

Characterization of Heart Rate Variability Dynamics in Heart Failure Patients Admitted to Intensive Care Unit

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Introduction: Heart failure (*HFail*) is a common and potentially fatal condition. The high mortality and difficulty of diagnosis make it a severe burden for the healthcare system, especially in intensive care units.

Goal: This work proposes a method to characterize *HFail* patients with respect to patients at risk but testing negative to *HFail* using autonomic indices from electrocardiogram (ECG) recordings in the intensive care unit (ICU).

Methods: We considered 51 ICU patients from the MIMIC-III database subjected to NT-proBNP laboratory measurement during their stay, of which 41 resulted positive to *HFail* (*NT-proBNP* >300 pg/mL). RR intervals from 1 hour ECG recordings in the hour preceding NT-proBNP measurements were selected, and a point process framework was applied to extract time-varying estimates of indices related to autonomic nervous system activity. A general linear mixed-effects model (GLMEM) was used to analyze the dynamics of the two populations during the hour before measurement.

Results: Results (see Fig.) showed a significant increasing trend in the average RR interval (μ_{RR}) in the negative population ($p < 0.001$). In parallel, RR variability (σ_{RR}^2) increased in negative subjects ($p < 0.001$) and decreased in positive patients ($p < 0.001$). HF power ($p < 0.001$) further showed statistically significant different dynamics between the two populations.

Conclusions: Our results point at significantly different vagal cardiac control dynamics in patients with positive NT-proBNP test in the hour preceding the measurement when compared with the negative group. These findings suggest that monitoring of autonomic tone might be useful for timely identifying ICU patients at risk of heart failure by simply monitoring heart rate variability dynamics.

