A Correlation Method Using Principal Components for the Analysis of fMRI Data

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Purpose: The purpose of our study is to evaluate the efficacy of the correlation method using principal component analysis in fMRI of motor system.

Materials and Method: Ten normal volunteers (mean age:29 yrs) were examined on a 1.5T MR unit (Signa Horizon, USA) with a conventional CP head coil. A single-shot GRE-EPI sequence (TR/TE/flip angle=3000ms/50ms/90, FOV=240 mm, matrix=64x64, slice thickness/gap=5mm/0mm, 15 axial slices) was used for functional MR data. A flow-sensitive conventional gradient echo sequence (TR/TE/flip angle = 50ms/4ms/60) was used for high resolution anatomical images. For motor cortex activation, finger tapping of the right thumb and index finger was carried out with the alternative movement of 2 activation and 3 rest periods (one period=24 sec) at a speed of 1/1 sec. EPI data sets were acquired with 60 images per one slice and the number of total scan time was 3 minute. Convolution by 2 dimension Gaussian-shape filter were applied to all images for reducing motion artifact. After de-trending the EPI data, each pixel and its 8 surrounding pixels of image was processed by principal component analysis (PCA). The first principal components obtained at each pixel were fed into the cross-correlation method using reference vector defined by a given paradigm. Also, raw EPI data sets not performed by PCA were used for comparison. The location of activation sites and the patterns of map images were analyzed.

Results: The correlation methods irrespective of the usage of PCA showed the strong activation detection of left premotor cortex in all volunteers. However, the correlation method using PCA provided a larger number of activated pixels compared to the same method without PCA.

Conclusion: Our results demonstrate the correlation method using PCA appears to be more effective for characterizing the temporal pattern of activated-induced signal changes than the conventional correlation method.