

## REFLEXES FROM THE INTESTINE ON THE LYMPH FLOW IN ONTOGENESIS

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Morphologists and physiologists have obtained valuable data in recent years concerning the innervation and functional regulation of the lymphatic system. According to the literary data [13], the reflex which causes the lymph vessels to contract is a contributory cause of edema in thrombophlebitis, since it hinders the elimination of the transudate through the lymph vessels. There are indications that the lymph circulation is disturbed in cardiac edema, that the lymph circulation plays an important part in the function of different parenchymatous organs [13] and that the lymphatic system participates in hypertonic disease [12].

The data adduced shows that the blood and lymph circulatory systems complement each other, together constituting a whole, and therefore that the physiological study of lymph circulation is of definite clinical importance.

The problem of lymph flow regulation during postnatal ontogenesis has been studied for several years at the Kazakh Medical Institute's Department of Normal Physiology. In the course of this research, we discovered certain age peculiarities in the reflex regulation of the lymph flow [1-4]. We are now experimenting to find the age peculiarities in the interoceptive reflexes on the lymph flow.

The existence of reflexes from the internal organs has been demonstrated in many works by Russian physiologists. Reflexes from the baroreceptors and chemoreceptors of the organs of the abdominal and thoracic cavities on arterial pressure and respiration have been proven to exist [17]. Interoceptive influences on the lymph flow have been established from the intestines, spleen, kidneys and kidney pelvis [8]. Reflexes from the same internal organs on venous pressure have been discovered [14-16].

There have recently been in the literature data concerning the interoceptive influences from the internal organs in ontogenesis. For example, L. E. Pal'gova [9-11] demonstrated in our laboratory the characteristics of the reflexes from the baroreceptors and chemoreceptors of the intestine, spleen and the excretory organs on arterial pressure and respiration in ontogenesis. E. I. Komarov [5-7] has described the reflexes from the mechanoreceptors and chemoreceptors of the bladder and intestine in kittens and puppies. We could find no literary information on the question of interoceptive influences on the lymph flow in ontogenesis.

This article presents the results obtained from some of our experiments with the stimulation of the intestinal mechanoreceptors in puppies of various ages to find the effect of this stimulation on the lymph flow.

### EXPERIMENTAL METHODS

In order to stimulate the intestinal mechanoreceptors, we distended the walls of an isolated intestinal loop by inflation. Intestinal inflation is the most adequate stimulation, since it is a frequent symptom of various intestinal diseases.

The experiments were conducted in the following manner. The animals were fixed to the operating table under ether anesthesia, and we operated to produce a fistula of the thoracic duct. Without dwelling on the details

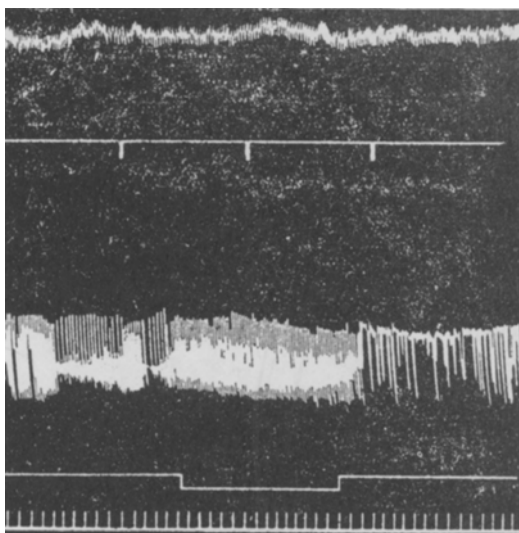


Fig. 1. Change in the lymph flow in an experiment on a puppy 10 days old. Curves (from the top to bottom) show: arterial pressure, lymph flow, respiration, indication of stimulation, indication of time (in 3 second marks).

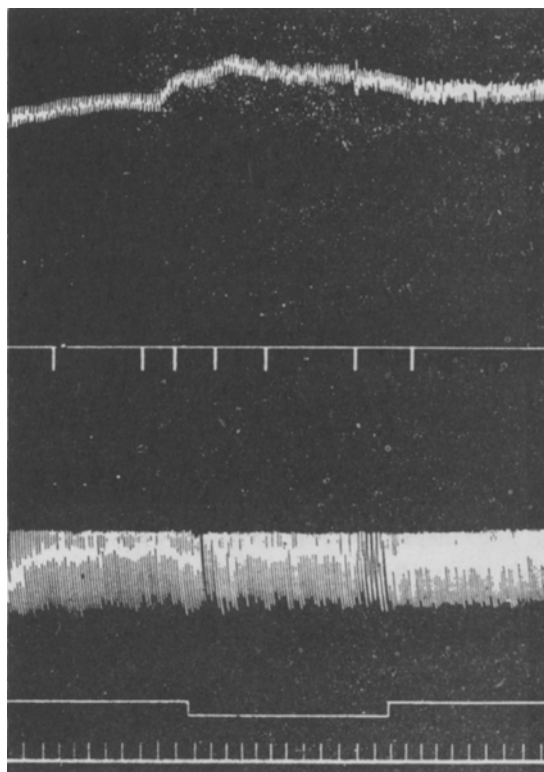


Fig. 2. Change in the lymph flow in an experiment on a puppy 14 days old. Curves are the same as in Fig. 1.

of the operation, we wish to note that it was not completed, i.e., the drainage cannula was not inserted, so that the lymph was not discharged in vain. After the anesthesia had passed, we ligated the carotid artery and inserted a cannula in the trachea. Then the abdominal cavity was opened by means of a small incision, and a loop of the small intestine withdrawn. A section of the intestine 10-15 cm long was excised between two ligatures, so that its only connection with the body was the neurovascular plexus which passes into the mesentery. Air was fed into the intestinal lumen through a cannula attached at one end of the isolated intestinal loop and connected by a rubber tube to a balloon. The amount of pressure produced was regulated by a mercury manometer. The intestinal loop was wrapped with gauze, which was moistened from time to time with a warm physiological solution. Then the jugular vein was dissected out in the region where the thoracic duct empties into it, and a cannula was inserted into the vein.

We recorded the lymph flow, arterial pressure, respiration, periods of stimulation and the time in 3-second intervals while the intestinal mechanoreceptors were being stimulated in this way by inflation.

#### EXPERIMENTAL RESULTS

We conducted 112 experiments on 30 puppies of varying ages. Inflation of the isolated intestinal loop with a pressure of 50-80 mm of mercury did not cause any pronounced changes in the lymph flow of puppies aged up to 14-16 days; in some cases, the lymph flow was even observed to decrease. There were various changes in the respiration of these puppies; the respiratory movements became either faster and deeper or slower and deeper. No great changes were observed in the arterial pressure. Sometimes a slight increase was observed (Fig. 1). In puppies aged 14-16 days or more, the same stimulation caused a pronounced increase in the lymph flow on a background of the same respiratory changes. There was a slight, gradual increase in arterial pressure. A pressodepressor reaction was observed in some cases (Fig. 2).

Upon analysis of the data obtained, we discovered that the change in the lymph flow depended on the age of the experimental animals. In puppies up to 2 weeks old, stimulation of the intestinal mechanoreceptors did not cause changes in the lymph flow, although there were changes

in the respiration and sometimes in the arterial pressure; if changes in the lymph flow did occur, as we observed

in some experiments, they were characterized by a decrease in the lymph flow, unlike the changes which occurred in the puppies more than 2 weeks old (we did not observe an increase in the lymph flow in any of the experiments on the younger age group). In puppies more than 2 weeks old, however, we observed an increase in the lymph flow in all the experiments, while the changes in arterial pressure and respiration were the same as in the younger age group. Moreover, the increase in the lymph flow occurred whatever the nature of the changes which occurred in the respiration and arterial pressure.

The fact that, in most of our experiments on puppies less than 2 weeks old, no changes occurred in the lymph flow in spite of the existence of functioning mechanoreceptors in the intestinal wall (shown by the blood pressure and respiratory reactions) may possibly be explained on the basis of data which we obtained earlier concerning the development of vagus reflexes on the lymph flow in growing puppies [4]. We showed that in newborn puppies, unlike mature animals, stimulation of the central and peripheral portions of the vagus nerve causes changes in the arterial pressure and respiration, but none in the lymph flow. This could indicate that the innervation of the thoracic duct is not completely developed in newborn animals.

The data presented indicate, first, that the intestinal mechanoreceptors can influence the lymph flow in puppies aged 2 weeks or more, and second, that this is a reflex type of reaction. The latter is shown by the fact that, in our experiments, the lymph flow increased in experimental animals 2 weeks old as soon as the stimulation was applied, as well as by the fact that the lymph flow did not change in animals less than 2 weeks old, although there were changes in the arterial pressure and respiration.

#### SUMMARY

Experiments were performed in 30 puppies. It was shown that the reflex regulation of lymph circulation depended on the age. Stimulation of gastric mechanoreceptors caused no change of the lymph flow in puppies up to 14 days old. However, in puppies older than 14 days increased lymph flow was noted with stimulation of the intestinal mechanoreceptors.

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