Impact Of Oxidative Stress on the Long-Term Heart Rate Variability: Linear vs. Nonlinear Heart Rate Dynamics

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Introduction: Heart rate variability (HRV) is a widely used noninvasive and quantitative marker of the cardiac autonomic control. An elevated oxidative stress (OS) and reduced HRV have been proven in specific disease subsets. However, the impact of OS on the long-term heart rate dynamics of both conventional linear and nonlinear origins in the general population are not known.

Methods: The 24-hr ambulatory electrocardiogram recordings and plasma 8-iso-Prostaglandin F2α (8-iso-PGF2α) as an OS marker were acquired simultaneously in 71 consecutive patients. The conventional time and frequency domain HRV parameters and nonlinear parameters were measured.

Result: The 8-iso-PGF2α is a significant determinant of most long-term conventional time and frequency domain HRV parameters and standard deviation (SD1, perpendicular to the line-of-identity; SD2, along the line-of-identity) descriptors from the Poincare plot analysis, but not of the nonlinear complexity and fractal parameters. Patients with a high OS burden had a lower absolute low frequency and high frequency (HF) power during both the night and morning periods, with a significant decrease in the HF power in the morning. Judging from the relationship between the OS severity and HF power, the estimated upper boundary value of the 8-iso-PGF2α was 57.35 through 73.10 pg/mL.

Conclusion: OS is one of the significant determinants of the HRV. The severity of the OS is reflected in the conventional time and frequency domain HRV parameters, but not in the nonlinear measurements.