Determination of the Frequency Bands for Heart Rate Variability: Studies on the Intact and Isolated Rabbit Hearts

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INTRODUCTION Many authors use in their studies the standards of the HRV frequency bands for human intact hearts, sincethese standards for animal's isolated hearts are still missing. However, there are other oscillations of HRV spectrum present in isolated heart, although there is no general consensus, what is their origin. Thus, it is important to define and compare the frequency bands of the intact and isolated hearts.

METHODS Twelve New Zealand rabbits were included in this study. The isolated hearts of 7 rabbits were perfused according to Langendorff. The ECG signals were recorded by touch-less method from three orthogonal leads. Moreover, the ECGs of the intact hearts of remaining 5 rabbits were recorded by 4 electrodes placed in such a way that the resulting records were comparable with those of isolated hearts. The RR-series were computed with own designed R-wave detector and detrended by smoothness prior procedure with the regularization parameter = 800. The detrended data were interpolated and resampled with frequency 15Hz. The limits between low and high frequencies (LF and HF) were defined on the basis of the spectral indices calculated from the accumulated power spectra of the HRV.

RESULTS The limits between LF and HF bands are defined as 0.86Hz and 1.47Hz for isolated and intact rabbit hearts, respectively. The HRV of the isolated hearts included in the present study have a different character of the power spectra: there are the spectra with one or two dominant oscillators or with no dominant oscillators. The pattern of the HRV spectrum of the isolated heart is determined by mechanisms, which differ from the phenomena occurring in the intact heart. These mechanisms are still unknown and are a very important topic for future studies.