

## Stress Evaluation using Functional MRI in patients with Coronary Artery Disease

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## Purpose

Emotional stress is discussed as an independent risk factor of Coronary Artery Disease. Previously, cardiovascular stress responses have been extensively studied in animal and human researches. But the mechanisms of stress influence to CAD development remain unclear.

Functional MRI provides technical instruments to study neuronal activation during stress.

The aim of the study was to evaluate the brain activation zones using fMRI in response to electrical stress stimulation in patients with CAD and healthy volunteers.

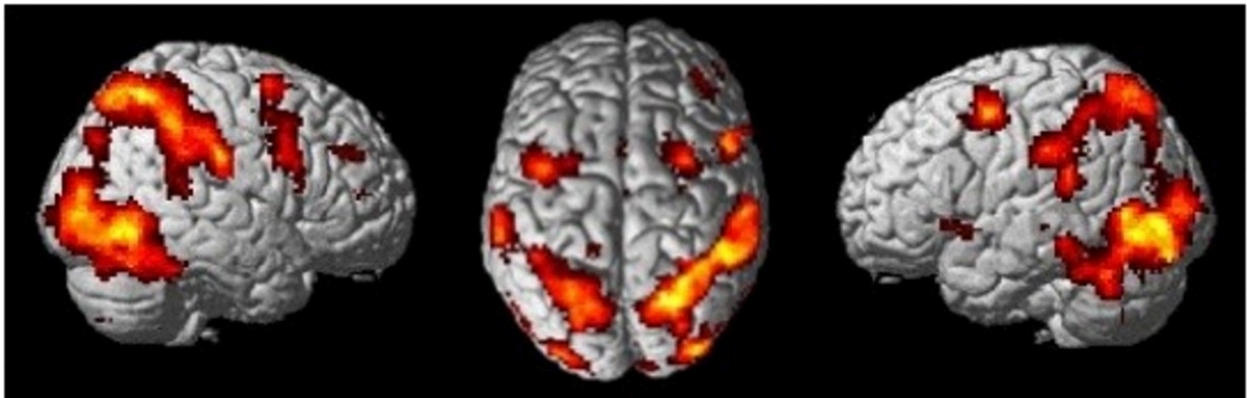
## Methods and Materials

48 men, aged from 29 to 77 years, took part in the study. They were divided into 2 groups: the experimental group (EG) included 23 patients with coronary artery disease and the control group (CG) included 25 healthy individuals. The experimental procedure involved psychological testing, registration of electroencephalogram (EEG), photoplethysmogram, galvanic skin response (GSR) and fMRI with electrocutaneous shock stimulation. MRI was performed using 3.0 T scanner. The data was processed and analyzed using SPM8.

## Results

In simulated stressful situations CAD patients differed from healthy individuals having increased values of galvanic skin response (GSR) and decreased power of the alpha rhythm in background electroencephalogram (EEG). Psychological indicators of chronic stress (PSM-25 questionnaire) were significantly higher in the experimental group.

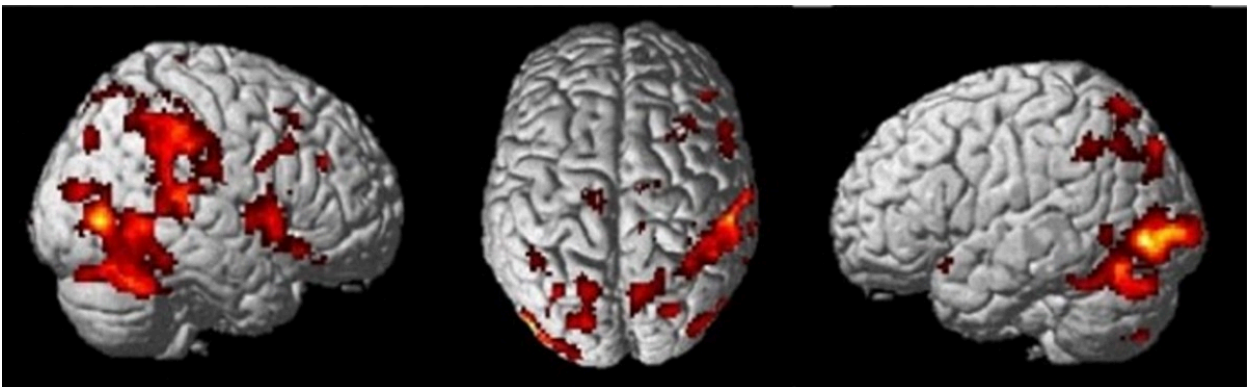
Functional MRI study analysis showed a decrease in the total volume of the activation zones in response to stress in patients with CAD (Fig.1,2).



**Fig. 1:** Brain activation map in response to stress in healthy volunteers group.

**References:** Dept. of Tomography, Cardiology Research Center - Moscow/RU

Brain activation map in response to stress in healthy volunteers group you can see on **fig. 1**.

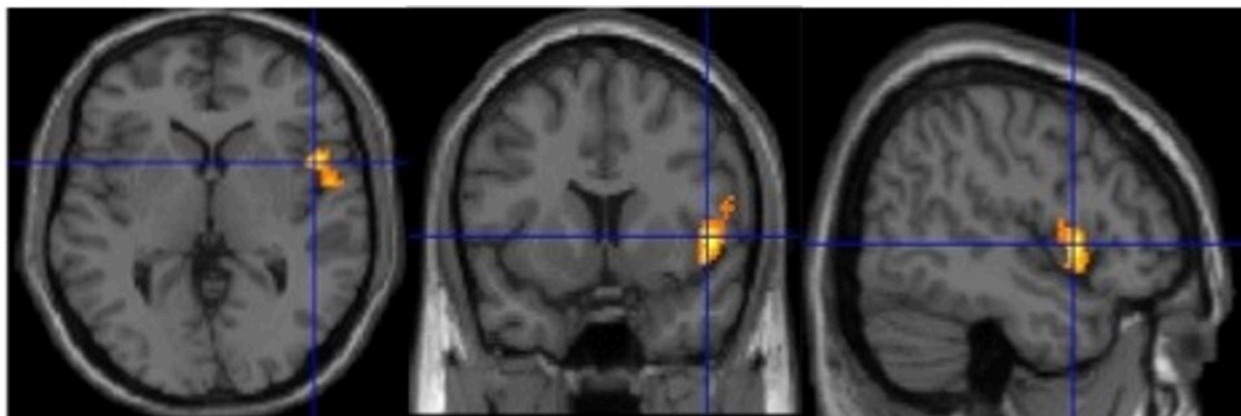


**Fig. 2:** Brain activation map in response to stress in patients with CAD.

**References:** Dept. of Tomography, Cardiology Research Center - Moscow/RU

**Fig. 2** showed brain activation map in response to stress in patients with CAD.

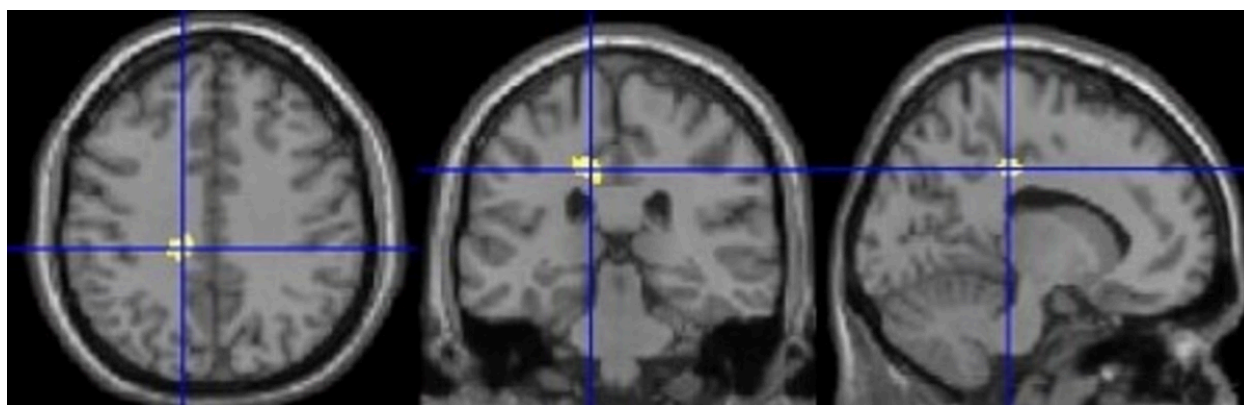
In addition, activation zones in patients with CAD were found in the right insula (Fig.3) and the left cingulate cortex (Fig.4).



**Fig. 3:** Activation zone in the right insula in response to stress in patients with CAD.

**References:** Dept. of Tomography, Cardiology Research Center - Moscow/RU

Activation zone in the right insula in response to stress in patients with CAD you can find on **fig. 3**.



**Fig. 4:** Activation zone in the left cingulate cortex in response to stress in patients with CAD.

**References:** Dept. of Tomography, Cardiology Research Center - Moscow/RU

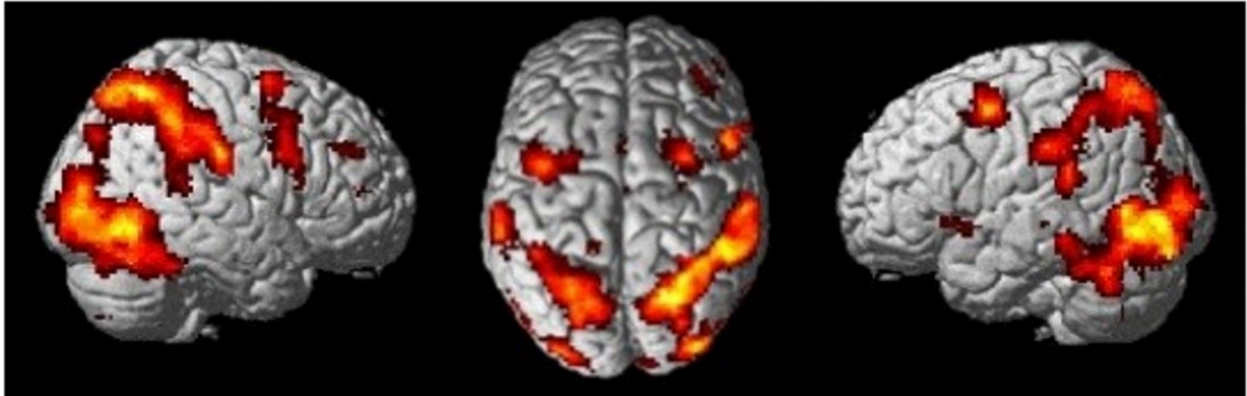
**Fig. 4** showed activation zone in the left cingulate cortex in response to stress in patients with CAD.

The revealed neuronal activation in response to stress influence proves the participation of the insula and the cingulate cortex in regulation of stressful behavior.



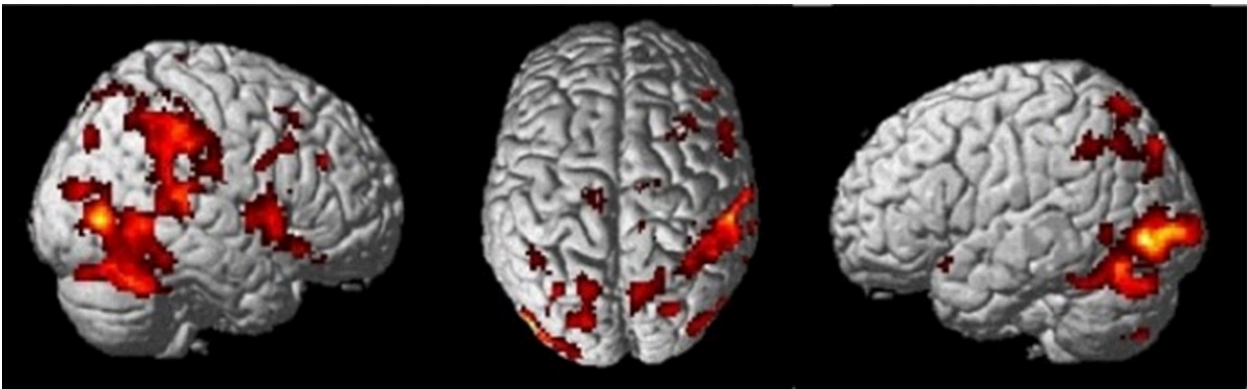


**Images for this section:**



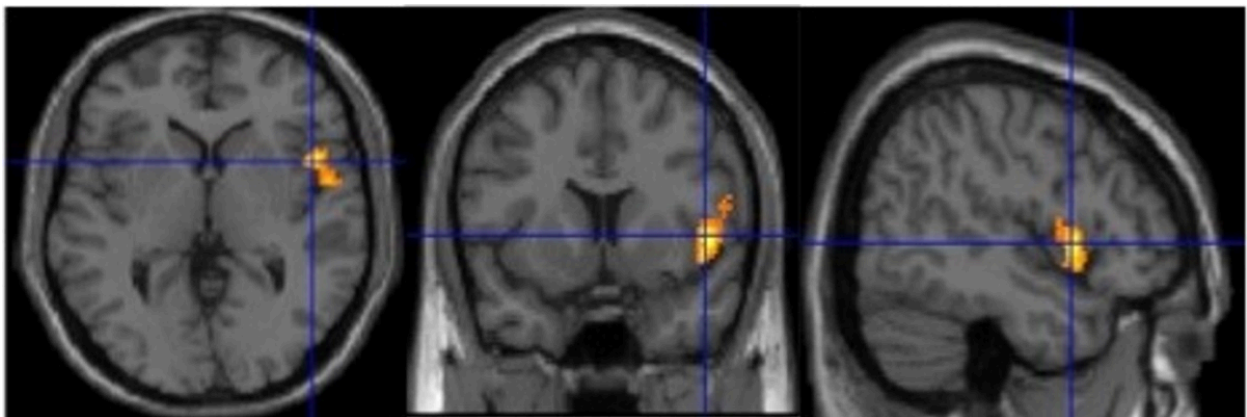
**Fig. 1:** Brain activation map in response to stress in healthy volunteers group.

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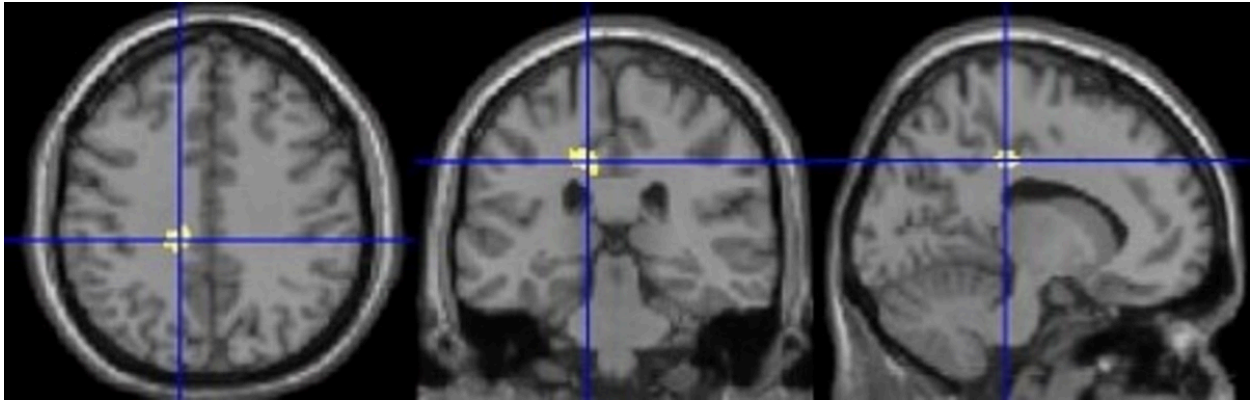


**Fig. 2:** Brain activation map in response to stress in patients with CAD.

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**Fig. 3:** Activation zone in the right insula in response to stress in patients with CAD.



**Fig. 4:** Activation zone in the left cingulate cortex in response to stress in patients with CAD.



## Conclusion

Patients with CAD showed significant activation zone in the right insula and the left cingulate cortex in response to electrical stress stimulation comparing with healthy individuals.

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