ON DEVELOPMENT OF THE LYMPH AND BLOOD OF DOGS IN THE PROTEIN COMPOSITION UNDER SOME EFFECTS ON ORGANISMS

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Abstract

Investigation of our sciences shows that the distribution of proteins is not the same for all organs and tissues of the body and in various animal species. Because we studied the protein composition of intestinal lymph and blood plasma at rest and during stimulation of mechanoreceptors in the rectum, the peripheral segment of the lumbar splanchnic and central end of the hypogastric nerves in the intact innervation and after chronic decentralization of the caudal mesenteric sympathetic ganglion (CMSG) and some more visceral nerve transection. The experiments were performed on dogs weighing from 8 up 26 kg. For stimulation of the peripheral segment of the lumbar splanchnic and hypogastric nerves of the central segment used an electronic stimulator type ISE-01 (pulse width of 2 m/s, the frequency of 20 pulses/sec, the intensity of 5-10V). Irritation of mechanoreceptors rectum is achieved by injecting air into the cylinder (150-300 ml) syringe Janet. Before, during, and after 2-5 minutes blood samples were taken from the femoral artery and the common mesenteric vein after stimulation. The concentration of total protein in the blood and lymph refract metric is determined, and the amount of protein fractions is determined by paper electrophoresis.

Thus, a comparison of the lymph and blood showed that a comparative study of the protein composition of body fluids allows us to study the quantitative changes in both the normal and the indicated effects on the body and in agreement with the literature data suggest that the lymphatic system of the intestine is involved in an adequate distribution of proteins between the blood and lymph, thereby providing fine regulation to changing internal and external environment, which once again clearly shows the close relationship between the circulatory and lymphatic systems.

Keywords: Caudal mesenteric sympathetic ganglion, electrical stimulation, lymphatic systems, mechanoreceptors rectum

Introduction

In recent years, there appeared a number of reports on the role of lymph in the distribution of proteins in the body (Gendon, 1957; Kohanina, 1965; Aynson, 1962) and influences on them by various factors (Yamamoto et al., 1998; Myrzakhanov, 1974, 1981, 1995; Potapov, 1977; Myrzakhanov et.al.,2012).

However, in the the literature we have not met the work, which would parallel study the protein composition of intestinal lymph and plasma of arterial and venous blood in dogs. Meanwhile, recent studies (Mijairi, 1970; Ainson, 1972) showed that the distribution of proteins carried out differently to all the organs and tissues of the body and in various animal species.

We studied the protein composition of intestinal lymph and blood plasma at rest and during stimulation of mechanoreceptors in the rectum, the peripheral segment of the lumbar splanchnic and central end of the hypogastric nerves in the intact innervation and after chronic decentralization of the caudal mesenteric sympathetic ganglion (CMSG) and some more visceral nerve the transection.

Materials And Methods

The experiments were performed on adult mongrel dogs weighing from 8 up 26 kg, under morfiyno-hexenal anesthesia. For stimulation of the peripheral segment of the lumbar splanchnic and hypogastric nerves of the central segment an electronic stimulator type ISE-01 (pulse width of 2 m/s, the frequency of 20 pulses/sec, and the intensity of 5 -10V) is used. Irritation of mechanoreceptors rectum is achieved by injecting air into the cylinder (150-300 ml) with syringe Janet. Before, during, and after 2-5 minutes blood samples were taken from the femoral artery and the common mesenteric vein after stimulation. The concentration of total protein in the blood and lymph is determined refract metrically, and the amount of protein fractions is determined by paper electrophoresis. Protein coefficient of blood and lymph was calculated. The total amount of tests of blood and lymph is 981. To prevent clotting of blood and lymph intravenous heparin there was administered at the rate of 206-420 ME per 1 kg of body weight of the animal.

The obtained data were processed statistically (Plohinsky, 1969; Rokitsky, 1973) and is presented in the tables.

Results

The experiments revealed that the dogs are found in the intestinal lymph of all fractions of blood plasma proteins, and the amount of protein in it is lower than in the plasma (Table 1).

Table 1

Total protein and its fractions in the lymph and blood plasma of dogs before and interoceptive exposure and electrical stimulation of certain visceral nerves in intact innervation (g%)

substrate stimulation	the amount of protein	total protein	albumins	globulin fractions			A/G coefficient
Mechanoreceptors rectum	1	3,27±0,13	1,74±0,09	0,60±0,05	0,67±0,05	0,28±0,01	1,07
	2	3,73±0,15	2,12±0,10	0,56±0,04	0,70±0,06	0,29±0,08	1,40
	3	3,64±0,17	2,07±0,13	0,55±0,05	0,77±0,06	0,33±0,02	1,17
Peripheral segment of the lumbar splanchnic nerve	1	3,44±0,11	1,70±0,09	0,63±0,07	0,84±0,09	0,27±0,07	1,10
	2	4,02±0,11	2,47±0,11	0,77±0,07	0,87±0,06	0,34±0,03	1,28
	3	3,78±0,10	2,20±0,10	0,67±0,04	0,90±0,07	0,31±0,03	1,22
The central segment of hypogastric nerve	1	3,37±0,08	1,50±0,07	0,49±0,05	0,68±0,05	0,31±0,04	1,04
	2	3,66±0,11	1,80±0,14	0,67±0,08	0,73±0,07	0,49±0,08	1,00
	3	3,50±0,09	1,80±0,15	0,47±0,03	0,60±0,04	0,33±0,05	1,31
In plasma, the arterial blood							
Mechanoreceptors rectum	1	6,18±0,07	3,11±0,04	1,07±0,01	1,33±0,02	0,61±0,03	1,03
	2	6,81±0,09	3,26±0,04	1,24±0,04	1,56±0,03	0,73±0,03	0,91

	3	6,22±0,09	3,09±0,05	1,08±0,03	1,37±0,04	0,79±0,06	0,99
Peripheral segment of the lumbar splanchnic nerve	1	6,28±0,15	3,19±0,09	1,12±0,03	1,41±0,03	0,55±0,02	1,03
	2	7,00±0,13	3,28±0,07	1,35±0,03	1,70±0,04	0,68±0,03	0,86
	3	6,41±0,07	3,27±0,10	1,12±0,03	1,33±0,03	0,68±0,04	1,04
The central segment of hypogastric nerve	1	6,22±0,10	3,09±0,07	1,11±0,04	1,47±0,05	0,58±0,03	0,98
	2	6,91±0,14	3,16±0,10	1,28±0,03	1,71±0,06	0,78±0,04	0,83
	3	6,47±0,12	3,20±0,11	1,14±0,15	1,45±0,04	0,71±0,03	0,96
In plasma, venous blood							
Mechanoreceptors rectum	1	5,50±0,15	2,92±0,10	0,95±0,03	1,31±0,05	0,58±0,03	1,03
	2	5,18±0,16	2,42±0,09	0,93±0,04	1,31±0,07	0,54±0,04	0,85
	3	5,98±0,10	3,00±0,05	1,02±0,02	1,39±0,02	0,64±0,02	0,98
Peripheral segment of the lumbar splanchnic nerve	1	5,84±0,15	2,97±0,08	0,98±0,02	1,29±0,05	0,60±0,02	1,04
	2	5,27±0,17	2,52±0,07	0,97±0,04	1,22±0,07	0,56±0,04	0,94
	3	5,95±0,14	2,97±0,08	1,00±0,02	1,33±0,05	0,65±0,04	1,00
The central segment of hypogastric nerve	1	6,03±0,18	3,11±0,09	1,15±0,03	1,26±0,05	0,51±0,02	1,06
	2	5,23±0,15	2,49±0,12	0,93±0,05	1,23±0,05	0,58±0,03	0,91
	3	6,23±0,21	3,13±0,11	1,16±0,02	1,35±0,07	0,59±0,01	1,00

Note to Table 1: 1 – before stimulation; 2 – at the time of stimulation; 3 – after 2-5 min. after stimulation.

The amount of protein in lymph averaged 53-55% and 56-59% of them in the plasma of arterial and venous blood, respectively, and lymph protein coefficient is slightly higher than that in plasma. However, the concentration of proteins in the intestinal lymph was less stable (range 2,00 to 4,38 g%).

After chronic decentralization CMSG (8 -10 days prior to the experiment), and some more visceral nerve the transection in the acute experiment is a noticeable decrease in the number of proteins in the blood, as if there is a "leveling" of its investigation to the indicators of of the body fluids (Table 2).

Table 2

Total protein and its fractions in the lymph and blood of dogs before and during interoceptive exposure and electrical stimulation of certain visceral nerves in chronic decentralization CMSG and additional the transection of some visceral nerves (g%)

substrate stimulation	the amount of protein	total protein	albumins	globulin fractions			A/G coefficient
Mechanoreceptors rectum	1	3,08±0,14	1,59±0,09	0,52±0,04	0,67±0,04	0,31±0,03	1,05
	2	3,94±0,18	2,18±0,14	0,61±0,05	0,75±0,06	0,38±0,03	1,26
	3	3,60±0,16	2,05±0,09	0,64±0,04	0,83±0,05	0,29±0,02	1,18
The central segment of hypogastric nerve	1	3,29±0,21	1,55±0,15	0,59±0,05	0,79±0,08	0,36±0,05	0,88
	2	4,03±0,18	2,18±0,12	0,64±0,04	0,88±0,06	0,34±0,04	1,19
	3	3,64±0,14	2,21±0,08	0,55±0,02	0,75±0,05	0,34±0,04	1,36
In plasma, the arterial blood							
Mechanoreceptors rectum	1	5,50±0,16	2,48±0,05	0,99±0,04	1,21±0,08	0,80±0,05	0,83
	2	6,01±0,14	2,68±0,09	1,11±0,08	1,36±0,09	0,85±0,09	0,81
	3	5,57±0,17	2,77±0,12	0,88±0,05	1,14±0,08	0,96±0,08	0,94
The central segment of hypogastric nerve	1	5,84±0,12	3,07±0,08	1,11±0,03	1,15±0,03	0,63±0,03	1,06
	2	6,24±0,13	2,87±0,13	0,88±0,09	1,44±0,07	1,04±0,08	0,85
	3	5,57±0,12	2,90±0,12	1,02±0,06	1,23±0,04	0,73±0,07	0,98
In plasma, venous blood							
Mechanoreceptors rectum	1	4,58±0,12	2,32±0,08	0,84±0,05	0,98±0,03	0,53±0,03	0,99
	2	4,13±0,17	2,01±0,10	0,78±0,05	0,94±0,05	0,57±0,03	0,88

	3	4,50±0,15	2,23±0,06	0,78±0,04	1,06±0,08	0,60±0,06	1,00
The central segment of hypogastric nerve	1	5,00±0,11	2,48±0,06	0,95±0,05	1,00±0,11	0,54±0,05	1,00
	2	4,55±0,12	2,27±0,06	0,81±0,04	0,98±0,02	0,55±0,04	0,97
	3	4,89±0,11	2,48±0,08	0,83±0,05	0,94±0,04	0,66±0,08	1,02

Note to Table 1: 1 – before stimulation; 2 – at the time of stimulation; 3 – after 2-5 min. after stimulation.

Interoceptive exposure from mechanoreceptors in the rectum and electrical stimulation of the peripheral segment of the lumbar splanchnic and hypogastric nerves of the central segment led to significant rebuilding in the distribution of proteins between blood and intestinal lymph. The nature of changes in the animals with intact nervous system and the animals that decentralize CMSG, and additionally some visceral nerves were cut, were similar. These changes were reflected in increasing the concentration of proteins in the intestinal lymph, to a lesser extent in the plasma of arterial blood and decrease in plasma of venous blood. The ratio between albumins and globulins (in favor of albumin) due to the larger increase in the concentration of albumin increased in the lymph, and plasma arterial and venous blood levels of a decrease of the protein factor.

Discussion

Our data on the protein composition of intestinal lymph and blood plasma are the first attempt the parallel analysis of protein spectrum of lymph and plasma arterial and venous blood. Experiments showed that the total protein in the intestinal lymph, compared to that in the arterial and venous blood, is much lower and similar to several studies (Zhdanov, 1952; Rusnyak et al., 1957). However, it contains all the fractions of blood plasma proteins.

Because lymphatic vessels are the only ways of transport proteins from the tissues into the bloodstream (Myrzakhanov, 1995; Aynson,1972), then an increase in the output of their blood capillaries should be reflected at the level of protein lymph. On the basis of our data on changes of fractional distribution of lymph proteins found that increasing the concentration of protein in lymph, primarily due to an increase in its albumin fraction. This is also evidenced by an increase of the protein ratio of lymph.

In this shift, apparently, considerable importance is the permeability of blood capillaries. According to some researchers, the increase in lymph protein is one of the most important evidence of increased permeability, but according to Gareev (1983), an increase in the protein content of the lymph is a kind of "indicator" of increasing the permeability of the capillaries. Since the change in the absolute number of proteins was not the same for all protein fractions, we must believe that their way out of the blood capillaries and the subsequent transport to the lymph into the blood stream is differentially. This with some confidence by increased protein ratio in favor of lymph albumin and consistent with the view that the increase in capillary permeability, whatever it may be origin, inevitably leads to a decrease in permeability to proteins with a high molecular weight (Aynson, 1972).

Thus, a comparison of the lymph and blood showed that a comparative study of the protein composition of body fluids allows us to study the quantitative changes in both the normal and the indicated effects on the body and in agreement with the literature data suggest that the lymphatic system of the intestine is involved in an adequate distribution of proteins between the blood and lymph, thereby providing fine regulation to changing internal and external environment, which once again clearly shows the close relationship between the circulatory and lymphatic systems.

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