THE EFFECT OF STAPHYLOCOCCAL ENTEROTOXIN ON GASTRIC AND INTESTINAL MOTILITY

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In recent years, considerable success has been achieved in the study of staphylococcal enterotoxin. However, the mode of action of the toxin has been comparatively little investigated.

J. Lavergne, J. C. Burdin and J. Sommelet [4] concluded from experiments on two cats that there was no sympa thotropic action.

M. Bayliss [3] suggested that the direct action of the toxin on the peripheral nervous system was of considerably greater importance in the etiology of vomiting than was any direct action on the vomiting center.

J. Richmond and C. Reed [5], in their experiments on isolated sections of rabbit intestine, concluded that the staphylococcal enterotoxin exerts a direct action on the smooth muscle of the intestine.

Our observations were made on cats, kittens, and puppies which were given filtered extracts of the toxin intravenously, per os, and intraperitoneally; this caused gastrointestinal disturbance (diarrhea and vomiting) as well as central nervous effects (staggering gait, tremor, convulsions).

These observations were our starting point in the investigation of the mode of action of enterotoxin filtrates. We therefore carried out several experiments on adult cats under urethane anesthesia and with no interference to the nervous connections. Altogether, we investigated 51 cats varying in weight from 2,200 to 4,000 grams.

Filtrates of the enterotoxin were taken from staphylococcal strains which were effective in producing the gastrointestinal syndrome in cats, kittens and puppies.

EXPERIMENTAL METHODS

The method of preparing the enterotoxin filtrate was as follows. A 24-hour agar culture of the staphylococcus, known to produce the enterotoxin, was transplanted to a nutrient medium and incubated in a thermostat for three days. An amount of CO₂ equal to 25-30% of the volume of the vessel was introduced daily. On the fourth day the culture was filtered through a sterile Whatman filter. In order to destroy the thermolabile hemolysin, the lethal filtrate of the toxin was heated for 30 minutes in a bath of boiling water. In order to exclude any effect of the nutritive medium, we carried out a control experiment in each group, using uninfected medium.

In the first experiments, we studied the effects of the filtrates on the gastrointestinal motility of the cat in situ.
The experiments were carried out as follows (using the principle of N. P. Nikolaev as modified by the department of Pharmacology of the Lvov Medical Institute). A laparotomy was performed under urethane anesthesia. After we cut the omentum and placed ligatures on the greater curvature of the stomach, small, and large intestines, we introduced a glass cylinder (13 cm long and 7 cm in diameter, open at both ends) into the peritoneal cavity. The cylinder was held in a vertical position in a holder, and 100-150 ml of Ringer-Locke solution heated to 38-39°C was poured through its upper end into the peritoneal cavity. Each of the three ligatures from the stomach, small, and large intestine were brought to the outside and connected to the recording system. The contractions were recorded on ordinary paper by a glass ink recorder attached to levers.

After recording the normal contractions of the stomach and intestines, 2 ml per 1 kg of the filtrate were given intravenously, but the amount was not allowed to exceed 6 ml.

**Experimental Results**

Twenty-one experiments on the effect of staphylococcal enterotoxin filtrates on gastric and intestinal motility were carried out. A record was made of the changes in motility of the stomach and intestine as affected by the staphylococcal enterotoxin filtrate. Injection of the filtrate caused an increase in gastrointestinal activity.

**Fig. 1.** The effect of staphylococcal enterotoxin filtrate (strain No. 1594) on the motility of stomach and intestine in the cat. Shows increase in contractions and tone.

The effect on both tone and rate of contraction is shown in Fig. 1.

In six control experiments with filtrates from uninfected media and from nontoxic strains of staphylococcus, there was no effect on the motility of the stomach or small intestine. In the experiments on the effect of the medium, there was a reduction in tone of the large intestine, and in two experiments the gastric tone was also reduced.

Having established the effect of the filtrate on the motility of the gastrointestinal tract, we then studied its action on the stomach and intestine after their motility had already been reduced by other means. For this purpose we used adrenalin, atropine, and papaverine.

After the motility of the intestine had been reduced in this way, the enterotoxin filtrate was given intravenously. Altogether, 17 experiments were carried out.

In adrenalin-treated animals, intravenous injections of enterotoxin filtrate caused an increase in tone of all parts of the gastrointestinal tract. There was an increase in the motility of the small and large intestine. In animals which had been treated with papaverine, there was a small increase in tone of all parts after enterotoxin filtrate was given. After atropine administration, the effect of enterotoxin filtrate was much less marked. There was sometimes a small effect on the large intestine.

For a more complete investigation, we carried out experiments with enterotoxin filtrates on spinally transected animals. Seven of these experiments were performed.