Differential brain activation associated with the effects of emotional and non-emotional distracters during a delayed-response working memory task in patients with schizophrenia

G-W. Kim1, M-S. Lee2, H-K. Kang3, T-J. Park4, Y-C. Chung5, J-C. Yang5, G-H. Chung5, and G-W. Jeong1,3

1Interdisciplinary Program of Biomedical Engineering, Chonnam National University Medical School, Gwangju, Chonnam, Korea, Republic of; 2Psychiatry, Chonnam National University Hospital, Korea, Republic of; 3Radiology, Chonnam National University Hospital, Korea, Republic of; 4Psychology, Chonnam National University, Korea, Republic of; 5Psychiatry, Chonbuk National University Hospital, Korea, Republic of; 6Radiology, Chonbuk National University Hospital, Korea, Republic of

Synopsis: Impairment of working memory (WM) is an important factor of the cognitive deficits in patients with schizophrenia. Dysfunction of the dorsolateral prefrontal cortex (DLPFC) closely related to delayed-response WM is potentially involved with cognitive impairment of the WM observed in schizophrenia patients. The purpose of this study was to assess the differential frontal activation patterns reflecting the effects of emotional and non-emotional distracters during maintenance processes of WM for the human faces in patients with schizophrenia and healthy controls by using a 3 Tesla function magnetic resonance imaging (fMRI).

Subjects and Methods: A total of 12 patients (mean age = 35.5±7.2 years) with schizophrenia and 8 healthy controls (mean age = 35.5±6.5 years) with no history of neurological or psychiatric illness were participated in this study. Patients with schizophrenia were assessed by a psychiatrist using the Structured Clinical Interview for DSM-IV Axis II Personality Disorders.

The paradigm consisted of a string of "encoding - WM maintenance - retrieval - fixation baseline". In the encoding task, three different human faces sequentially appear once. The subjects performed a WM maintenance for faces with either non-emotional distracters (faces or scrambled faces) or emotional distracters (unpleasant or neutral scenes) (Fig. 1). The subjects were instructed to look at the distracters while maintaining the WM. In the retrieval task, either of the previously used human face or a new human face appears. The brain activation maps and their resulting qualification were analyzed by statistical parametric mapping (SPM2) program.

Results and Discussion: The scores for the face recognition task of the face and unpleasant scene distracters in healthy controls were 65.4% and 65.6%, respectively, while the scores in patients with schizophrenia were 52.6% and 53.3%, respectively.

Emotion and non-emotional distracters influenced the differential activation patterns between patients with schizophrenia and healthy controls (p<0.01) in the frontal cortical areas during the delay interval of a WM task. In both patients with schizophrenia and healthy controls, non-emotion distracters showed increased signal intensities in the DLPFC, whereas emotion distracters showed decreased signal intensities in the DLPFC (Fig. 2,3). Compared to healthy controls, patients with schizophrenia showed significantly decreased activation in the DLPFC during a delayed-response WM with emotional and non-emotional distracters (Fig. 4). It is noted that patients with schizophrenia showed dysfunction of the DLPFC during a delay-response WM with distracters over healthy controls, providing poorer task performance.

Conclusion: This finding demonstrates the differential brain networks between patients with schizophrenia and healthy controls in the WM task with emotional and non-emotional distracters. This finding will be helpful to assess the neural mechanism related to general impairment of emotional and cognitive function observed in schizophrenia patients.

References

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