Balanced and unbalanced augmentation of sympathetic nerve activity and its correlation to specific ECG features in cardiovascular diseases

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Introduction: A sudden change in the autonomic nerve activity and its balance between the right- and left- sides are considered to be related to specific ECG characteristics in some cardiovascular diseases (LQTS, Takotsubo cardiomyopathy, early repolarization syndrome, etc.). However, this issue has not been well studied in systematic experimental protocol.

Methods: Experiments were performed using a canine model (n = 18). To simulate right- and left-sides unbalanced augmentation of sympathetic nerve activity, electrical stimulation (5ms, 20Hz) was applied either from left- or right- side stellate ganglion (LSG and RSG). To simulate the right- and left-side balanced augmentation of sympathetic nerve activity, electrical stimulation (2ms, 20Hz) was delivered from the inside lumen of renal artery (RN). BP, HR, ECG were continuously monitored during and after cessation of the stimulation.

Result: 1. BP/HR were increased by all stimulation maneuvers (RSG: + 35±28/58±21%, LSG: +60±41/17±24%, RN: +32±15/45±27%). 2. QTc interval was relatively stable (RSG: +8±20%, LSG: +6±16%, RN: +5 ±6%), and giant negative T wave was not observed in any stimulations. 3. PVC/NSVT were induced 100% in LSG, 83% in RN and 22% in RSG. J-waves became visible 89% in LSG but none in other stimulation maneuvers. The appearance of J-waves was associated with ST-segment elevation in 44% of them.

Conclusion: The balanced and unbalanced augmentation of sympathetic nerve activity failed to induce typical ECG configurations in cardiovascular diseases. Heterogeneous distribution of the myocardial repolarization can be a cause of the LSG stimulation induced J-waves.