Title: Investigation of neurovascular coupling during spontaneous activity and motor task

Considering the growing popularity of imaging techniques based on hemodynamic response such as fNIRS or fMRI, understanding the phenomenon of neurovascular coupling is in the focus of attention of scientific community. The approach which significantly contributes to elucidation of the relation between hemodynamic response and brain electrical activity are simultaneous measurements of EEG+fNIRS or EEG+fMRI.

The results of two studies[1,2] will be presented. In the first study a relation between EEG signals and changes in oxyhemoglobin (HbO) and deoxyhemoglobin (HbR) concentrations measured by means of fNIRS was investigated. The study[1] has shown a strong negative correlation between the envelopes of EEG in Alpha and Beta bands and changes of concentrations of HbO and a strong positive correlation between the envelopes of EEG in Alpha and Beta bands and changes of concentrations of HbR during motor task.

Mayer Waves (MW) seem to play an important role in the mechanisms of neurovascular coupling. MW are oscillations with frequency about 0.1 Hz which are observed in both nervous (EEG amplitude modulation) and vascular (blood pressure, changes of concentration of HbO, HbR) systems. The second study[2] was aimed to investigate the mechanism of MW generation in the context of neurovascular system. DTF[3] (Directed Transfer Function) was used to obtain causal couplings between EEG signals, changes in concentrations of HbO and HbR, HRV (Heart Rate Variability) and systolic and diastolic pressure (sBP, dBP) in the frequency range corresponding to MW. The results have shown strong reciprocal connections between HRV, sBP and dBP, which indicates the existence of oscillating circuits possibly related to MW generation.

References

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