IAA/IAF SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

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ANATOMICAL AND FUNCTIONAL BRAIN APPROACH ALONG SHORT ABRUPT CHANGES IN G-LEVELS

Abstract

To conduct experiments under abrupt changes in g-levels, a small aerobatic plane has been used, providing 6-8 seconds of reduced gravity, alternating with 5-7 seconds of hypergravity periods. The aircraft cockpit is transparent, unpressurized, non-thermostated and noisy. Due to the specific conditions of the flight and previous findings [1], we hypothesized that other sensory inputs could have an impact on brain final response when gravity is altered. Therefore, this study focuses on the evaluation of such hypothesis, based on the analysis of the evolution in time of intracranial activity of limbic, visual and auditory cortices.

Five subjects (N=5, ages 37+/- 9) have flown with their eyes both open and closed. Electroencephalogram (EEG) signals were recorded with an Emotive Epoc headset, synchronized with a triaxial accelerometer and an altimeter. The global brain bioelectric activity throughout the parabola was obtained applying Standardized Low Resolution Brain Electromagnetic Tomography, and it was analyzed for the Limbic, Visual and Auditory cortices. Intracranial activity of the Temporal and Occipital lobes were carried out as well in order to compare the different periods/phases of the flight. Results detected a desynchronization in brain bioelectrical activity between first hypergravity and hypogravity phases in all lobes and cortices, only in the case of open eyes. Statistical significant differences (at confidence interval 95 %) between mean intracranial activity of the baseline (inside the aircraft) and both hypergravity phases were obtained, by using ANOVA. Spectral entropy evolution in time has been considered as a fast indicator of the sudden extracranial brain activity variation during short g-changes. For open eyes, spectral entropy values indicated a slight decrease at the onset of the hypogravity phase, whereas in case of closed eyes, this change was undetectable.

In summary, the intracranial activity connected to sensory cortices and with lobes had similar patterns, for both type of experiments. Therefore, the sensory inputs have great importance, but they may not be the only factors that might influence the brain response during the short abrupt gravity load changes.

[1] D. Dubert, X. Ruiz, Jna. Gavaldà, A. Perez-Poch, CASEIB, Madrid 2015.