Altered brain connectivity for recognition memory of socially relevant information in patients with schizophrenia: a group independent component analysis (ICA)

J. Oh¹, J.W. Chun², E. Kim², H.J. Park³, B. Lee¹*, J.J. Kim²,4*

¹Department of Biomedical Science and Engineering, Gwangju Institute of Science and Technology, Gwangju, Korea, ²Institute of Behavioral Science in Medicine, Yonsei University College of Medicine, Seoul, Korea, ³Department of Nuclear Medicine, Yonsei University College of Medicine, Seoul, Korea, ⁴Department of Psychiatry, Yonsei University College of Medicine, Seoul, Korea

Background: Patients with schizophrenia show deficits in recognition memory, and these problems can cause significant troubles during social interaction. It is because the gaining and maintaining of social information can help a person in exhibiting adaptive behaviors and regulatory functions in a society. However, the aberrant brain networks related to these deficits are still not fully understood. The purpose of this study was to elucidate the altered brain networks in patients with schizophrenia while they were recognizing socially relevant information using an old-new recognition task.

Methods: Sixteen patients with schizophrenia and sixteen healthy controls participated in this study. First, subjects performed an encoding task in the fMRI scanner. Forty pictures depicting social situations were presented with 3 words (theme word: main theme word, related word: related to the theme but more concrete than the theme word, unrelated word: present in the stimulus picture but without a direct relationship to the main theme) for each picture during this task, and subjects were asked to select the theme word for each picture among the 3 words. Ten minutes after the encoding task, subjects performed an old-new recognition task. In this session, they were asked to discriminate whether the presented words (120 old words from the encoding task and 40 new words) were old or new. Discriminability in the old-new recognition task was measured using two-high threshold theory. ICA was carried out by FSL (FMRIB Software Library) MELODIC (Multivariate Exploratory Linear Optimized Decomposition into Independent Components) version 3.14. To investigate the differences of connectivity between groups, FSL dual regression technique, which permits voxel-wise comparisons, was used. A threshold-free cluster enhanced technique was used to control for multiple comparisons.

Results: Patients showed significantly lower discriminability ($p < 0.001$) than healthy controls in the old-new recognition task. In the connectivity analysis using ICA, 36 independent components were initially calculated, and 19 components were finally identified as anatomically and functionally meaningful networks. Among the networks, after voxel level correction, patients exhibited significantly decreased functional connectivity in the frontopolar and language comprehension networks.

Conclusions: Functional connectivity analysis showed aberrant connectivity of patients in the frontopolar and language comprehension networks, possibly leading to low recognition performance and social dysfunction. Therefore, restoring the connectivity of these networks will help the social rehabilitation of patients with schizophrenia.