

COMBINED INVESTIGATION OF GASTRIC AND INTESTINAL FUNCTION IN EXPERIMENTAL PLEURO-PNEUMONIA

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Long-term experiments on seven dogs showed that the secretory, motor, and absorptive functions of the stomach and intestine are simultaneously disturbed in experimental pleuro-pneumonia. As a rule the secretory and motor disturbances were more severe in the stomach and the disturbances of absorption more severe in the intestine. Gastric functions were restored on the 23rd-40th day, intestinal functions were restored on the 26th-39th day, and clinical recovery took place on the 8th-10th day after the onset of the disease.

A close functional connection between the respiratory and digestive organs under normal and pathological conditions has been demonstrated experimentally [1-8]. The writer's studies of gastric and intestinal function, undertaken on various animals, have shown that the activity of both organs is disturbed when the lungs and pleura are affected by inflammatory conditions.

This paper describes the results of a combined investigation of gastric and intestinal functions in dogs with experimental pleuropneumonia.

EXPERIMENTAL METHOD

Experiments were carried out on seven dogs with gastric fistulas and with Thiry and Thiry-Vells isolated loops of the jejunum. Three of the dogs also had isolated gastric pouches of the Pavlov type.

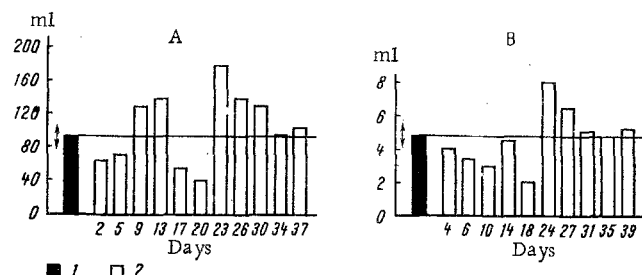


Fig. 1. Changes in secretory function of stomach and intestine in the dog Zor'ka, with experimental pleuro-pneumonia: A) volume of gastric juice during 3 h of experiment; B) volume of intestinal juice during 2 h of experiment; 1) normal (mean results of 5 control experiments); 2) on different days of the disease. Arrow indicates limits of variations in volumes of gastric and intestinal juice in control experiments.

Parallel studies were made of the secretory, motor, and absorptive functions of the stomach and intestine of each dog. Gastric secretion was stimulated by meat, and intestinal stimulation mechanically. The volumes of gastric and intestinal juices were measured, and the acidity, digestive power, and pepsin content of hourly samples were determined. Absorptive power was estimated relative to glucose. The intensity of absorption was determined refractometrically. Gastric and intestinal movements were recorded graphically by a balloon method.

Pleuropneumonia was produced by injection of 5% silver nitrate solution into the pleural cavity. The presence of the disease was confirmed by clinical, hematologic, roentgenologic, morbid anatomical, and histological investigations.

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EXPERIMENTAL RESULTS

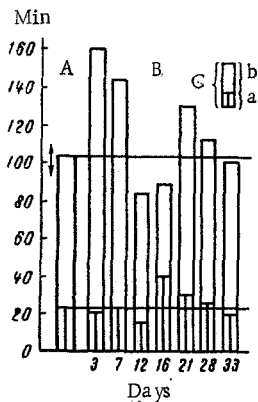


Fig. 2. Periodic gastric movements in the dog Zor'ka: under normal conditions (A), and on various days after onset of pleuropneumonia (B). a) Period of contraction; b) period of rest; c) total period. Arrow indicates limits of variations of total period in control experiments.

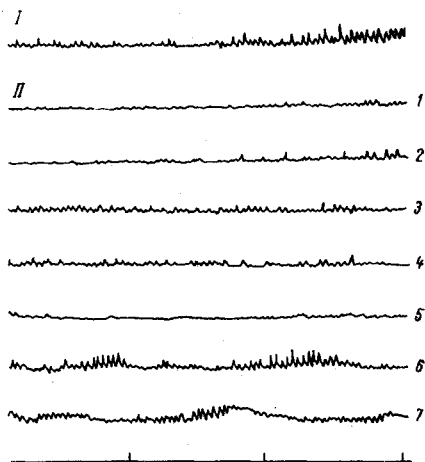


Fig. 3. Character of contractions of small intestine in the dog Zor'ka: I) in control experiments; II) in pleuropneumonia; 1-7) on the 3rd, 7th, 12th, 16th, 21st, 28th, and 33rd days, respectively, after onset of disease. Time marker 2 min.

absorption in the intestine fell from 60.8 ± 2.2 to $42.2 \pm 3.3\%$ ($P < 0.001$). In a third dog, absorption in the stomach and also in the intestine was lowered on some days of the experiment and raised on others. Normal intestinal absorption was restored a few days later than normal gastric absorption. In the dog Zhulik, for example, absorption in the stomach reached its initial level on the 26th day, and in the intestine not until the 33rd day.

Parallel investigation of the gastric and intestinal movements showed that during pleuropneumonia in the same animal motor disturbances developed concurrently but followed a different course. The disturbances of periodic gastric movements consisted of changes in the relationship between periods of rest and of contraction, changes in their durations and in the duration of the total period ("resting" + "hunger"

During the first few days of the disease the latent period of gastric secretion was increased, while that of intestinal secretion was sometimes increased and sometimes decreased. Secretion itself was considerably disturbed. The character of these disturbances varied. Whereas the gastric secretory activity of most animals showed definite fluctuations, and hyposecretion alternated with hypersecretion, hyposecretion was more characteristic of the intestine. In control experiments on the dogs Pantera and Zor'ka, for instance, during a 3-h period the mean volume of gastric juice secreted was 110 ± 4.5 ml. During the disease, the volume of gastric juice was 80 ± 9.5 ml on the 2nd-5th day ($P < 0.01$), 153 ± 15.8 ml on the 6th-16th day ($P < 0.02$), 47 ± 12.3 ml on the 17th-23rd day ($P < 0.001$), and 169 ± 28.6 ml on the 24th-36th day ($P < 0.05$), respectively.

The composition of the gastric juice also was changed. The content of free hydrochloric acid was reduced on some days of the experiment and increased on others. The pepsin content and digestive power of the juice likewise fluctuated, but their predominant change was a decrease. In control experiments, during the 1st hour of secretion the pepsin output was between 1990 and 2500 units, and the digestive power of the juice between 5 and 6.5 mm. In pleuropneumonia the pepsin output was reduced to 360-400 units, and the digestive power to 3-4 mm.

The secretory activity of the intestine was considerably reduced in these dogs. Between the 2nd and 23rd days after the onset of the disease, in an experiment lasting 2 h only 3 ± 0.3 ml of intestinal juice was secreted, compared with 4.6 ± 0.2 ml in the control ($P < 0.001$). Intestinal secretion was restored in one dog on the 31st and in the other on the 39th day, and gastric secretion on the 34th-40th day after the onset of the disease, clinical recovery having occurred on the 8th-10th day (Fig. 1).

The relationship between disturbances of secretion in the stomach and intestine was slightly different in another two dogs. Hypersecretion of the intestinal glands was predominant, and the disturbances of intestinal secretion lasted 3-5 days longer than the disturbances of gastric secretion.

The absorptive power of the two organs also was affected. In the dogs Sigma and Zhulik for example, glucose absorption in the stomach and intestine was considerably impaired during the disease. The mean level of glucose absorption in the stomach of these animals in the control experiments was $18 \pm 1.8\%$. In the period from the 2nd to the 23rd day after the beginning of the disease absorption fell to $11.7 \pm 2.2\%$ ($P < 0.001$). Glucose

contractions) (Fig. 2), and weakening of the strength of contractions. The disturbances of intestinal movements were characterized chiefly by disturbances of smooth muscle contraction, but also by changes in the strength and frequency of the rhythmic intestinal contractions (Fig. 3). As a rule the gastric movements were more severely disturbed than the intestinal movements.

On some days of the disease a decrease in the intensity of a particular aspect of function of either the stomach or intestine was accompanied by an increase in intensity of the corresponding activity of the other organ. For example, a decrease in intestinal secretion was accompanied, in several experiments, by an increase in gastric secretion, and vice versa.

These experiments thus showed that in experimental pleuropneumonia in animals both gastric and intestinal functions are simultaneously disturbed. Recovery from the disturbances of activity of these organs occurs long after the apparent clinical recovery of the animal. As a rule the motor disturbances of the stomach and intestine disappear first and the secretory disturbances last.

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