

EFFECT OF DOPA ON BIOCHEMICAL CHANGES IN THE MYOCARDIUM FOLLOWING ELECTRICAL STIMULATION OF THE AORTIC ARCH

N. A. Novikova, V. B. Isachenko,
K. G. Lakhina, and V. A. Kovaleva

UDC 616.127-003.8-092.9-085.31:547.
583.5]-07:616.127-008.9-074

The effect of DOPA on the development of neurogenic myocardial degeneration after electrical stimulation of the reflexogenic zone of the aortic arch was studied. The results showed that stimulation of the aortic arch leads to exhaustion of the noradrenalin content, to an increase in the lactic acid level in the heart muscle, and to a decrease in the voltage of the T wave of the ECG. Administration of DOPA prevents these changes.

The development of neurogenic degeneration is accompanied by depletion of the tissue catecholamine reserves, leading to disturbance of metabolism and subsequent structural changes in the organs [1]. Extremal stimulation of the aortic arch leads to the development of myocardial degeneration after 48 h [3]. In the early stages after electrical stimulation of the aortic arch for 3 h, exhaustion of the catecholamine reserves is observed in the myocardial tissues [6], and these are accompanied by changes in some parameters of carbohydrate metabolism, indicating intensification of the anaerobic phase of glycogen breakdown [7, 8].

The noradrenalin precursor DOPA prevents exhaustion of the catecholamines in organs produced by extremal stimulation [9] and prevents the development of neurogenic degeneration of the liver and stomach [2, 5].

In this investigation the effect of DOPA was studied on the character of the ECG and on the noradrenalin and lactic acid concentrations in the heart muscle after electrical stimulation of the aortic arch.

EXPERIMENTAL METHOD

Experiments were carried out on 20 male rats weighing 230-280 g. The reflexogenic zone of the aortic arch was stimulated by means of a special electrode inserted through the right common carotid artery [3]. The ECG of all the rats was recorded on the EKSP4-3 electrocardiograph in standard lead II (tape winding speed 100 mm/sec, sensitivity of the apparatus 10 mm/mV) before and immediately after stimulation for 3 h. Immediately after the end of the experiment the lactic acid concentration (by the method of Barker and Summerson) and the noradrenalin level in the myocardium [4] were determined. Ten rats were subjected to electrical stimulation only. Another group of ten rats received

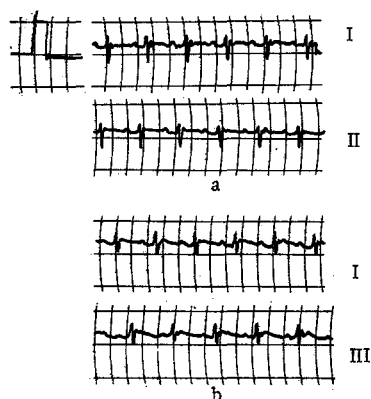


Fig. 1. ECG of rats before and after electrical stimulation of the aortic arch: a) rat No. 1, b) rat No. 2. I) Before stimulation, II) after stimulation for 3 h, III) DOPA given before and during stimulation

Laboratory of Experimental Pharmacology, Department of Pharmacology, Institute of Experimental Medicine, Academy of Medical Sciences of the USSR, Leningrad. (Presented by Academician of the Academy of Medical Sciences of the USSR S. V. Anichkov.) Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 77, No. 3, pp. 81-82, March, 1974. Original article submitted March 26, 1973.

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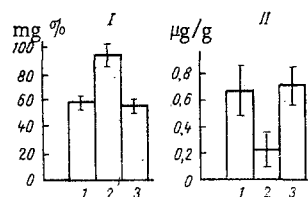


Fig. 2. Lactic acid (I) and noradrenalin (II) levels in myocardial tissue after electrical stimulation of the rat aortic arch for 3 h: 1) control; 2) stimulation; 3) DOPA + stimulation. Values of $M \pm m$ shown.

intraperitoneal injections of DOPA in doses of 10 mg/kg before and 1 h after the end of stimulation for 3 h. The intact rats acted as the control.

EXPERIMENTAL RESULTS

Immediately after stimulation for 3 h a marked decrease in voltage of the T wave was observed on the ECG (Fig. 1) and the S-T interval was displaced toward the isoelectric line. Simultaneously with the changes on the ECG, the lactic acid level was raised (Fig. 2). Meanwhile, the nonadrenelin concentration in the myocardium was sharply reduced. Insertion of the electrodes into the aortic arch did not itself alter the parameters studied.

Injection of DOPA prevented the decrease in voltage of the T wave (Fig. 1) and the changes in concentration of lactic acid and noradrenalin in the myocardium (Fig. 2). The results thus confirm the view that the sympathetic nervous system and catecholamines play a role in the development of neurogenic myocardial degeneration.

LITERATURE CITED

1. S. V. Anichkov, I. S. Zavodskaya, E. V. Moreva, et al., Neurogenic Dystrophies and their Pharmacotherapy [in Russian], Leningrad (1969).
2. S. V. Anichkov and V. V. Korkhov, in: Neurotrophic and Dystrophic Effects [in Russian], Kiev (1969), p. 19.
3. Z. I. Vedeneeva, Kardiologiya, No. 6, 58 (1964).
4. V. A. Govyrin, in: Adrenalin and Noradrenalin [in Russian], Moscow (1964), p. 282.
5. O. N. Zabrodin, Byull. Éksperim. Biol. i Med., No. 7, 58 (1970).
6. I. S. Zavodskaya and E. V. Moreva, Kardiologiya, No. 7, 73 (1968).
7. V. B. Isachenko and N. A. Novikova, in: Problems in the Pharmacology of Neurotrophic Drugs (Abstracts of Proceedings of a Conference) [in Russian], Riga (1971), p. 153.
8. V. B. Isachenko and N. A. Novikova, Byull. Éksperim. Biol. i Med., No. 4, 47 (1972).
9. S. V. Anichkov, I. S. Zavodskaya, E. V. Moreva, et al., in: Peptic Ulcer, Lippincott, New York (1971), p. 307.