

EFFECT OF ASCARID TOXIN ON EXCITABILITY OF INTESTINAL CHEMOCEPTORS

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We have shown in an earlier paper [9] that contact of chemoceptors with helminthic toxins causes reflex changes in blood pressure, respiration, and other processes.

The object of the present research was to ascertain whether the physiological properties of interoceptors are affected by contact with helminthic toxins.

EXPERIMENTAL METHODS

We performed 22 experiments on cats under urethane narcosis. We studied reflex changes in blood pressure and respiration following stimulation of intestinal receptors with acetylcholine and carbon dioxide, before and after injecting ascarid toxin into the intestinal blood vessels. For this purpose, an intestinal loop isolated from the systemic circulation was prepared. An aqueous extract of *Ascaris suum* was prepared by E. N. Pavlovsky's procedure, and 1 ml of extract, diluted from ten- to a thousand-fold, was injected into the appropriate vessel. In using aqueous extracts of the worms we realized that these were not fully equivalent to the isolated helminthotoxins. It is, however, generally accepted that the extracts have a similar composition to the products of digestion of the worms in the intestine of the host. Stimulation with carbon dioxide was achieved by changing the perfusion fluid to Ringer-Locke solution saturated with CO₂. Acetylcholine solution was injected into the intestinal vessels.

EXPERIMENTAL RESULTS

The first series of experiments dealt with alterations in the reaction to carbon dioxide. The following findings emerged. Before treatment with ascarid extract, carbon dioxide produced its usual effect, viz., reflex rise in arterial pressure and in respiration. After the extract had been applied, the same concentration of carbon dioxide produced the opposite effect, viz., fall in blood pressure and depression of respiration (see Figure); in some of the experiments this change did not appear immediately after introduction of the extract. At first, we observed only weakening or disappearance of the reflexes, or a diphasic pressor-depressor reaction, and this was followed by fall in blood pressure and depression of respiration. The normal reaction to CO₂ could not be restored by prolonged perfusion with Ringer-Locke solution, for 2-3 hours.

In the second series of experiments we studied the effects on the reflex reactions to acetylcholine (at dilutions of 1×10^{-3} to 1×10^{-5}) after introduction of ascarid extracts.

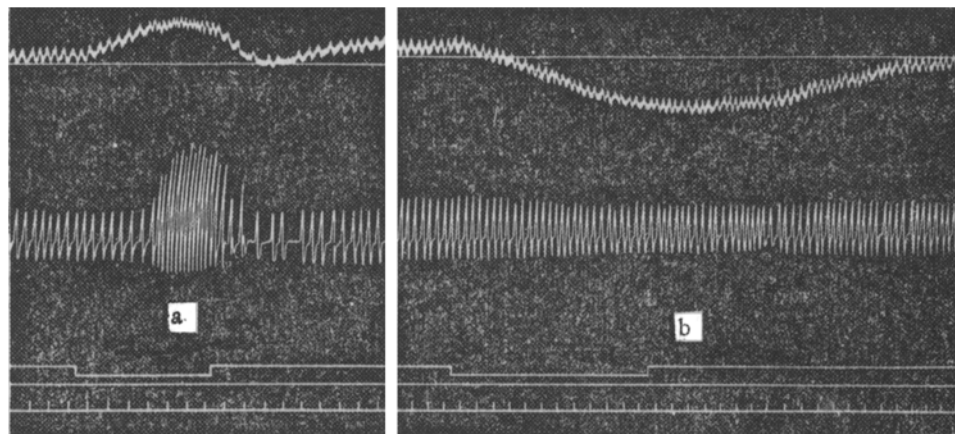
These experiments showed that stimulation of the chemoceptors with acetylcholine after exposure to ascarid toxin gave heightened blood pressure and respiration reflexes. In addition to this effect, we observed in some of the experiments a change in the nature of the reflexes: instead of a monophasic pressor reaction, we found a diphasic pressor-depressor reflex.

Thus all our experiments showed that the effect of toxic ascarid constituents on the chemoceptors of the intestinal blood vessels was to change the degree and the nature of reflex reactions of the vasomotor and respiratory centers to such stimuli as carbon dioxide and acetylcholine.

Alterations of reflexes from intestinal chemoceptors have been reported by a number of authors for various experimental conditions (V. N. Chernigovsky [8], V. A. Lebedeva and V. N. Chernigovsky [6], M. A. Erzin [1], V. A. Lebedeva [2, 3, 4, 5], F. A. Levtova [7], and others).

According to these authors, the alterations in the excitability of the chemoceptors are connected with primary reactions of nerve endings to disturbances of metabolism of the organ.

V. A. Lebedeva concluded, from her numerous researches, that the depressor response to carbon dioxide found under conditions of impaired metabolism should be regarded as a consequence of enhanced excitability of the receptors. In our experiments poisoning with ascaris extracts caused a depressor reflex response to hypercapnic Ringer-Locke solution, and an intensified response to stimulation with acetylcholine. It follows that in both series of experiments the excitability of the chemoreceptors of the intestinal blood vessels was raised, as a result of the toxic action of the ascaris extractives. It may be supposed that the helminthic toxins provoke a profound disturbance of the metabolism of the intestinal cells.



Changes in reflex blood pressure and respiration responses to stimulation of intestinal chemoreceptors with carbon dioxide (A) before, and (B) after, action of ascaris extract. Explanation of tracings (from above down): blood pressure (mercury manometer), initial blood pressure level, respiration, stimulation signal, zero level of the manometer, time marker (5 second intervals).

We shall in our future researches examine the effects of helminthic toxins on the metabolism of the tissues of the receptor field.

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