DBS for Tremor: Network Effects

CAN CONNECTIVITY LINK THE EFFECTS OF STN AND VIM DBS ACROSS TREMOR-RELATED DISEASES?
A MULTI-COHORT FUNCTIONAL CONNECTIVITY STUDY

INTRODUCTION

- Tremor represents one of the most common symptoms in movement disorders and occurs in multiple diseases, such as essential tremor (ET) and Parkinson’s disease (PD).
- Multiple regions serve as targets for Deep Brain Stimulation (DBS), for example the ventral intermediate nucleus (VIM) in ET-patients or the subthalamic nucleus (STN) in PD patients.
- This study investigates functional connectivity profiles of different stimulation targets in patients with tremor, regardless of the underlying disorder.

RESULTS

- In total data from 31 PD patients with STN DBS and 36 ET patients with VIM DBS were included (see Introduction for electrode localizations).
- Our analysis pipeline revealed one R-map for each cohort, representing voxels of high connectivity values to the stimulation area and optimal clinical outcomes.
- STN R-map showed significant association with clinical improvement values in VIM cohort and vice versa.

METHODS

- Retrospective imaging and clinical data (UPDRS-III for PD and FTM for ET) from DBS centers Berlin, Würzburg and Amsterdam were analyzed using the following approach:

  - Retrospective imaging and clinical data (UPDRS-III for PD and FTM for ET) from DBS centers Berlin, Würzburg and Amsterdam were analyzed using the following approach:

  - Electrode localization & VTA estimation
  - Correlation of BOLD signals from VTA & HCP connectome
  - Estimation of each VTA’s connectivity profile: “Fingerprint Map”
  - Correlation with clinical improvement scores
  - Prove similarity
    - Combined “Agreement Map”
    - Cross-validation

CONCLUSIONS

- While recent connectivity network analyses for the total UPDRS-III in PD patients revealed differences from networks in ET patients, our results suggest that a symptom-specific, common network for tremor exists across both ET and PD patients.
- Consistent with previous studies, both M1 and cerebellar regions appear to play an important role in a functional network for tremor improvement.