Functional Connectivity of Alexithymia in Heroin Addicts

C. Xie[1,2], C. Xie[3], G. Bi[1], G. Liu[1], L. Fu[1], Y. Shao[1], J. Xie[2], W. Li[2], Z. Wu[2], L. Ma[4], Z. Yang[1], and S-J. Li[2]

[1]Beijing Institute of Basic Medical Science, Beijing, China, People's Republic of, [2]Biophysics, Medical College of Wisconsin, Milwaukee, Wisconsin, United States, [3]Neurology, Medical College of Southeast University, Nanjing, Jiangsu, China, People's Republic of, [4]Radiology, Department of Radiology, PLA Hospital, Beijing, China, People's Republic of

***Introduction*:** Alexithymic individuals have difficulty in recognizing and describing emotions. Although recent neuropsychological and neuroimaging data have addressed the fundamental role of the amygdala in mediating emotion in different diseases, such as depression, schizophrenia, and cocaine abuse[1-3], to the best of our knowledge, the neural processing of an alexithymic response in heroin-dependents has not been examined. To this end, we utilized resting-state functional connectivity MRI to determine changes in functional connectivity and investigate the neural basis of the alexithymia in heroin addicts.

***Methods*: fMRI experiments**: Written consent informs and Toronto Alexithymia Scale (TAS-26) were obtained from each subject. MRI scans were conducted at a GE 3.0T Signa LX scanner with a birdcage RF head coil. A 3D high resolution RF spoiled gradient recalled acquisition anatomical images were acquired prior to functional scans. The fMRI data were obtained by using single-shot EPI sequence (TE=25ms, TR=2000ms, FOV=24×24cm, matrix=64×64, flip angle=90°, slice thickness=5mm, space=1.0mm). 180 imaging volumes were acquired in each functional scan run. All subjects were instructed to keep their eyes closed, relax and move as little as possible. Foam pads were used to reduce head motion during EPI data acquisition. **Data preprocessing**: The average score of alexithymia on all heroin subjects and control group with nonalexithymia was 81 and 53, respectively. Then, the former was divided into a low score group (<81, n=11) and a high score group (≥81, n=14). All image data processing and statistical analysis were conducted with AFNI. The first 5 data points of resting-state datasets were discarded in order to obtain a stable state, followed by physiological motion correction, volume registration and motion correction. The resulting datasets were then normalized to a standard Talairach image space, and resampled to the resolution of 2-by-2-by-2mm. In the Talairach space, the time series were further passed through several additional preprocessing steps, including up to third order detrending, low-pass temporal filtering of frequencies [0.015, 0.1], and deconvolving the white-matter, ventricular, and global signals using General Linear Model (GLM). **Functional connectivity analysis**: The seed ROIs located in both sides of amygdala were chosen based on anatomical division. The maps of cross-correlation coefficients (CC) for individual subjects were obtained by cross-correlating each voxel time course with the average time course of seed voxels. For group statistical analysis, a two-sample t-test was used to test any significant difference of functional connectivity between two groups.

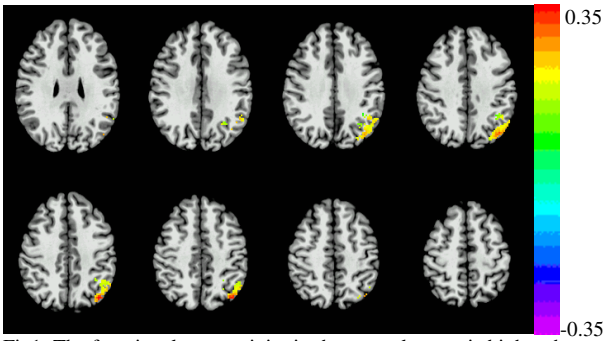

Fig1. The functional connectivity in the control group is higher than that in the heroin group with low score (P<0.05, corrected).

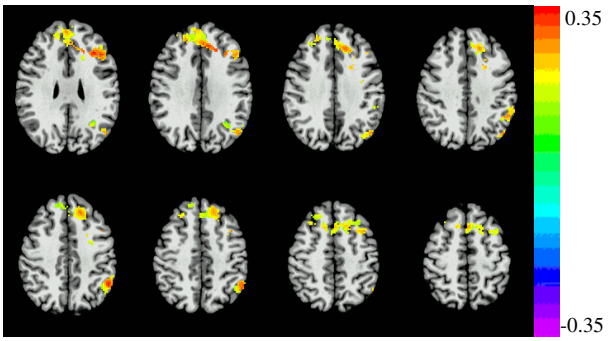

Fig2. The functional connectivity in the control group is even higher than that in the heroin group with high score (P<0.05, corrected).

***Results*:** Compared to the control group, the functional connectivity with in the amygdala region in both the low-score group and the high-score group were significantly lower than that of the control group (P<0.05, corrected). Moreover, more decreased regions were revealed in the high-score group than the low-score group, shown in figure 1 and 2. The FC decreases in left inferior parietal gyrus (BA40) were found in both low- and high-score groups. In addition, more decreased regions were found in prefrontal regions for the high-score group, including left medial frontal gyrus, bilateral superior frontal gyrus (BA 9/10) and left middle frontal gyrus (BA 9), while none of them were significant in the low-score group.

***Discussion*:** Neuroimaging studies concerning alexithymia have verified that subjects with or without alexithymia had different activated brain regions based on the TAS [4-6]. In this study, we have examined the differences of resting-state functional connectivity in heroin addicts with alexithymia. The results showed that, compared to non-heroin subjects, FC in the high-score group decreased more severely than that in the low-score group. These brain regions mentioned above were closely associated with emotional processing, indicating that FC decrease could be related to alexithymia in heroin addicts. In addition, since the subjects with alexithymia may have a difficulty describing their inner emotional changes, the impaired ability to describe their feelings appropriately may result in inaccurate ratings of their psychological states. Therefore, when we used self-report questionnaires to ask for subjects to describe or estimate how they think, imagine, and feel about their self emotional states, the careful consideration should be taken into account for interpretation of subjective feelings, especially for drug craving.

***Conclusions*:** In conclusion, alexithymia is related to the functional disruption of amygdala with the left inferior parietal gyrus. The higher score of alexithymia extended the functional disruption to the area of left medial frontal gyrus, bilateral superior frontal gyrus (BA 9/10) and left middle frontal gyrus (BA 9). It is suggested that since alexithymia may affect subjective assessment on a variety of emotional ratings, caution should be taken when interpreting or evaluating those emotional ratings obtained from heroin dependent subjects.

***Acknowledgements*:** This work was supported by NIH grants DA10214 and RR00058.

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