

AMPLITUDE OF HEART RATE MODULATION WITH THE PERIOD OF 3 CARDIOCYCLES DEPENDS ON THE PHYSIOLOGICAL AROUSAL OF THE BRAIN

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Introduction. Last conference we suggested that there is the modulation with a period of 3 cardiocycles in heart rate variability and that its amplitude is associated with mental status. The aim of this study was to specify a component of psychophysiological status this amplitude is associated with. We hypothesized that this component is the physiological arousal of brain. Arousal is a general activation of the brain cortex by the reticular activating system.

Methods. It is known that mental relaxation, meditation and sleeping associated with reduction of the arousal level. Therefore, we use these states to prove our hypothesis. In according to these states the study was designed in 3 stages. Short tachograms of 300 cardiointervals recorded in different psychophysiological states was analyzed with the discrete Fourier transform. Some of the tachograms were got of the PhysioNet that is an Internet physiological signals database funded by the National Institutes of Health. This database is available via the URL <http://www.physionet.org/physiobank/database/meditation/>.

Results and discussion. Stage one. In group of 12 volunteers ECG was recorded subsequently in rest and during mental relaxation. To provoke mental relaxation they were introductory asked to imagine some pleasant and relaxing things from their experience while staying in rest. The amplitude of the modulation with the period of 3 cardiocycles decreases in 10 volunteers during relaxation that was statistically significant ($p \leq 0,05$).

Stage two. In the other group of 12 subjects heart rate was analyzed at rest and during Kundalini Yoga (8 subjects) and Chi (4 subjects) meditation (the data from the PhysioNet database). The amplitude of the modulation with the period of 3 cardiocycles decreases in 11 subjects during meditation and it was also statistically significant ($p \leq 0,01$).

Stage three. The spectral analysis of heart rate was carried out in group of 11 subjects during sleeping (the data from the PhysioNet database). The average level of the 3-cardiocyte modulation in this group was significantly lower than one in the group of 38 sleepless rest subjects ($p \leq 0,02$) but not than one in the group of 11 meditators during meditation.

In conclusion. The results showed that the amplitude of 3-cardiocyte modulation of heart rate in records of 300 cardiointervals depends of the physiological arousal of brain. As arousal is a physiological component of stress, the amplitude of this heart rate modulation may be used as a diagnostic parameter on the arousal in stress related studies.