Effects of Voltage-Sensitive Dye di-4-ANEPPS on Isolated Rat Heart Electrogram

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Although the classical suction microelectrodes are still considered golden standard for recording of monophasic action potentials, there are various new methods enabling to record electrical changes from small area on the heart surface. One of them is recording of cardiac electrical activity using voltage-sensitive dyes (VSDs) by optical method. VSDs exhibit large fluorescence and/or absorption changes that vary with changes of the membrane potential. Staining of the heart with the dye should not result in pharmacological or toxic effects to the preparation. Data about response of the heart to staining with VSD are scarce. In order to determine this response in classical biomodel in basic cardiology, we followed arrythmia-preceding parameters in isolated rat heart electrogram during staining with VSD di-4-ANEPPS and washout periods. Three Wistar rats were included in this study. Each experiment consisted of heart isolation, control perfusion, staining and washout. The isolated hearts were perfused according to Langendorff at constant pressure (80mmHg) with Krebs-Henseleit solution (37C, 1.25mM Ca2+). During the experiment, electrogram by touch-less method was recorded. Off-line analysis comprised assessment of RR interval, QT interval and QTc interval. All parameters were normalized to the end of control. The type and incidence of arrhythmias were evaluated and the hearts were assigned Lambeth score (expressing severity of arrhythmias). Perfusion with di-4-ANEPPS caused specific changes of electrograms in all examined hearts. AV-blockades and single ventricular extrasystoles were observed during staining and disappeared during washout. Two hearts reached score 1 during staining. Normalized RR interval lengthened at the beginning of staining, then gradually decreased and restored during washout. QT and QTc interval slightly prolonged during staining and a recovery was observed in washout. We conclude that VSD triggered certain electrophysiological changes in rat isolated hearts and that these changes were insignificant and mostly reversible. Supported by GACR 102/07/1473 and MSM 0021622402.