

UDC 636

## HEMATOLOGICAL FEATURES OF INFECTIOUS ANEMIA IN CATS

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### ABSTRACT

This article describes the study results of clinical and epizootical signs of infectious anemia in cats. Predisposition to the disease by age and breed has been analyzed. The incidence was analyzed and predisposing factors of the disease were established. These studies has been managed in veterinary clinics of Moscow and Moscow Oblast in 2017. During data analysis it was found that hemobartonellosis proceed in three forms: acute, subacute and chronic. Animals has been divided into three groups by intensity of clinical signs and changes in hematology profiles. Acute and subacute forms were characterized by symptomatology and erythropenia, thrombocytopenia and high decrease of hematocrit and hemoglobin. Symptomatology and changes in hematology profiles in chronic form of disease were less expressed and in more cases illness has been detected in follow-up cat examination.

### KEYWORDS

Infectious anemia, hemobartonellosis, hemotropy micoplasmosis, hemoplasma, erythrocyte, hemoglobin, anemia, cats.

Hemobartonellosis is severe infection disease of animals, which is characterized by erythrocytes affection and anemia. Hemotropic mycoplasmas (hemoplasmas) also known as hemato barnellas and eperythrozoon is small nonculturable bacteria without cell wall. Hemoplasmas parasitize on erythrocytes surface, but not get into cell [1]. Having attached to the surface of the erythrocyte, parasites may cause it destruction (hemolysis). As a result, the content of erythrocytes and hemoglobin in the blood decreases. These processes lead to disruption of the oxygen supply of cells and tissues, acid-base balance is disrupted, as a result, acidosis develops. Hemoplasmas is wide distributed and cause infectious anemia in different warm-blood animals including birds. Hemotropic mycoplasmas in cats firstly was found in South Africa in 1942 and was called *Eperythrozoon felis* [4]. In Russia this etiological agent was described in 1951 by N.A. Kolabsky and A.D. Melnikova [3]. Firstly this microorganism was classified as *Rickettsia*, but according to last data, it belongs to *Mollicutes*. Following last data there is three different species of hemaplasmas which cause cats infections: *Mycoplasma haemofelis*; *Mycoplasma haemominutum*; *Mycoplasma turicensis*. Infectious anemia of cats can proceed in different forms from asymptomatic carriage to cute anemia endangering animal life depending on animal organism vulnerability to this etiological agent and its pathogenicity. *M. haemofelis* have the highest pathogenic potential, since infection with this pathogen, in most cases, is associated with the development of a clinically pronounced disease [1].

Carriage and chronic progress of disease in cats quite often proceed into cute and acute forms with hemolytical crisis [2]. Infection proclivity increases after stress. Also risk groups includes immunosuppressive cats infected with feline leukemia virus (FLV) and feline immunodeficiency virus (FIV) [5].

*Research objective:* Definition of mainly clinical signs and hematological parameters of blood in cats infected by *M. Haemofelis* with different forms of disease progress.

### MATERIALS AND METHODS

Research was based on data received from veterinary clinics of Moscow and Moscow Oblast in 2017. In the course of the work, 36 clinical cases among cats infected with

*Mycoplasma haemofelis* were studied. Identification of etiological agent was carried out by molecular genetic diagnostic assay polymerase chain reaction (PCR). Morphological blood tests were performed on hematological analyzers HemaScreen Vet and PCE-90 Vet.

## RESULTS OF STUDY

The object of the study was 36 cats infected by *M. haemofelis*. Among them there was 22 males and 14 females. The disease was detected in cats of all ages, animals aged from 3 months to 13 years were examined. During analysis of collected material, it was established that young cats aged from 1 year to 6 years are more susceptible to the disease - 61.1% of the total number of examined animals. Seasonality of this disease is not observed, illness cases are registered the whole year round. Among the infected animals there were more mongrel cats and mestizos - 72.2% of the total number of cases. The cats under investigation were home-kept, but 80.5% of them had free access to the street or in the spring-summer period were exported to the country sites, which indicates the possibility of contacting with street animals. Analyzing the infectious anemia incidence in cats, predisposing factors of the disease development (among which are stress, trauma, surgical interventions, immunosuppressive conditions, diseases of the viral and non-infectious etiology) have been established. Associated course of infectious anemia with viral leukemia was registered in 30.5% of the examined animals and with viral immunodeficiency in 5.5% of the examined animals.

According to the obtained data, hemobartonellosis in investigated cats proceeded in 3 forms - acute, subacute and chronic. The animals were divided into groups according to the clinical signs severity and the decrease level of the red blood basic indicators (erythrocytes, hemoglobin, hematocrit). The first group included cats with the acute form of the disease (n = 15), which was characterized by a severe course, pronounced symptomatology and the following changes in the general clinical analysis: decrease in hematocrit by 2-4 times, reduction in red blood cell count on 45 - 80% and hemoglobin on 50 - 70% of the lower limit of the norm.

The second group includes animals with subacute form of disease (n = 12). The clinical manifestation was less pronounced and in the hematological analysis such changes in red blood as a decrease in the hematocrit value by 1.2 - 1.7 times, hemoglobin by 12 - 50%, and in the number of erythrocytes by 7 - 40% were observed.

The third group was characterized by a chronic course of hemobartonellosis (n = 9) and had no obvious clinical manifestation, in the general blood test the indices were at the lower limit of the norm or had a small decrease: hematocrit - up to 20.5 - 25.3%, hemoglobin - 20%, the number of erythrocytes - to a level of 23%.

In the first group of cats, the following clinical signs of the disease were identified and systematized during the survey: infected animals were characterized by mobility lack, apathy, weakness. Absence of appetite was detected in 93.3% of cases. Vomiting was observed in 60% of cats. The reaction to noise and tactile stimuli is sharply reduced. Body temperature was within the physiological norm, in 26.6% of cases the temperature was raised to  $40.3 \pm 0.7$  °C. During chest inspection tachypnoea was revealed in 40% of patients with a level of up to  $44.0 \pm 6.0$  respiratory movements per minute. During auscultation tachycardia was heard in 46.6% of animals (up to  $231 \pm 28$  beats per minute). Visible mucous membranes were pale, anemic or milky white. In animals, dehydration of 1-3 degrees is observed, the skin fold does not spread more than 20 seconds, the skin turgor is reduced. During abdominal wall palpation, such pathologies as splenomegaly and hepatomegaly were detected in 53.3% of cases. Urine acquired a darker color (signs of hemoglobinuria) in 46.6% of cases.

During the hematological study of blood in the first group of cats, a sharp decrease in red blood indices was recorded, namely, the number of red blood cells reduce to  $1.93 \pm 0.88 \times 10^{12} / l$  at a normal volume of  $5.0 - 10.0 \times 10^{12} / l$ . There was haemoglobinaemia - up to  $36.6 \pm 13$  g / l at a rate of 80 - 150 g / l. The drop in the hematocrit value was up to  $10.3 \pm 3.1\%$  with a normal content of 24 - 45%. The sedimentation rate of erythrocytes (ESR) had a sharp

increase to  $69 \pm 13$  mm / h at reference values of 1-13 mm / h. Platelets tended to decrease to  $97.6 \pm 42.0 \times 10^{12}$  / l at a normal value of 300.0 - 800.0  $\times 10^{12}$  / l. Leukocytosis up to  $29.5 \pm 4.3 \times 10^{12}$  / l at a normal amount of 5.5 – 19.5  $\times 10^{12}$  / l. Also in some animals of this group, the decrease in the number of leukocytes was also controlled to  $2.1 \pm 0.9 \times 10^{12}$  / l. The relative number of lymphocytes remained within reference values or slightly increased to  $47.5 \pm 12.3\%$  at a rate of 20 - 55%. In the blood the large amount of normocytes, anisocytes, poikilocytes and hypochromic erythrocytes were found.

In the second group of cats with subacute form of disease there was a similar symptoms with animals from group 1. Symptoms such as fatigue, apathy, lack of body weight were detected. Selectivity in food was observed, complete rejection of food was detected in 33.3% of cases. Vomiting was present in 25% of cats. Patients were in a state of dehydration of 1-2 degrees. The temperature was within the physiological norm or was slightly reduced to  $37.9 \pm 1.1$  °C. During examining and auscultation of the chest, tachycardia and tachypnoea were not as vividly manifested as in the first group of cats - the signs were fixed in 25% of cases. Ictericness of visible mucous membranes and skin were found in 91.6% of patients. The skin was not elastic. Wool - ruffled, dull, dry. Splenomegaly, hepatomegaly and haemoglobinuria were expressed in 16.6% of cats.

The picture of the general clinical analysis of the blood of cats from the second group had the following deviations: a decrease in the number of red blood cells to  $3.87 \pm 0.82 \times 10^{12}$  / l at a normal volume of 5.0 - 10.0  $\times 10^{12}$  / l. The decrease in blood hemoglobin to  $60 \pm 11$  g / l and hematocrit to  $18.1 \pm 2.4\%$  at a rate of 80 - 150 g / l and 24 - 45%. ESR increased to  $34.3 \pm 11.0$  mm / h with an adequate value of 1 - 13 mm / h. Thrombocytopenia to  $167.6 \pm 38.0 \times 10^{12}$  / l at natural value in 300.0 - 800.0  $\times 10^{12}$  / l. The number of leukocytes increased to  $27.5 \pm 2.7 \times 10^{12}$  / l at a normal amount of 5.5 - 19.5  $\times 10^{12}$  / l. Lymphocytes within the physiological norm of  $33.4 \pm 9.2\%$ . Anisocytosis was also detected.

In cats of the 3rd group clinical signs were poorly expressed. Only during the planned examination or inspection before vaccination some deviations can be detected. So, in a number of cases, the visible mucous membranes were anemic with a weakly expressed icteritiousness, dryness and tarnishing of the wool were also noted. In the future, when detailed anamnesis was collected, other characteristic symptoms were noted, which the owners did not attach importance to: decrease in activity, 22.2% observed selectivity in food. Body temperature, respiratory rate and heart rate were within the physiological norm. Darkening of the urine was observed in 11.1% of cases.

In the chronic course of the disease many indicators were within the physiological norm or were slightly reduced. The number of erythrocytes was at the lower boundary of the reference values or decreased to  $4.67 \pm 0.82 \times 10^{12}$  / l. The concentration of hemoglobin was also within the lower limit or decreased to  $73 \pm 8$  g / l. There was a slight decrease in hematocrit to  $22.9 \pm 2.4\%$ , a decrease in platelets to  $243 \pm 38 \times 10^{12}$  / l, an increase in ESR to  $15.6 \pm 7.2$  mm / h. (see table 1).

Table 1 – Average hematological red blood indicators of infected cats by *M. haemofelis* in different forms of the disease

Indicators	Reference values	Units	1st group (acute)	2nd group (subacute)	3rd group (chronic)
Erythrocytes (RBC)	5.0-10.0	$\times 10^{12}/l$	$1.93 \pm 0.19$	$3.87 \pm 0.11$	$4.67 \pm 0.19$
The average volume of erythrocytes ( MCV)	39.0-55.0	phl	$42.7 \pm 1.36$	$56.5 \pm 0.67$	$41.5 \pm 0.77$
Hematocrit (HTC)	24.0-45.0 %	%	$10.3 \pm 0.94$	$18.1 \pm 0.48$	$22.9 \pm 0.38$
Hemoglobin (HGB)	80.0-150.0	g/l	$36.6 \pm 1.68$	$60.1 \pm 2.11$	$73.3 \pm 1.53$
The average content of hemoglobin in the erythrocyte (MCH)	14.0-27.0	pkg	$18.1 \pm 0.86$	$21.65 \pm 1.25$	$14.2 \pm 0.76$
The average concentration of hemoglobin in the erythrocyte (MCHC)	300.0-360.0	g/l	$289.2 \pm 0.86$	$308.7 \pm 1.44$	$353.4 \pm 2.11$
ESR	1.0-13.0	mm/h	$69 \pm 2.5$	$34 \pm 1.49$	$15 \pm 1.252$
Platelets (PLT)	300.0-800.0	$\times 10^{12}/l$	$97.6 \pm 7.98$	$167.0 \pm 7.31$	$243 \pm 4.52$
Pathological forms of cells	-	-	anisocytosis normocytes hypochromia poikilocytosis	anisocytosis	

The change in the morphology of red blood cells is the most important symptom that indicates the development of anemia. The presence of pathological forms of erythrocytes - anisocytes, poikilocytes and normocytes, as well as the presence of hypochromia, indicate the development of severe hemolytic anemia. Table 2 shows the values of the relative leukocytosis level estimated from leukograms of animals in the studied groups.

Table 2 – Average values of the leukocyte formula of cats infected with *M. haemofelis* in different forms of the disease course

Indicators	Reference values	1st group (acute)	2nd group (subacute)	3rd group (chronic)
Leukocytes	5.5-19.5 $\times 10^{12}/l$	29.46 $\pm$ 1.43	27.5 $\pm$ 1.97	16.13 $\pm$ 2.11
Basophiles	0-1%	0.33 $\pm$ 0.15	0.16 $\pm$ 0.11	0
Eosinophiles	2-12%	14 $\pm$ 0.96	4 $\pm$ 0.38	3 $\pm$ 0.25
Neutrophiles:				
Young	0-1%	0.8 $\pm$ 0.44	0.41 $\pm$ 0.19	0.33 $\pm$ 0.16
Stabbed	0-3%	4.13 $\pm$ 0.69	3.3 $\pm$ 0.29	2.1 $\pm$ 0.3
Segmented	35-75%	51 $\pm$ 4.2	78 $\pm$ 1.76	62 $\pm$ 2.77
Lymphocytes	20-55%	46.8 $\pm$ 3.46	33.4 $\pm$ 3.04	18.1 $\pm$ 1.34
Monocytes	1-4%	3 $\pm$ 0.33	3.3 $\pm$ 0.4	2.4 $\pm$ 0.19

As can be seen from Table 2, in the acute course of the disease, an increase in the number of eosinophils, stab neutrophils, with a reduced content of segmented nuclei is established in the leukoformula, which is a shift of the leukocyte formula to the left - a testimony of the regenerative potential of leukopoiesis in acute inflammatory and / or infectious reactions. In the second group there is an increase in the total number of neutrophils (neutrophilia). In the chronic stage of the disease there was a slight decrease in lymphocytes (lymphopenia).

During treatment with the disappearance of clinical signs, many cats had not completely get rid of the pathogen, but remain carriers. In the future there are relapses of the disease. Reactivation of the latent form of the disease to acute occurs under the stress factor influence, after surgical interventions or against a background of other diseases. In the absence of treatment, the forecast is unfavorable, the likelihood of cats death is high. The presence of concomitant retroviral infections complicates the course of the disease and the animal's recovery.

## CONCLUSION

Hemobartonellosis is a serious infectious disease, which has recently been increasingly registered in domestic cats in the Moscow Oblast. The disease affects animals of all ages, but a higher incidence is observed in young cats aged from 1 to 6 years old. Infectious anemia of cats does not always flow with a pronounced clinical picture, there is a tendency to a chronic course of the disease. The acute form of the disease is accompanied by a severe course and sharply expressed symptoms - cachexia, dehydration, anemia or icterus of the visible mucous membranes, cardiovascular and hepatolental syndromes. In the hematological profile, changes are mainly concerned with the number and morphology of red blood cells. A sharp decrease in erythrocytes on 45 - 80% of the lower limit of the norm was observed, hemoglobin - on 50 - 70%, platelets decreased by 2.5 - 6 times. The hematocrit value fell below the critical level to 7.2 - 13%. ESR increased sharply by 4 - 6 times. In the acute course of the disease, both the increase in the number of leukocytes (leukocytosis) and their decrease (leukopenia) by 2 - 5 times, changes in the forms and sizes of erythrocytes, which indicated the development of hemolytic anemia, were detected.

The subacute course of the disease was characterized by a similar but less pronounced symptomatology. They also detected mucosal icterus, body weight loss, dehydration signs. During hematological analysis changes in blood parameters were observed: erythropenia, hemoglobinemia, anisocytosis, thrombocytopenia, a decrease in

hematocrit up to 16%, and 2 - 3 times increase in the leukocytes total number. ESR had an increase in 2 - 4 times from the physiological norm.

The chronic course was clinically manifested minimally, in some animals, by selectivity in food and by rapid fatigue, by slight anemia of the visible mucous membranes. In the general blood clinical analysis a slight decrease in hemoglobin, erythrocytes, platelets and hematocrit is monitored.

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