Involvement of Na^+ / Ca^{2+} exchanger in the spontaneous Ca^{2+} Transients of Guinea-Pig Pulmonary Vein Cardiomyocytes

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Pulmonary veins contain a myocardial layer, whose electrical activity is considered to be involved in the genesis and maintenance of atrial fibrillation.

To obtain insight into the automaticity of the pulmonary vein myocardium, we studied the spatio-temporal pattern of the rise in Ca^{2+} during the early phase Ca^{2+} transient of the isolated guinea pig pulmonary vein cardiomyocytes were studied with confocal microscopy.

On induction of Ca^{2+} transients by electrical field stimulation of the pulmonary vein cardiomyocytes, the rise in Ca^{2+} concentration first occurred at the subsarcolemmal region and then spread to the cell interior; this phenomenon was similar to that of atrial but not ventricular cardiomyocytes.

In pulmonary vein cardiomyocytes showing spontaneous activity, the Ca^{2+} transients were preceded by increased firing of Ca^{2+} sparks, which means Ca^{2+} release from sarcoplasmic reticulum. SEA0400, an inhibitor of the Na^+/Ca^{2+} exchanger, decreased the frequency of the Ca^{2+} transients and eventually inhibited the Ca^{2+} transients completely without decreasing the firing of Ca^{2+} sparks.

In conclusion, the guinea-pig pulmonary vein myocardium has a tendency to show spontaneous electrical activity, which is mediated by Ca^{2+} released from the sarcoplasmic reticulum and the resulting activation of the Na^+/Ca^{2+} exchanger.