ALTERED COUPLING IN TRIPLE NETWORKS UNDER PARKINSON'S DISEASE

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Target audience:
The researchers in cognitive neuroscience or clinical research, especially the network connectivity and Parkinson’s disease (PD) will be most interested in this study.

Purpose:
The purpose of this study is to explore and compare the network coupling in the triple networks, including the salience network (SN), executive control network (ECN) and default mode network (DMN), for the PD group and normal control (NC) group. We attempted to find the abnormality coupling between networks (SN, ECN and DMN) in PD group, which may further contribute to the understanding of the mechanism of PD.

Methods:
Eighteen (mean (SD) = 60.7 (18.7) years) PD patients and twenty-two (mean (SD) = 55.4 (16.4) years) normal controls (NC group) participated in this study. Brain scans were performed in a 3.0-T Siemens whole-body MRI scanner (echo planar imaging sequence, TR/TE/flip angle=2s/40ms/90°, slice number=28, matrix size=64x64, voxel size=4x4x5mm³). During each scan, 210 images were collected and the subjects were instructed to rest and keep their eyes closed. These functional images were realigned, normalized, re-sliced to 3x3x3mm³ voxels and smoothed by a Gaussian kernel with full-width at half maximum of 10 mm (Statistical Parametric Mapping software). Group independent component analysis (group ICA) was applied on all the subjects’ data to identify the triple networks (SN, ECN and DMN), and then a mask was obtained for each network according to its group map (p < 0.01, FDR corrected). The averaged time series were extracted based on each mask for all the subjects. Then, Pearson correlation analysis was used between the time series of SN and DMN, SN and ECN to explore the network coupling for PD and NC respectively. After that, each correlation coefficient was covert into z-score using Fisher’s r-to-z transform, and independent-samples t-test was applied on the z-score to test the difference between the PD and NC group.

Results:
Fig.1 illustrates the triple networks (SN, DMN, left ECN (LECN) and right ECN (RECN)) identified by the group ICA. Fig.2 reveals that for the PD group, the network coupling between SN and LECN, between SN and RECN, between SN and DMN are all significantly decreased compared with the NC group (p = 0.04 for (SN, LECN); p = 0.03 for (SN, RECN); p = 0.03 for (SN, DMN); independent-samples t-test).

Discussion:
SN was suggested to be able to monitor and orient external stimuli and internal events, thus may dynamic mediating the ECN and DMN activity. The decreased coupling between SN and L/RECN suggest that for PD patients, SN may bias ECN and less focus on the processing of external stimuli. Furthermore, the decreased coupling between SN and DMN indicate that for PD patients, SN may also less mediate the processing of internal events.

References: