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Structure of heart rate asymmetry

Heart rate asymmetry (HRA) is a physiological phenomenon reflecting the fact that heart rate decelerations contribute more to short-term HRV than accelerations, and accelerations contribute more to long-term and total HRV than decelerations. These HRA methods are variance-based, and can be called macrostructural. Recently, a methods based on a counting statistics which depends on fast- and slow- changing rate of microstructure of the RR intervals time series was defined. In this study we show that the related entropic parameters H_{AR} (dependent on accelerations) and H_{DR} (dependent on decelerations) are asymmetric. The nature of this asymmetry is exactly the same as with the variance-based descriptors: it is unidirectional and consistent.

Materials and methods: 24-hour Holter ECG recordings were obtained from 50 healthy subjects, including 27 women. The microstructure related to decelerations and accelerations was calculated from the resulting RR time series and the H_{AR} and H_{DR} were computed. This was repeated for the same recordings in shuffled order, for which the shuffling distribution of microstructure is known for theoretical considerations. The H_{AR} and H_{DR} were compared with the t-test after establishing normal distribution with the Shapiro-Wilk test. The presence of asymmetry in the studied group was established with the binomial test.

Results: The value of H_{AR} was 1.08±0.021 and H_{DR} 1.01±0.18. This difference is statistically significant with p<0.001. There were 43 cases with $H_{AR} > H_{DR}$, and the binomial test for equality of both of proportions being equal gives a statistically significant result p<0.001. No differences were observed for shuffled data.

Discussion: Heart rate asymmetry understood as a consistent and unidirectional difference between patterns of accelerations and decelerations is an inherent property of the RR intervals time series. It is visible both in macrostructural, variance-based descriptors and microstructural counting based entropic parameters.