Title text here; Development of approaches to comparison of fMRI and EEG resting state networks (case report)

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Background: The fMRI resting state (RS) networks analysis is common approach in study of the basic level of the human brain functional activity in health and pathology. However, for a number of fMRI research studies there are some objective and subjective restrictions, especially in various forms of cerebral and somatic diseases. In this regard, the identification of analogues rsfMRI networks in the characteristics of the bioelectric activity of the brain is helpful: EEG is the more common method of research, which has almost no restrictions.

The objective of this study was to estimate capacity of independent component analysis (ICA) EEG to definition RS networks which are identical to hemodynamic fluctuations.

Methods: At the same day we studied one health volunteer with fMRI (3T) and EEG with the eyes closed. To identify the rsfMRI networks we used algorithm in the FSL program. After selection the cerebrospinal fluid and vascular artifacts, 7-8 networks were identified as basic described in literature with a more detailed analysis: DMN, sensorimotor and executive control components. EEG was recorded monopolarly from symmetrical occipital, parietal, central, frontal and temporal regions in both hemispheres. The data were processed by the spatial ICA in our modification [Knyazev et al., 2011] with GIFT. We analyzed the topography of EEG activity sources for each of the main ranges of physiological rhythms: delta (1-4 Hz), theta (4-8 Hz), alpha (8-12 Hz) and beta (12-30 Hz). Compared the compliance of fMRI DMN, Sensorimotor and executive control networks topography with localization of equivalent sources of EEG activity: efficiently and based on calculation of spatial correlations.

Results: Pilot fMRI -EEG comparison in resting state revealed although low (about 0.15 -0.23), but significant correlation of network topography hemodynamic signals and EEG activity of all analyzed frequency ranges. However, there is a selective affinity topography of studied rsfMRI networks towards localization of sources individual EEG rhythms: DMN - alpha (what is more, in form of two independent sources: frontal and occipital), and the delta and beta (frontal sources); sensorimotor - a source of beta activity; executive control - with the sources localization of alpha and theta activity.

Conclusions: These results indicate the availability of development of this research direction.

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