THE MECHANISM OF INTOXICATION IN DYSENTERY

COMMUNICATION 2. THE EFFECT OF DYSENTERY TOXIN AND ANATOXIN ON INTESTINAL RECEPTORS

I. P. Myagkaya

Laboratory of Receptor Physiology (Chief — Active Member AMS USSR V. N. Chernigovsky), Laboratory of Pathologic Physiology (Chief — Professor V. S. Galkin), the I. P. Pavlov Institute of Physiology, AS USSR (Director — Academician K. M. Bykov) and Department of Preliminary Instruction in Internal Diseases, the 1st I. P. Pavlov Medical Institute, Leningrad (Director — Active Member AMS USSR M. D. Tushinsky)

(Received October 4, 1956. Presented by Active Member Acad. Med. Sci. USSR M. D. Tushinsky)

The results of experiments described in the first communication [1] showed that the action of the Shiga dysentery toxin on the mucosa of a perfused section of the intestine of an animal poisoned with the same toxin produced changes in the intensity of reflexes from intestinal chemoreceptors.

It remained unclear whether these changes were caused by the action of the toxic group of the toxin or by enhanced sensitivity to its antigenic group. The present work is concerned with elucidation of these questions.

EXPERIMENTAL METHODS

A total of 26 experiments was carried out on cats; in 5 of these the animals had had a preliminary administration of anatoxin, in 15 the animals were in a state of dysentery intoxication and in 6 the animals had been immunized by dysentery toxin 3 days prior to the experiment. Anatoxin was prepared by addition of formalin to the toxin used.

In the first series of experiments the animals received anatoxin subcutaneously (24 hours prior to the experiment) in doses corresponding to 20 lethal mouse doses per 1 kg body weight. In one experiment the dose of anatoxin corresponded to 40 lethal doses of toxin per 1 kg weight.

Two groups of animals were used in the second series of experiments. The first group (6 experiments) was given toxin subcutaneously 4-6 hours prior to the experiment, the second group (9 experiments) was given the toxin subcutaneously 24 hours prior to the experiment.

The third series of experiments was performed on animals which had been immunized by five administrations of anatoxin at 5 day intervals and in amounts corresponding to 60 lethal doses of the toxin (14-17 lethal doses per 1 kg body weight). Fourteen days after the last dose of anatoxin the animals were given 30 lethal doses of toxin subcutaneously on two consecutive days (a total of 14-17 lethal doses per 1 kg body weight). A critical experiment was performed on the fourth day.

As in the previous experiments, perfusion of an intestinal loop was used in the present work. The toxin and anatoxin were introduced into the lumen of the perfused segment of the intestine.

The order of experimental procedures remained as before [1].
EXPERIMENTAL RESULTS

In all the 5 experiments of the first series introduction of anatoxin into the lumen of the intestine exerted no effect on the pressor reactions elicited by subsequent introduction of nicotine into the vessels.

In four experiments introduction of anatoxin was followed by application of toxin to the intestinal mucosa. In one of these experiments a slight increase in the reflex blood pressure reaction was noted (a rise of 2 mm of Hg). In the remaining experiments the reflexes were unchanged. Increase of arterial blood pressure was elicited in these experiments, as in the case of healthy animals, by the addition of 1 ml nicotine in dilution $1 \times 10^{-8}$ (1 γ) to the perfusion fluid.

At autopsy no changes were found in the internal organs.

Figure 1 shows the kymograms of one of these experiments. The initial stimulation of the intestinal loop receptors by nicotine (4 γ) gave rise to an increase in arterial blood pressure equal to 8 mm Hg. Introduction of anatoxin (1) into the intestinal lumen did not cause a rise in blood pressure or stimulation of respiration. The magnitude of reflexes to nicotine following introduction of anatoxin remained as before: 6-8 mm Hg (b). Reflexes of the same magnitude were obtained in the course of 52 minutes following introduction of the anatoxin.

Fig. 1. Reflex reactions in a cat in experiment with preliminary administration of anatoxin in dose corresponding to 18 doses lethal for mouse per 1 kg body weight. Records from top down: arterial blood pressure, initial level of arterial blood pressure, respiration, base line of manometer, stimulus marker, time marker (2 seconds).


Application of toxin to the intestinal mucosa ([3]) caused no change in the magnitude of reflex blood pressure and respiration reactions.

It could thus be concluded, on the basis of this series of experiments, that introduction of anatoxin as well as of toxin into the intestinal lumen of animals which had previously received anatoxin did not lead to changes in pressor reactions of arterial blood pressure in response to introduction of nicotine into the vessels.

Consequently, these changes which were obtained when toxin was given to animals which had been previously given the same toxin subcutaneously were caused by the state of dysentery intoxication and not by the action of the antigen group of the toxin.