Increased Ca(2+) sparks and sarcoplasmic reticulum Ca(2+) stores potentially determine the spontaneous activity of pulmonary vein cardiomyocytes

陳亦仁
CHANG SH;Chen YC;chiang SJ;Higa S;Cheng CC;Chen YJ;Chen SA

摘要

Abstract

Pulmonary veins (PVs) contain cardiomyocytes with spontaneous activity that may be responsible for PV arrhythmia. Abnormal Ca(2+) regulation is known to contribute to PV arrhythmogenesis. The purpose of this study was to investigate whether PV cardiomyocytes with spontaneous activity have different intracellular Ca(2+) ([Ca(2+)](i)) transients, Ca(2+) sparks and responses to isoproterenol and ryanodine receptor modulators (magnesium and FK506) than do PV cardiomyocytes without spontaneous activity and left atrial (LA) cardiomyocytes. Through fluorescence and confocal microscopy, we evaluated the [Ca(2+)](i) transients and Ca(2+) sparks in isolated rabbit PV and LA cardiomyocytes. PV cardiomyocytes with spontaneous activity had larger [Ca(2+)](i) transients and sarcoplasmic reticulum (SR) Ca(2+) stores than PV cardiomyocytes without spontaneous activity or LA cardiomyocytes. PV cardiomyocytes with spontaneous activity also had a higher incidence and frequency of Ca(2+) sparks, and had Ca(2+) sparks with larger amplitudes than other cardiomyocytes. Magnesium (5.4 mM) reduced the [Ca(2+)](i) transient amplitude and beating rate in PV cardiomyocytes with spontaneous activity. However, in contrast with other cardiomyocytes, low doses (1.8 mM) of magnesium did not reduce the [Ca(2+)](i) transients amplitude in PV cardiomyocytes with spontaneous activity. FK506 (1 microM) diminished the SR Ca(2+) stores in PV cardiomyocytes with spontaneous activity to a lesser extent than that in other cardiomyocytes. Isoproterenol (10 nM) increased the [Ca(2+)](i) transient amplitude to a lesser extent in LA cardiomyocytes than in PV cardiomyocytes with or without spontaneous activity. In conclusion, our results suggest that enhanced [Ca(2+)](i) transients, increased Ca(2+) sparks and SR Ca(2+) stores may contribute to the spontaneous activity of PV cardiomyocytes.