

The neural correlates of the judgemental capacity due to affective facial expressions

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Abstract

Even the same affective facial expressions may have different meanings due to social or interpersonal context. Therefore, the judgmental capacity for the appropriateness of the facial affective expressions should be one of the critical factors for human social interactions. We perform this study to identify neural correlates of this capacity using fMRI technique. In the experimental session, subjects should perform the judgmental tasks for the appropriateness of a facial affect with seeing visual stimuli. Two kinds of stimuli were presented; pictures of depicting emotion-laden situation and with affective facial picture. Our results indicate the activation of bilateral frontomedian cortex (BA 8), left inferior frontal cortex (BA 47), left anterior temporal pole (BA 38), left thalamus were activated during the judgmental tasks for the appropriateness of a facial affect. According to the former studies, these areas are known to be related to ToM task or memory of emotional cue. Further studies are needed to clarify this any way, but this result should be helpful to understand the pathophysiology of the abnormal social behavior in various neuropsychiatric disorders such as autism, schizophrenia.

Introduction

Information processing which is affected by facial expressions should be important for performing social and interpersonal interactions. Number of studies was carried out for investigating the neural mechanisms of this processing with using pictures of facial expressions. But, even the same facial affective expressions may have different meanings due to social or interpersonal context. It might be therefore essential to appropriate social judgment and behavior to compare the situation and other people's facial expressions continuously. As a matter of fact, this judgmental capacity for the appropriateness of affective facial expressions should be one of the critical factors for human social interactions. For example, in order to judge the appropriateness of a affective facial expression in an emotion-laden situation, one should be able to understand the emotion-laden situation through simulation. Furthermore, on the basis of this emotional experience, one should be able to predict the emotional response of other people. If the prediction is matched with other people's emotional response, it can be estimated that the response was appropriated and can be empathized with the response. These processes are underlying a kind of theory of mind (ToM) task. In terms of ToM task, a lot of studies about the neural correlates of this have been reported. It is worth noting that the majority of these studies used stories or cartoons described contextual situation as ToM tasks. But, most of these tasks involved non-emotional situation and have distances with the real every day life. In the real social situations, it is also important to perform ToM tasks involving emotional situation. We perform the study to identify neural correlates of judgmental capacities for the appropriateness of affective facial expressions to an emotion-laden situation.

Methods

Fourteen (7 male and 7 female) right-handed healthy subjects have volunteered for our study. Each subject performed judgmental task for the appropriateness of facial affects (JAFA task) and gender matching tasks (Fig 1). Gender matching task was used as control task. The experimental paradigm is shown in Fig 2. Functional images of the whole brain were acquired using a 3.0 Tesla MRI system (ISOL, Korea) (4-mm contiguous slices; TE, 35 ms; TR, 3000 ms; matrix size, 64 x 64; FOV, 22 x 22 cm). The functional images were realigned to the first images by SPM99 and normalized to the standard space of Talairach and Tournoux and smoothed with 10mm Gaussian kernel. Statistical analyses used in the present study were performed according to the random effects model and contrast images for a given category of stimulus were subjected to a 'one-sample t-test' to test for significant activation during the task. The threshold was set at $p < 0.001$ (uncorrected) and cluster size > 10 .

Results and Discussion

Both frontomedian cortex (BA 8), left inferior frontal cortex (BA 47), left anterior temporal pole (BA 38), left thalamus were activated during the JAFA task, compared to during the gender matching task (Fig 3). These areas are known to be related to ToM task or emotional memory. This result should be helpful to understand the pathophysiology of the abnormal social behavior in various neuropsychiatric disorders such as autism, schizophrenia.

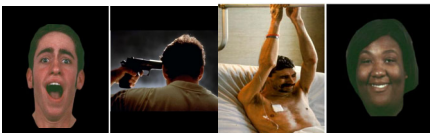


Fig 1. Judgmental task for the appropriateness of a facial affect (JAFA task) and gender matching task. Left picture is example of appropriate facial affect and right one is example of inappropriate one. In gender matching task, right picture is example of same gender and right one is example of different gender

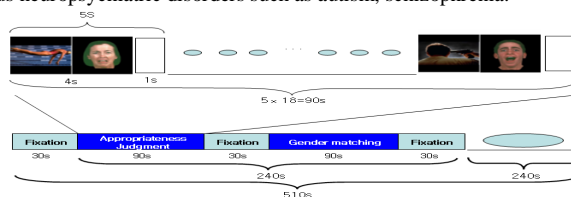


Fig. 2. The scheme of the experimental design

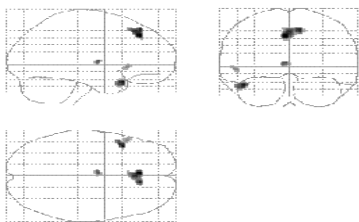


Fig 3. The brain activation during the judgmental task for the appropriateness of a facial affect compared to gender matching task

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