

Effect of Neuropeptide Y on Action Potential Generation in Working Cardiomyocytes of the Right Atrium in Rat Heart

A. A. Zverev¹, T. A. Anikina¹, N. G. Iskakov¹, A. L. Zefirov²,
and T. L. Zefirov¹

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We studied the effect of neuropeptide Y in concentrations of 10^{-8} - 10^{-6} M on electrical activity of adult rat right atrial cardiomyocytes with preserved spontaneous activity. Neuropeptide Y was found to modulate the amplitude-time parameters of action potential: in concentrations of 10^{-7} and 10^{-6} M it reduced the membrane potential, increased the amplitude of action potential and duration of the repolarization phase, and reduced the frequency of action potential generation. In concentration of 10^{-6} M, neuropeptide Y produced stronger effect on the analyzed parameters, while in concentration of 10^{-8} M it produced no significant changes.

Key Words: *neuropeptide Y; action potential; membrane potential; cardiomyocytes; rat*

Neuropeptide Y (NPY) and its receptors are involved in various functions of the cardiovascular system. NPY affects HR, heart force, vascular tone, and produces trophic effects promoting proliferation of the myocardium cells, blood vessels, and adipose tissue [11]. Addition of NPY induces a 2-fold increase in the intracellular calcium concentration in working cardiomyocytes [11].

NPY is considered as the main co-transmitter of the sympathetic nervous system [1]. NPY is stored in synaptic vesicles of nerve endings and is released after electrical stimulation, acting through specific receptors. NPY acts through 6 known receptors (Y1-Y6) and is the most common neuropeptide in the heart [4,6,8,9]. All NPY receptors are metabotropic and their activity is mediated by G proteins: G_i , G_s , and G_{so} . All effects in the heart are mediated by activation of Y1, Y2, and Y5 receptors. NPY has been identified in the myocardium, endocardium and cardiomyocytes [9]. About $2/3$ neurons in mammalian sympathetic ganglia contain this peptide beside norepinephrine [7]. In the

heart intramural nodes, NPY was detected in the vast majority (>80%) of neurons, 100% of NPY⁺ neurons also contain acetylcholine [12]. In rats, NPYergic heart innervation is present since birth [2].

The effect of NPY was studied in isolated cardiomyocytes [10], myocardial strips [8,13], isolated hearts [5]. We have not found any research on the effect of NPY on myocardial electrical activity.

The aim of our study was to investigate the effect of NPY on the parameters of electrical activity of rat right atrial preparations with their own rhythm.

MATERIALS AND METHODS

The study was carried out on 100-day white outbred laboratory rats ($n=23$), kept under identical conditions in the vivarium of Kazan Federal University.

The thorax was opened under urethane anesthesia, heart was quickly removed, placed in a Petri dish with oxygenated working solution, and the preparation of right atrial appendage with sinoatrial node, transverse crest, and fragments of the superior and inferior vena cava was prepared. The preparation was placed in a perfusion chamber with thermostated ($37\pm 1^\circ\text{C}$) solution (in mmol/liter): 129 NaCl, 4 KCl, 1.2 CaCl_2 , 0.5 MgSO_4 , 20.9 NaH_2PO_4 , 20 NaHCO_3 , and 5 glucose (95% O_2 and 5% CO_2). To maintain pH within 7.3-7.4,

¹Department of Human Anatomy, Physiology, and Health Protection, Kazan (Volga Region) Federal University; ²Department of Normal Physiology, Kazan State Medical University of Ministry of Health of Russia, Kazan, Tatarstan Republic, Russia. *Address for correspondence:* alekcei5@rambler.ru. A. A. Zverev