Comparison of Voltage-Sensitive Dye di-4-ANEPPS Effects in Isolated Hearts of Rat, Guinea Pig and Rabbit

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Voltage sensitive dyes (VSDs) are used for recording of monophasic action potentials (MAPs) by optical method in cardiac preparations. Their direct influence on myocardium is not completely known. Previously we studied electrophysiological changes caused by VSD di-4-ANEPPS during staining and washout in guinea pig and rabbit hearts. However, often used animal in basic cardiology studies is rat. Therefore we decided to compare the electrophysiological effects of VSD in isolated hearts from the two abovementioned species and from Wistar rats. The hearts were perfused according to Langendorff at constant pressure (80mmHg) with Krebs-Henseleit solution (37C, 1.25mM Ca2+). Each experiment consisted of heart isolation, control perfusion, staining with VSD and washout. Touch-less 3D-electrogram was recorded, the heart rate (HR) was assessed and normalized to the end of control. The type and incidence of arrhythmias were evaluated and the hearts were assigned s.-c. Lambeth score (expressing severity of arrhythmias). Normalized HR decreased in all hearts ($p<0.01$ vs. control). During staining, this decrease was least steep in rabbit, then successively in rat and in guinea pig hearts. During washout, the highest degree of recovery was observed in rat hearts. The severity and incidence of arrhythmias did not differ significantly when rabbit and guinea pig hearts were compared. In rat, no arrhythmias appeared during staining and only one heart reached score 1 during washout (e.g. very low incidence of nonsignificant rhythm disturbances). Although the procedure of staining with the dye affects electrophysiological properties of the myocardium in all tested species, rat heart may be considered to be the most suitable for electrophysiological studies using di-4-ANEPPS. However, rat myocardium differs markedly from the human one. In order to advance towards clinically applicable research, the rabbit myocardium should be employed in such studies as the second choice. Supported by GACR 102/07/1473 and MSM 0021622402.