Analysis of the Influence of Parasympathetic Postganglionic Neurons on Cardiac Response in Ventricular Fibrillation

Juan Guerrero, Alfredo Rosado*, Antonio J Serrano, Manuel Bataller, Francisco J Chorro, Luis Such and Antonio Alberola

Departamento Ingeniería Electrónica. Escuela Superior Ingeniería, Grupo de Procesado Digital de Señal. Universidad de Valencia. Spain, Spain

Physical training modifies the sympathetic-vagal balance of autonomic nervous system. Additionally, previous studies show that this training produces intrinsic modifications of cardiac electrophysiological properties in isolated heart during ventricular fibrillation (VF).

In order to verify if these modifications are related to the activity of postganglionic parasympathetic neurons, we studied ten trained rabbits. Two records per subject were acquired during VF: before (G1) and after (G2) the infusion of atropine to inhibit the activity of neurons.

Mapping records were obtained using a 240-channel electrode array located in the left ventricle of isolated heart perfused by Langendorff system. VF was induced by stimulation at increasing frequencies.

The records were processed in 4-second consecutive segments to analyze the time course of fibrillation. For each channel and segment, the following parameters were computed: a) dominant frequency (DF), obtained by the Welch periodogram b) normalized energy (NE) in a frequency band centered at the DF; c) regularity index (RI), which analyzes the similarity of local activation waves in every segment and channel; d) coefficients of variance for DF (CVDF), NE (CVNE) and RI (CVRI).

For each segment, we obtained the average value of each of the parameters analyzed for all electrodes. The results are: a) DF (G1: 13.671+-0.509 Hz, G2: 14.783+-0.455 Hz), b) NE (G1: 0.398+- 0.014; G2: 0.380+- 0.013); c) RI (G1: 0.855+- 0.017; G2: 0.865+- 0.015), d) CVDF (G1: 0.109+- 0.009; G2: 0.098+- 0.008), e) CVNE (G1: 0.398+- 0.014; G2: 0.380+- 0.013) f) CVRI (G1: 0.084+- 0.009; G2: 0.078+- 0.008).

The results in the calculated parameters do not show significant differences between groups. Thus, the parasympathetic postganglionic neurons seem to have no effect on the cardiac response in VF due to physical training.