IMPACT OF DIFFERENT MENTAL STATES ON LOW-FREQUENCY FUNCTIONAL FLUCTUATION

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[Objectives] Recently, there is an increasing interest in slow spontaneous fluctuation of brain activity during resting state. A great number of studies using the amplitude of low-frequency fluctuation (ALFF)[1] have reported alterations of resting state function activity thought to reflect traits or psychopathological conditions. However, the properties and characteristics of the ALFF are not completely clear. While the ALFF has been found relatively stable over time[2], studies also indicated that learning tasks prior to collecting resting fMRI data might modulate resting state activity[3]. The objectives of the present study are to address whether different mental states such as (stressful versus relaxed states) can modulate subsequent ALFF during resting state.

[Methods] Seventeen younger healthy adults completed three-visit resting-state scans, apart from 5-10 days between two visits. The resting state fMRI data were acquired from Philips Achieva 3.0T scanner using sense EPI sequence (TR= 2500 ms; TE = 30 ms; flip angle = 90°, 39 slices, matrix = 128 × 128; FOV = 192 mm; voxel size = 1.75 × 1.75 × 3.84 mm). During each visit, participants completed either of the three tasks, a mathematic mental load task (MATH), a speech task (SPEECH), both of which were classic tasks inducing mental stress, and a mindful breathing task (MINDFUL), which we proved induced relaxed mental state previously[4]. There was a resting-task-resting scan order for each visit. We used the DPARSF_V2.3_130615 and followed the instructions for data preprocessing and ALFF data analysis (http://www.restfmri.net/forum/DPARSF). To investigate each task effect on subsequent ALFF at the group level, paired-t tests were used to compute post vs. pre each task in ALFF separately and among tasks. To ensure the results were not induced by test-retest variability, we also measured the Intraclass Correlation Coefficient (ICC) of the first resting scan among the three visits. All significant results were thresholded at $p<0.05$ with FDR correction.

[Results] Post the stressful MATH task, we found enhanced ALFF in the amygdala, insula, subgenual cingulate, and lateral orbitofrontal cortex. Post the stressful SPEECH task, we found enhanced ALFF in the amygdala, hippocampal head, superior marginal gyrus area, dosal regions of the pons, as well as decreased ALFF in the mid and posterior cingulate, fusiform gyrus, visual cortex, and inferior temporal cortex. Post the MINDFUL task, there were decreased ALFF in the insula and amygdala ALFF. In comparison of the three tasks, there were significantly increased ALFF in the superior marginal gyrus area post SPEECH vs. post MATH, and significantly decreased activation in the insula post MINDFUL than post MATH and SPEECH. The test-retest reliability tests revealed that the ICC was over 0.7 for all above reported regions.

[Conclusion] We found temporal modulation effect of tasks/mood on subsequent ALFF in resting state which warrant careful interpretation of ALFF findings in the future.

References

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