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INTRINSIC ACTIVITY

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MEETING ABSTRACT

A3.50

LORETA mapping and coherence analysis reveal brain functional connectivity features during choice reaction task in military service members with mild traumatic brain injury and posttraumatic stress disorder

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Background: Mild traumatic brain injury (mTBI) and posttraumatic stress disorder (PTSD) are common impairments among military service members who took part in armed conflicts as well as among civilians all over the world. Both mTBI and PTSD could cause long-term alterations in cognitive processes such as general information processing and decision-making. The simplest way to model decision-making in the study is the simple choice reaction (CR) task.
Methods: A simple computer CR task (with two types of neutral visual stimuli) was used to test participants. CR time of responses was detected. EEG was recorded at sampling rate of 500 Hz during the whole testing procedure. sLORETA was applied for EEG source localization (*i.e.* mapping) to identify brain regions involved in CR [1]. Also, statistical non-parametric mapping in sLORETA was used to display differences between activation of brain regions of participant groups [2]. Functional connectivity was assessed with EEG coherence analysis between all possible coupled pairs of electrodes in delta (0.5–3.9 Hz), theta (4.0–7.9 Hz), alpha (8–12 Hz), beta-1 (14–19.9 Hz) and beta-2 (20–35 Hz). The significant level of coherence value was established equal or greater than 0.7 [3]. Statistical analysis of CR time of responses (CRT) was done in STATISTICA.
Results: The CRT of the mTBI group was greater than that of the control group (471 [446; 579] ms vs. 410 [392; 430] ms ($U = 116$; $p = 0.002$)), while no difference was revealed between PTSD group and control group (434 [405; 485] ms vs. 410 [392; 430] ms ($U = 135$; $p = 0.087$)). In the control group activation of fronto-parieto-occipital and temporo-occipital regions as well as connectivity between respective regions in the theta band were observed. The PTSD group demonstrated activation of the right fronto-parieto-temporal regions and the right insula in comparison to zero. There was no difference between the PTSD group and the control group ($p = 0.493$). The PTSD group connectivity pattern was specific because of coherence between prefrontal regions in the delta band and lack of interhemispheric coherence in all bands. Nevertheless, the same fronto-parieto-occipital connectivity was present as seen in the control group. The mTBI group had greater activation of the left temporo-occipital regions, the left insula and posterior cingulate cortex compared to the control group ($p = 0.018$; threshold = 0.574)). Coherence analysis showed general weak functional connectivity in the mTBI group: lack of interhemispheric and fronto-parieto-occipital coherences.
Discussion: In view of the disruption of neural networks as the result of TBI [4] the following assumption can be made: mTBI results in the slowing of information processing caused by altered fronto-parieto-occipital functional integrity. At the same time intact fronto-parieto-occipital functional connectivity in PTSD and the control group provide efficient performance in the CR task.

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Keywords: posttraumatic stress disorder – traumatic brain injury, mild – LORETA – coherence analysis – decision-making – choice reaction task

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