MORPHOLOGICAL PARAMETERS OF RABBIT BLOOD DURING MIGRATION OF CYSTICERCUS PISIFORMIS

Abstract. During the migration period of Cysticercus pisiformis, the largest changes in the morphological parameters of rabbit blood occur on the 25th and 35th day and register hemoglobinemia (78.97 ± 1.21 g / l and 80.22 ± 1.01 g / l) (p˂0.001), erythropenia (3.76 ± 0.21 T / l and 3.98 ± 0.11 T / l (p˂0.001)) and an increase in white blood cells by 32.1% and 29.1%. Eosinophilia (6.24 ± 0.31 and 5.02 ± 0.12% (p˂0.01)), lymphopenia, monocytosis and an increase in rod-shaped neutrophils by 61.4% and 47.3% were registered in the leukoformula. An increase in the leukocyte intoxication index by 43.9% and 51.5% indicates a significant inflammatory process during the migration of C. pisiformis.

Keywords: rabbits, Cysticercus pisiformis, blood, leukoformula

Highly productive development of rabbit breeding is restrained due to parasitic diseases, among which cysticercosis occupies one of the leading places. The disease progresses with liver dysfunction and significant depletion. Cysticerci have the most pathogenic effect on the body of rabbits when they pass through the liver parenchyma. As a result of active promotion of cysticerci in the liver parenchyma, parenchymal hepatitis develops [1, 2].
Pysiform cisticercosis is characterized by traumatic hepatitis. The ingress of eggs of this helminth into the intestines of rabbits leads to the release of oncospheres that penetrate the mucous membrane. Then through the portal vein or lymphatic vessels, they are introduced into the liver, less often – in other organs and tissues. After 26 days, most cysticerci penetrate the serous lining of the liver and fall into the abdominal cavity, attached to the omentum, lumbar or pelvic rectum, less often – on the peritoneum and pleura, where after 2-2.5 months they reach the invasive stage [3].

The parasitocenosis in the intestines of rabbits is the richest and most diverse. It localizes various species of bacteria, pathogenic fungi, protozoa and helminths. All these organisms are in a certain relationship not only with the host, but also with each other. Existing relationships can be both antagonistic and synergistic [4–7].

The level of natural resistance characterizes the degree of resistance of the organism to diseases, which is influenced by such factors as the age of the animal, the seasons, feeding and housing conditions [8–10]. Indicators of natural resistance include phagocytic activity of neutrophils, bactericidal activity of serum and lysozyme activity of serum [11, 12].

One of the main criteria for assessing the biological characteristics of the organism is the study of the state and development of internal organs. A living organism is a single system that has developed in the process of evolution, so its individual parts, systems, organs, tissues and cells are interconnected [13, 14].

Most of the problems that affect the health of the domestic rabbit's gastrointestinal tract are caused by hereditary factors or forms of housing. The condition of internal organs depends not only on the breed but also on feeding conditions, providing the body with all necessary components, exposure to pathogens, including Cysticercus pisiformis [15].

Larval forms of cysticerci, during migration, affect natural resistance, but the degree of this influence has not been fully described by scientists to date, therefore one of the most pressing problems for raising rabbits is to reduce their resistance, which is due to the spread of invasive diseases, primarily cisticercosis which is caused by the larval stage of Cysticercus pisiformis of the sexually mature cestode.
Taenia pisiformis.

The aim of the study was to analyze the effect of larval forms of Cysticercus pisiformis on morphological parameters of rabbit blood.

**Materials and methods.** In order to reproduce cysticercosis, experimental infection of 60-day-old rabbits with Taenia pisiformis cestode eggs was performed. Before the start of the experiment, all animals were coproscopically examined for the absence of eimeriosis and pasalurosis.

Rabbits of the experimental group (n=15) were infected with Taenia pisiformis eggs at the rate of 100 ± 10 eggs (1 ml) per animal. Taenia pisiformis eggs were obtained from sexually mature cestodes removed from spontaneously infested dogs, which were washed in Petri dishes and injected into rabbits individually using a syringe with a rubber nozzle.

It takes about 2 months for the larvae of Cysticercus pisiformis to develop before the invasive stage. Oncospheres secreted in the gastrointestinal tract migrate from the blood to the liver and then through its parenchyma to the surface towards the serous membrane. The larvae settle under the serous membrane of the liver, on the mesentery and omentum, rarely under the pleura of round-oval shape 0.5–1 cm in size, filled with fluid with scolex inside.

To clarify the experimental infestation of rabbits with cysticercosis, the animals were slaughtered on the 25th day.

In order to clarify the nature of the morphological parameters of the blood of rabbits during the period of migration of Cysticercus pisiformis larvae, animals (n=3) were slaughtered and blood samples were taken on the 25th, 35th, 45th and 55th days. Blood was taken from the rabbits in the morning, at rest, from the jugular vein into test tubes with an anticoagulant. The puncture site was treated with alcohol [16].

Morphological blood parameters were determined by conventional methods (Kondrakhin I. P. et al., 1985). The number of erythrocytes and the content of hemoglobin on FEC-M according to the method of E. S. Gavrilets (1966), the number of leukocytes - using a counting chamber with a Goryaev grid (Chumachenko V. E., 1991). Leukogram was derived by counting individual
leukocytes in fixed smears stained according to Romanovsky-Giemsa, determination of hemoglobin concentration - by the hemoglobin-cyanide method according to the method of Derviz G.V. and Vorobiev A.G. (1959).

In blood smears determined the percentage of erythrocytes with signs of toxic granularity, leukocyte index of intoxication by the method of A. V. Starikov, O. V. Kushka (1985), using the formula:

$$LII = \frac{(4Mts+3Yu+2P+C)\times(P+1)}{(Mon+Lymph)\times(E+1)}$$

where:
- $LII$ – leukocyte intoxication index;
- $Mts$ – myelocytes;
- $Yu$ – young leukocytes;
- $P$ – rod-shaped leukocytes;
- $C$ – segmental leukocytes;
- $Mon$ – monocytes;
- $Lymph$ – lymphocytes;
- $E$ – eosinophils.

When working with animals, the requirements of the "European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes" were complied with (Strasbourg, March 18, 1986).

Research results. In the blood of sick animals on the 25th day after infection with C. pisiformis, a probable ($p<0.001$) decrease in hemoglobin content by 24.9% (78.97±1.21 g/l) was established, on the 35th day - by 23.8%, on the 45th day – by 15.2%, and on the 55th day - only by 12.5%, (105.21±0.41 g/l) compared to the rate before infection (Table 1).

| Indicators | before infection | The period of migration of larvae, days |
|------------|-----------------|----------------------------------------|
|            |                 | 25 th                        | 35 th                        | 45 th                        | 55 th                        |
| Hemoglobin, g/l | 105.21±0.41 | 78.97±1.21***      | 80.22±1.01***      | 89.25±2.01***      | 92.11±1.82***      |

Table 1

Morphological parameters of rabbit blood during migration of Cysticercus pisiformis
Table continuation 1

|                      | June | 25th | 35th | 55th |
|----------------------|------|------|------|------|
| Erythrocytes, T/l    | 6.37±0.17 | 3.76±0.21*** | 3.98±0.11*** | 4.62±0.31*** | 5.72±0.25* |
| Leukocytes, G/l      | 6.98±0.27 | 9.22±0.31*** | 9.01±0.12*** | 7.46±1.02*   | 7.15±0.37*  |
| Leukogram, %         |      |      |      |      |
| Basophils            | 1.09±0.27 | 1.72±0.11*   | 1.68±0.01*   | 1.35±0.03*   | 1.24±0.02*  |
| Eosinophils          | 4.21±0.49 | 6.24±0.31**  | 5.02±0.12    | 4.98±0.24*   | 4.75±1.05*  |
| Neutrophils:         |      |      |      |      |
| Stick-core           | 5.65±0.23 | 9.12±1.02**  | 8.32±1.14*   | 7.85±1.02*   | 6.79±0.43*  |
| Segmental            | 22.95±1.01| 22.16±2.04*  | 23.03±1.02   | 22.17±1.01*  | 22.86±1.17* |
| Lymphocytes          | 62.44±0.95 | 56.76±1.02*** | 58.69±1.12   | 60.29±0.82*  | 60.85±1.04* |
| Monocytes            | 3.66±1.35 | 3.79±1.21    | 3.11±0.42*   | 3.24±0.12*   | 3.51±1.05*  |
| LII                  | 0.66 | 0.95 | 1.0  | 0.89 | 0.77 |

Note: * - p<0.05, ** - p<0.01, *** - p<0.001 – compared to the rate before infection

The largest number of erythrocyte decreases of 41.0% and 37.5% were recorded on the 25th and 35th day – the period of migration of *C. pisiformis* through the liver parenchyma, while on the 55th day of the experiment the number of erythrocytes decreased by 10.2%.

Given the nature of the pathological process, there was a significant increase in the number of leukocytes on the 25th and 35th day by 32.1% and 29.1%, respectively.

In the leucoform of sick rabbits on the 25th day of the experiment eosinophilia was noted (6.24 ± 0.31%, p <0.01, compared to the rate before infection – 4.21 ± 0.49%), which is 48.2% more. An increase in the number of rod-shaped neutrophils by 61.4% (p <0.01) was also recorded, which indicates inflammatory processes as a result of parasitism of *C. pisiformis* pathogens.

The number of lymphocytes on the 25th day decreased by 9.1%, on the 35th day - by 6.0%, and on the 55th day – by only 2.5%. The number of monocytes on the 25th day increased by 3.6%, and on the 35th day decreased by 15% and on the 55th day was lower by 4.1% compared to the pre-infection rate.

The leukocyte index of intoxication before infection of rabbits was 0.66 conventional units. After infection with *C. pisiformis* on the 25th day, the intoxication index increased by 43.9%, and on the 35th day – by 51.5%, which indicates the severity of the inflammatory process in animals. On the 55th day, the
leukocyte intoxication index was higher by only 16.7% and amounted to 0.77 conventional units, compared to the rate before infection, ie the disease becomes chronic.

**Conclusion.** During the migration of *C. pisiformis*, the greatest changes in the morphological parameters of rabbit blood occur on the 25th and 35th day and are characterized by hemoglobinemia, erythropenia and an increase in white blood cells by 32.1% and 29.1%. Eosinophilia, lymphopenia, monocytosis and an increase in rod-shaped neutrophils by 61.4% and 47.3% were registered in the leukoformula. An increase in the leukocyte intoxication index by 43.9% and 51.5% indicates a significant inflammatory process during the migration of *C. pisiformis*.

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