New insight into arrhythmia onset using HRV and BPV analysis

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Abstract

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Abstract:
In this paper Heart Rate Variability (HRV) and Blood Pressure Variability (BPV) were analyzed before the onset of cardiac arrhythmia in order to derive markers for short-term forecasting. The (a) coherence between systolic blood pressure (SBP) and cardiac oscillations in low-frequency (LF) and high-frequency (HF) band; (b) fluctuations of phase; (c) HRV and BPV as a LF power and HF power in frequency and time-frequency domain; (d) transfer function analysis of cardiovascular signals were analyzed. Arrhythmia was preceded by: a) lower coherence; b) increase in fluctuations of phase between signals; c) higher spectral energy associated with respiratory frequency in blood pressure signal; d) raise of sympathetic outflow to the heart; e) decreased HRV. Cardiac arrhythmia was characterized mainly by an increase in LF power of blood pressure, cardiac signal and transfer function. During self-termination of arrhythmia a larger increased in total BPV and HRV was recorded. These results suggest that important information about both neuronal cardiovascular control and risk for spontaneous arrhythmia can be provided by combined analysis of frequency, phase, and time-frequency analysis of blood pressure and cardiac oscillation.

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Contents

I. Introduction

In the last decades, several studies have suggested the role of the autonomic nervous system (ANS) both in the genesis and maintenance some of arrhythmias [1]–[4]. Time and frequency domain analysis of heart rate variability (HRV) has been proven effective in describing alterations of ANS control mechanisms and in identifying patients with increased cardiac and arrhythmic mortality [4]–[9].

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