Electrophysiology of single cardiomyocytes isolated from rabbit pulmonary veins: implication in initiation of focal atrial fibrillation

陳亦仁

Chen YJ;Chen SA;Chen YC;Yeh HI;Chang MS;Lin CI.

摘要

Abstract

Pulmonary veins (PVs) are important foci in initiation of paroxysmal atrial fibrillation. However, the mechanisms of the high arrhythmogenic activity of PVs are unclear. This study aimed to isolate single cardiomyocytes from PVs and evaluate their electrophysiological characteristics and arrhythmogenic potential. Cardiomyocytes of rabbit PVs were isolated by retrograde perfusion with digestive enzymes from aorta via left ventricle and left atrium. The action potentials and ionic currents were investigated in isolated single PV cardiomyocytes using the whole-cell clamp technique. Dissociation of PVs yielded single pacemaker cardiomyocytes (76%) and non-pacemaker cardiomyocytes with a fast response action potential. Both the pacemaker and non-pacemaker cardiomyocytes had similar inward Ca2+ currents and transient outward K+ currents. However, the pacemaker cardiomyocytes had a smaller inward rectifier K+ current (1.50 ´ 0.22 versus 4.21 ´ 1.15 pA/pF, P < 0.005) and a larger delayed rectifier K+ current (0.60 ´ 0.05 versus 0.24 ´ 0.05 pA/pF, P < 0.005) than non-pacemaker cardiomyocytes. Acetylcholine induced hyperpolarization and inhibited the spontaneous action potential. Isoproterenol (10 nM) accelerated the spontaneous activity and induced early or delayed afterdepolarization, which could be suppressed by nifedipine. The PV cardiomyocytes with early afterdepolarization have a greater prolongation of action potential duration (<APD, +67 ´ 17 versus -109 ´ 20 ms, P < 0.0001) and a greater increase of inward Ca2+ current (0.90 ´ 0.23 versus 0.38 ´ 0.08 pA/pF, P < 0.05) after isoproterenol than those without early afterdepolarization. These findings suggest that PV

cardiomyocytes have distinct action potentials and ionic current profiles, which may be responsible for the high arrhythmogenic activity of the PVs.