Relationship between Heart Rate Turbulence and Local Physiological Variables in Heart Failure Patients

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Bakground. Heart Rate Turbulence (HRT) is a strong risk stratification criterion in patients with cardiac disorders. Several physiological factors affect HRT, e.g, previous cardiac cycle (CC), coupling interval (CI), and compensatory pause (CP). However, current HRT measurements imply an average of the available HRT individual tachograms that might blur this influence. Objective. We propose to filter individual tachograms, using a support vector machines approach, to measure HRT local parameters and to relate them with their local physiological conditions (CC, CI and CP). Materials and Methods. We used a filtering method based in SVM regression. We also used a mirror technique for compensating border effects. For each patient all tachograms were filtered individually. The HRT parameter, Turbulence Slope (TS) was calculated on the filtered individual tachograms. From a database with 60 heart failure patients, those with 4 or more HRT individual tachograms were selected (8 patients). In order to quantify the relationship between HRT parameter and the physiological variables we computed the Pearsons correlation coefficient (r) between them (TSvsCC, TSvsCI and TSvsCP). Whenever was r >= 0.5, we computed the slope of the regression line to characterize the relationship. Results. TSvsCC: 4 patients had r >= 0.5. The mean slope was 0.05 $[TS_{units/ms}]$, meaning that a change of 50 ms in the CC would lead to a change of 2.5 units in TS parameter. TSvsCI: 2 patients had r >= 0.5. The mean slope was 0.3 $[TS_{units/ms}]$, meaning that a change of 50 ms in the CI would lead to a change of 15 units in TS parameter. TSvsCP: 3 patients had r >=0.5. The mean slope 0.04 $[TS_{units/ms}]$, meaning that a change of 50 ms in the CP will lead to a change of 2 units in TS parameter. Conclusions. SVM filtering procedure might allow taking into account the local physiological conditions, which modulate the HRT response. This approach can complete the current HRT methods, and provide a more physiological interpretation of the HRT parameters.