We propose to measure the relationship of intrinsic activity in the brain to cognitive performance, with the goal of developing a better understanding of the specific causes of impairment. This would lay the groundwork for developing biomarkers of brain (patho)physiology that would advance the goal of precision medicine for treatment of PD.

Further information available at:

Types:
Investments > €500k

Member States:
United States of America

Diseases:
Parkinson's disease & PD-related disorders

Years:
2016

Database Categories:
N/A

Database Tags:
N/A