Using Resting-State Functional Connectivity Within the Basal Ganglia as a Biomarker for Symptoms of Parkinson’s Disease

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Disclosure

• Nothing to Disclose
Purpose

- To investigate the use of functional connectivity as a biomarker for PD
Parkinson’s Disease

- Affects Nigrostriatal Dopaminergic Neurons
- Motor Impairments
  - Tremors
  - Muscular Rigidity
  - Lessened Balance and Coordination
  - Bradykinesia
- Cognitive Impairments
  - Hallucinations
  - Impaired Speech
  - Delayed Memory/Memory Loss

Source: http://kin450-neurophysiology.wikispaces.com/Rhett+Syndrome
Unified Parkinson’s Disease Rating Scale - III

**UPDRS-III Score**
- a. Posture
- b. Postural/Kinetic Tremor
- c. Resting Tremor
- d. Movement
- e. Rigidity

- Unified Parkinson’s Disease Rating Scale Section III
  - For assessment of Motor Symptoms
  - Rigidity
    - Scores: 0 to 12
Functional Connectivity

- BOLD Signals from MRI
- Connection between Brain Regions
- Signals sensitive to oxygen
- Synchronization of BOLD Signals = High Functional Connectivity
Brain Images from Parkinson’s Progression Markers Initiative Database

- RS-fMRI data from 70 PD patients obtained
  - Aged 38-79; 21 females
  - Data from 8 sites
- 4 ROIs identified from AAL
  - Left and Right Caudate
  - Left and Right Putamen
- Analysis conducted in MATLAB

Source: http://jn.physiology.org/content/103/1/297
Connectivity Correlation with Behavioral Scores

- Functional Connectivity correlated with PD Symptoms
- Connectivity between Left and Right Caudate correlated to the UPDRS-III Rigidity score
- Significant, P< 0.05.

**Variables of No Interest**
- Scan Date
- Scan Site
- Age
- Sex
- PD Medication
- Cognitive Assessment Scores
Functional Connectivity Maps for Left Caudate

Less Severe Rigidity
More warm color = More Functional Connectivity
Severe Rigidity
Caudate Nuclei to UPDRS-III Rigidity

Severity of Rigidity in Parkinson's (UPDRS-III rigidity sub scores) vs. Amount of Connectivity between Left and Right Caudate

R = 0.3630
P = 6.76e-6
Conclusion

- As functional connectivity levels in the Caudate decrease, Parkinson’s Disease patients suffer worse symptoms of Rigidity.
- Suggests use of functional connectivity as a biomarker for Parkinsonian Symptoms.
Future Studies

• Further subdividing basal ganglia regions
• Investigate cognitive effects
  • Correlating with subcomponents of MoCA
  • Assess the destruction of Nigrostriatal Dopaminergic Neurons on Cognitive Function
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