Poster Session 1

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Changes of the late sodium current and the inward rectifier potassium current can contribute to generation of arrhythmias in heart failure

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Arrhythmias are important mortality factors in heart failure. These arrhythmias are generated by the electrical remodeling of the myocardium. The aim of this study was to describe the cellular electrophysiological changes in the left ventricular myocardium accompanying heart failure.

We used New Zealand white rabbits for our studies. At 3 months of age we either executed a sham operation on them (age-matched control group) or we destructed their aortic valve with a catheter. In 6-9 months this third degree aortic insufficiency led to heart failure with a decreased ejection fraction (heart failure group, HF).

We carried out our experiments on single cardiomyocytes enzymatically isolated from the left ventricle. We studied the electrophysiological properties of these myocytes with a recently developed action potential clamp method: the "sequential dissection of ionic currents". Intracellular calcium levels were measured by using the calcium sensitive dye Fura-2.

The maximal rate of repolarization of the action potential (AP) was significantly smaller in the HF group. In the HF group the peak density of the late sodium current was 35% larger while the charge carried by this current was about 50% greater than in the control group. Current densities of the L-type calcium current were smaller during the whole AP in the HF group. The peak of the inward rectifier potassium current was also lower in the HF group compared to the control.

The diastolic calcium content was not significantly different between the groups. Peak values of the calcium transients were about 20% smaller in the HF group however.

Based on our results the increased late sodium current and the decreased inward rectifier potassium current can contribute to the generation of arrhythmias in heart failure. The significantly smaller calcium transient peak can play a role in the impaired ventricular pump function.

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