MENTAL STATUS AND HEART RATE VARIABILITY

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Introduction. Many correlation and experimental studies show that heart rate variability (HRV) and especially power of high frequency spectral range (0.15 – 0.5 Hz) relates to mental status. But, there are not reliable psycho-diagnostic techniques based on analysis of HRV so far. "Complex and largely undiscovered physiology" (Taylor & Studinger, 2006) of HRV is a probable cause of this. The purpose of this study was to discover the features of heart rate variability which are actually related with mental status.

Methods. Three groups of 68, 39 and 19 healthy volunteers were in study. Actual mental status was evaluated by the Russian questionnaire technique like the POMS (Profiles of Mood States). In order to avoid a contradiction when series of time intervals (RR) are analyzed as a function of the same time we analyze them as a function of number. 150 harmonics were defined by digital Fourier transformation technique. In order to normalize the distribution of frequency values they were logarithmically transformed. To investigate the frequency structure of heart rate oscillations the factor analysis of the frequencies was carried out.

Results and discussion. The results in each group were similar. Forms of the diagrams of factor loadings of the four first factors are like wave. If we interpreted the waves as physiological phenomena of periodical modulation of heart rate, we conclude that there are at least three such phenomena in high frequency range instead of the one mainly being discussed now. Second factor has the wave at about 0.14 – 0.24 1/beat and peak at 0.18 1/beat. It may only be the frequencies of respiratory sinus arrhythmia. The next two factors have not physiological interpretation yet. The wave of the third factor is about 0.21 – 0.31 1/beat with peak is at 0.26 1/beat. The first factor which has a grates eigenvalue has the wave at frequencies from 0.25 up to 0.5 1/beat and peak 0.35 1/beat. The periodogram values at the frequencies of the first factor has significant positive correlations with the POMS scale of Vigor. Stepwise methods of multiple regression analysis let us to get a good model with R-square equals to 0.83.

In conclusion. The results let us suppose that there are at least three periodical phenomena of HRV in frequency range related with mental status. Two of them have not been discovered and physiologically explained yet. The most powerful of these phenomena relates to mental status. It has frequencies from 0.25 to 0.5 1/beat and peak 0.35 1/beat. Despite of difference of the peak frequencies the waves of factor loadings are overlapped. Therefore, regression models would be more fit for useful evaluation of mental status, rather then power of spectral density within any frequency range.