PD2i Heart Rate Complexity can Detect Cardiac Autonomic Neuropathy: an Alternative Test to Ewing Battery

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Cardiac autonomic neuropathy (CAN) in diabetes has been called a "silent killer", because so few patients realize that they suffer from it, and yet its effect can be lethal. Early sub clinical detection of CAN and intervention are of prime importance for risk stratification in preventing sudden death due to silent myocardial infarction. This study evaluates the usefulness of a new heart rate variability (HRV) complexity measure, the Point Correlation Dimension (PD2i), derived from short term ECG recordings, as a screening tool for CAN. The PD2i was developed to measure complexity in nonstationary data with some tolerance for background noise. As a complexity measure it determines the degrees of freedom, or a number of independent variables operating at each point in time to produce the data, and will track those changes with only a small (4%) error (Skinner et al., 1994). A total of 33 sets of ECG recordings during supine rest were acquired from diabetic subjects with CAN (CAN+) [10 subjects] and without CAN (CAN-) [23 subjects] and analyzed. Participants in the study were identified as CAN+ by the use of the lying to standing tests for heart rate and blood pressure changes, as suggested by Ewing to be useful as an indicator of autonomic dysfunction in clinical testing. PD2i indices (mean, standard deviation, minimum and maximum) were used for analyzing HRV signals of all subjects. Significantly reduced ($p < 0.01$) PD2i indexes were found in CAN+ group [Table], which could be a practical diagnostic and prognostic marker. The relative importance of PD2i features was determined by receiver-operating curve (ROC) analysis for CAN+/- discrimination. The areas under the ROC curves were found to be 0.72, 0.79, 0.80 and 0.70 for minimum, maximum, mean and standard deviation of PD2i respectively. Our results demonstrate the potential utility of PD2i (a complexity based estimator) of HRV in identifying CAN.