Changes in heart rate variability and ECG in a murine model of hypertrophic cardiomyopathy

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Introduction: Hypertrophic cardiomyopathy (HCM) is a common heritable cardiac disease with a diverse disease spectrum including sudden death, progressive heart failure, and chronic and/or paroxysmal atrial fibrillation. Depressed heart rate variability (HRV), a measure of autonomic function, has been demonstrated to predict for mortality risk in various cardiac disorders such as heart failure and myocardial infarction. It is unknown if HRV is altered in Gly203Ser cardiac troponin-I (TnI) transgenic (TG) mice, a murine model of HCM.

Methods: Tail tip genotyping was used to identify TG mice from their wild-type (WT) counterparts. Upon reaching 30 or >50 weeks of age, TG and WT mice were anesthetized and underwent 30 minutes of 3-lead electrocardiography recording using PowerLab and LabChart Pro (ADInstruments). HRV was calculated using 2 minute ECG tracings for time- and frequency-domain methods of HRV analysis. Electrogram (ECG) parameters were calculated in 100 successive beats from each tracing, with averages generated for each group of successively occurring 4 beats.

Results: No significant age-related differences were observed in any HRV and ECG parameters of both mice strains. TG mice demonstrated similar heart rates, increased PR interval and P wave duration ($P<0.01$ and $P<0.0001$ respectively), and similar QRS, QT and QTc intervals as compared to controls. Time-domain HRV analysis revealed decreased standard deviation of RR intervals (SDRR), coefficient variance of RR intervals (CVRR), and standard deviation of heart rate (SD rate) in TG mice (all $P<0.05$). Total power, power spectrum of low frequency (LF), of high frequency (HF), and LF/HF ratio were not significantly altered in TG mice.

Conclusions: No age-related differences in ECG and HRV were observed in the current study. Mice with the TnI gene mutation demonstrating phenotypic features of human HCM demonstrated slowed atrial and atrioventricular conduction, and decreased HRV compared to WT mice.