Electrophysiological Changes in MI Rats Induced by VNS

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Objectives
To understand the mechanisms behind the beneficial effects of vagal nerve stimulation (VNS) on cardiac electrophysiology in chronic MI rats

Background
• Electrical stimulation of the right vagus nerve has been shown to lower heart rate, improve plasma biomarkers, attenuate remodeling, and increase survival.[1][3]
• VNS has also been shown to have antiarrhythmic effects in chronic heart failure animals. [2][3][4].

Methods

Surgery

- Figures 1A-1B: Different groups for Sprague-Dawely rats; Heart after 10 weeks of MI surgery; Guide and surgery image of lead installation; Cyberonics 105 VNS stimulator.

Optical Mapping
• External stimuli were applied to the base of the heart from a basic cycle length (BCL) of 250ms to 30ms, or until ventricular fibrillation (VF) occurred.
• Optical mapping movies of the right atrium were acquired during sinus rhythm.
• Heterogeneity index μ = (APD95% - APD5%) / APD50%

VNS stimulation
• Pulse width: 500 μsec;
• Frequency: 20 Hz;
• Current: 1 mA;
• Duty cycle: 12% ;

VNS prevents VF despite MI and large slope of APD restitution

- Figures 2A-2B: 2D APD80 and APD50 maps, and representative action potential traces for the RV for all four groups.

Conclusions

Ventricles
- No VNS-treated rats exhibited VF;
- VNS prolonged APD, especially at faster pacing rates;
- Slope of APD restitution was greater than 1 for all VNS treated animals;
- APD heterogeneity was significantly reduced in the RV of MI-VNS group;
- VNS has no minimal effect on CV Atrium
- Chronic MI decreased APD and VNS restored APD
- VNS had no effect on APD heterogeneity that was increased due to chronic MI.

References and Acknowledgements

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