

Effects of rapid atrial pacing on the arrhythmogenic activity of single cardiomyocytes from pulmonary veins: Implication in initiation of atrial fibrillation

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Abstract

Background - Pulmonary veins (PVs) are important sources of paroxysmal atrial fibrillation. Long-term rapid atrial pacing (RAP) changes atrial electrophysiology and facilitates the maintenance of atrial fibrillation. It is not clear whether RAP alters the arrhythmogenic activity of PVs. The purpose of this study was to isolate single PV cardiomyocytes from control and RAP dogs and evaluate their electrophysiological characteristics. Methods and Results - The action potential and ionic currents were investigated in PV cardiomyocytes from control and long-term (6 to 8 weeks) RAP (780 bpm) dogs by use of the whole-cell clamp technique. Dissociation of PVs yielded rod-shaped single cardiomyocytes without (n=91, 60%) or with (n=60, 40%) pacemaker activity. Compared with the control group, the RAP dog PV cardiomyocytes had faster beating rates (0.860.28 versus 0.450.07 Hz, $P<0.05$) and shorter action potential duration. The RAP dog PV cardiomyocytes with pacemaker activity have a higher incidence of delayed (59% versus 7%, $P<0.001$) or early (24% versus 0%, $P<0.005$) afterdepolarization. The RAP dog PV cardiomyocytes with pacemaker activity had smaller slow inward and transient outward but larger transient inward (0.0170.004 versus 0.0090.002 pA/pF, $P<0.05$) and pacemaker (0.1110.019 versus 0.0280.008 pA/pF, $P<0.001$) currents. The RAP dog PV cardiomyocytes without pacemaker activity had only smaller slow inward and transient outward and larger pacemaker currents. Conclusions - PVs contain multiple cardiomyocytes with distinct electrophysiological characteristics. RAP changes the electrophysiological characteristics and arrhythmogenic activity of PVs.