

Heart Rate Variability in Coexisting Diabetes and Hypertension

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Short Editorial regarding the article: *Effects of Coexistence Hypertension and Type II Diabetes on Heart Rate Variability and Cardiorespiratory Fitness*

The autonomic nervous system regulates heart rate through sympathetic and parasympathetic response to different stimuli. The resultant fluctuation between intervals of consecutive heart beats, called heart rate variability (HRV), is a valuable tool to assess autonomic nervous system activity.¹ A decrease in HRV is a marker of reduced parasympathetic and increased sympathetic tone and has long been considered to negatively impact the prognosis in cardiovascular disease.²

In 1996, the European Society of Cardiology and the North American Society of Pacing and Electrophysiology suggested standards for evaluation, physiological interpretation, and clinical use for time- and frequency-domain HRV analysis in short- and long-term recordings.³ Some nonlinear measures have been suggested to work better than traditional measures in predicting future adverse events in several patient groups. More recently, newer computational tools have been derived from nonlinear dynamics and complex systems.⁴ Although the physiological background of nonlinear measures of HRV is less understood than the conventional measures, it is speculated that nonlinear dynamics could provide better understanding on nonlinear behavior commonly occurring within human systems due to their complex dynamic nature.^{5,6} In accordance, a good agreement between some non-linear HRV measures and the Framingham cardiovascular risk score was observed, suggesting that they could be used for screening cardiovascular risk.⁷ In 2015, the e-Cardiology Working Group of the European Society of Cardiology and the European Heart Rhythm Association launched a critical review of new methodologies for analyzing HRV, including entropy rate, fractal scaling and *Poincaré* plot, and their application in different physiological and clinical studies.⁸

Keywords

Hypertension; Diabetes Mellitus; Chronic Disease; Heart Rate; Autonomic Nervous System.

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Alterations in HRV time and frequency domain indices have been frequently observed in chronic diseases, such as diabetes and hypertension, and associated with cardiac autonomic dysfunction.^{9,10} Since co-existence of diabetes mellitus and systemic arterial hypertension is very common, some studies have compared HRV between type 2 diabetic patients with and without hypertension, and found contradictory results using time-and frequency-domain HRV analysis.¹¹⁻¹³ However, non-linear dynamics for HRV analysis in type 2 diabetes and hypertension co-existence is still to be explored.

In this issue of the *Arquivos Brasileiros de Cardiologia*, Bassi et al.¹⁴ published a study evaluating the influence of systemic arterial hypertension on cardiac autonomic modulation and cardiopulmonary capacity in type 2 diabetic patients. Diabetes subjects were assigned to a normotensive (n = 32, age = 51 ± 7.5 years) or a hypertensive group (n = 28, age = 51 ± 6.9 years). Both groups had a poor glycemic control (normotensive group: glycosylated hemoglobin = 8.00 ± 2.14%; hypertensive group: glycosylated hemoglobin = 8.70 ± 1.60%; p = 0.39) and the hypertensive group had a higher insulin resistance (normotensive group: insulin resistance index (HOMA-IR) = diabetes 4.0 ± 4.0; hypertensive group: HOMA-IR = 8.0 ± 6.6; p = 0.02). The authors found that hypertensive and diabetic subjects had lower SD1 (derived from *Poincaré* plot) and Shannon entropy, both non-linear measures of HRV, in comparison to non-hypertensive diabetic patients. In addition, SD2 (derived from *Poincaré* plot) and approximate entropy correlated negatively with exercise capacity variables.

Although a healthy control group was not evaluated, the results suggest that systemic arterial hypertension further impairs HRV in diabetic patients. These data reinforce epidemiological findings showing that the combination of diabetes mellitus and hypertension induces greater cardiac remodeling than either condition alone.¹⁵ Furthermore, heart failure is more prevalent in patients with both diseases. Additional studies are needed to establish the role of autonomic nerve dysfunction as a predictor of poor prognosis in patients with co-existing diabetes and hypertension.

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