
Behavioral, Neural and Cardiovascular Responses to Emotional Stimuli: Simultaneous Recording of fMRI and Continuous Blood Pressure Reactions

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Abstract

Introduction: Recent evidence suggests that the brain is causally involved in the initiation and progress of cardiovascular diseases, by failing to regulate blood pressure responses to emotional events. This study examines the neural regions regulating blood pressure reactions to negative stimuli. Methods: 24 healthy subjects (11 females; age = 24.75 ± 2.49 years) were asked to ignore task-irrelevant emotional content, while engaging in emotional Stroop and emotional perceptual load tasks. fMRI data was collected in a 3T-Siemens scanner simultaneously to continuous blood pressure recording. The data was analyzed by a whole-brain general linear model including task relevant events as covariates and blood pressure as regressor. Results were threshold at $p < 0.05$ and corrected for multiple comparisons. We furthermore used a small volume correction for the amygdala. Results: In the emotional Stroop task, negative words resulted in enhanced activation the left inferior frontal gyrus and bilateral amygdala. Blood pressures significantly correlated with neural activation in the left amygdala. In the perceptual load task, high perceptual load resulted in reduced activation in bilateral amygdala and orbitofrontal cortex. These results are in line with previous evidence that emotional reaction depends on sufficient resources. Blood pressure significantly correlated with activation in the right amygdala. Conclusions: Taken together, the fMRI results suggest that emotional irrelevant content activates emotion-related neural network, albeit this activation depends on sufficient resources. The blood pressure findings corroborate previous results suggesting a role for the amygdala in blood pressure regulation. These findings have implications regarding early neuro-therapeutic interventions for individuals at high risk to develop cardiovascular diseases.

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