The morphological research of calves’ erythrocytes and neutrophils during acute bronchopneumonia

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Abstract. The investigation was held on 30 clinically healthy and sick with bronchopneumonia calves of black-spot breed at the age of 2-3 months. The development of an acute from of bronchopneumonia in calves population was connected with decrease of the number of erythrocytes, hematocrit, the middle square and diameter of red cells, simultaneous increase of speed of subsidence of erythrocytes and the interchange for increasing amount of echinocytes and ovalocytes, also micro- and macrocytes. At young big horn that was sick we saw leukocytosis, the increase of percent of monocytes, young and palochkoyaderny neutrophils and decrease the number of lymphocytes in blood. We found the increase of the square of granulocytes with simultaneous decrease of their phagocyte activity.

Keywords: calves, bronchopneumonia, erythrocytes, hemostasis, neutrophils, phagocytosis

Introduction
An acute calves bronchopneumonia is one of the wide-spread pathological states in population of young big horn in our country [1, 2, 3]. This disease is connected with the number of different etiological factors (lowering of the air temperature, the moistening of the air and its pollution, drafts, the transportation of the young big horn and so on) on their organism [4, 5, 6, 7, 8]. Different variants of misfeeding and keeping animals as individually, as in a complex can form the base of weakened immunity, the increase of sensibility to microflora of environment and development of bronchopneumonia.

The developing disease in bronchi and lungs is connected with hypoxia and visible change in blood system, and its exodus in many ways is stated by functional condition of the last [9, 10, 11].

Erythrocytes and neutrophils are the most important cell components of blood from the morphofunctional state of which depends keeping the optimal level of oxygen and oxidation-peroxidation processes in blood cells, the immunity and phagocytosis [12, 13].

Basing upon the leading role of hypoxia and pathogenesis of bronchopneumonia, the aim of this work is learning special things about morphological parameters of erythrocytes and neutrophils in peripheral blood of calves during acute bronchopneumonia.

Materials and methods
We watched 30 clinically healthy and sick with acute bronchopneumonia calves of black-spot breed at the age of 2-3 months that are kept in “Sovhoz Lensky” of Kungur part of Perm region. Our clinical watch was done according to the common veterinary practice scheme; we used both common and special methods of investigation.

In peripheral blood, taken from the jugular vein of calves in the morning before feeding we counted the number of erythrocytes, hemoglobin, leukocytes, speed of subsidence of erythrocytes and made a formula of leukocytes [14].

The analysis of cells was done on dry painted monolayer dabs according Romanovsky- Gimze with definition of the cells’ size. Erythrocytes were spread according morphological types: diskocytes, echinocytes, ovalocytes. We studied the common concentration of erythrocytes in blood (RBC) with a help of hematologic analyzer type MedonicM (Unimed) and the average volume of erythrocytes (MCV), hematocrit (HCT), the average essence of hemoglobin in erythrocytes (MCH), the average concentration of hemoglobin in erythrocytes (MCHC), the width of spreading of erythrocytes (RDW).

The morpholometrical study of erythrocytes and neutrophils was done with help of using suspension of daily culture of an intestinal stick [15]. The given results were studied statistically; and the results were thought to be true when \( p \leq 0.05 \).

The results of studies
The number of erythrocytes in clinically healthy big horn is \( 35,30 \pm 0,12 \times 10^{12}/l \), hemoglobin -
changed from 16,8 to 23,8 mkm.

square of erythrocytes at clinically healthy calves
and ovalocytes were present in 3-4 % of cases. The
square decreased in average for 29 % (p≤0,05) and
compared with the same of healthy. So, the middle
categorized by the number of peculiarities as
cells in sick with bronchopneumonia calves is
cells of different size.

absolute meaning, that also proves the existence of
level of spreading cells changed from 18,98 to 16,08
small less of the average volume of erythrocytes and
25 %) (p≤0,05). Simultaneously with it we saw a
average diameter of erythrocytes (an average amount
erythrocytes because of increase of defective forms
population.

So the number of microcytes in blood was in average
increasing of the part of microcytes and macrocytes.
appearance of anisocytosis, that cleared it self by
(p≤0,01) as compared with the same at healthy calves.
subsidence of erythrocyte in average in 2,3 times
(p≤0,05) and simultaneous increase of speed of
average for 26 % (p≤0,05), hematocrit – for 23 %
(p≤0,05) and simultaneous increase of speed of
subsidence of erythrocyte in average in 2,3 times
(p≤0,01) as compared with the same at healthy calves.

In peripheral blood of sick animals we saw an
appearance of anisocytosis, that cleared it self by
increasing of the part of microcytes and macrocytes.
So the number of microcytes in blood was in average
33,06 ± 1,52 %, and macrocytes – 3,14 ± 0,12%. The
level of spreading cells changed from 18,98 to 16,08
absolute meaning, that also proves the existence of
cells of different size.

Morphological characteristics of red blood
cells in sick with bronchopneumonia calves is
characterized by the number of peculiarities as
compared with the same of healthy. So, the middle
square decreased in average for 29 % (p≤0,05) and
made 13,60 ± 0,73 mkm². Analogically, the decreased
average diameter of erythrocytes (an average amount
25 %) (p≤0,05). Simultaneously with it we saw a
small less of the average volume of erythrocytes and
visible decrease of hemoglobin part in erythrocytes
from 23,28 ± 3,54 pg to 15,60 ± 1,58 pg that is
because of hemoglobin’s producing fail. So, we
proved interchange of quality essence of red cells
population.

We noticed interchange of erythrocytes of
erythrocytes because of increase of defective forms
parts of echinocytes and ovalocytes in average at 5,4
and 3,3 times (p≤0,05) as compared with number of
those at healthy animals that may point to weakening
vitality of erythrocytes and show the developing of
pathological process in bronchi and lungs.

Studding the amount of cells that take part in
forming of immune system at clinically healthy calves
showed that the number of basophiles reached in
average 0,63 ± 0,12 %, eosinophils – 1,55 ± 0,50 %,
young neutrophils – 0,20 ± 0,09 %, palochkoyaderny
neutrophils - - 3,88 ± 0,58 %, segmentoyaderny
neutrophils – 35,86 ± 0,66 %, lymphocytes – 56,25 ±
1,98 %, monocytes – 1,63 ± 0,25 %.

Carrying cells morphometry neutrophilic
part at clinically healthy animals we stated that young
granulocytes square made in average 96,32 ± 15,37
mkm², palochkoyaderny neutrophils – 106,10 ± 12,77
mkm², segmentoyaderny neutrophils – 140,09 ± 6,23
mkm². Square kernels of neutrophils varied from
42,95 to 55,34 mkm².

While developing the acute bronchopneumonia at young big horn we watched
interchangeable leukocytosis. The number of
leukocytes as for control figures increased in group up
to 32 % (p≤0,01). In leykotsitarny formula we
watched monocytosis – the percent of monocytes
increased in average for 90 % (p≤0,01), neutrocytosis
– increase of part of young neutrophils in 7,5 times
(p≤0,01), palochkoyaderny granulocytes in 4 times
(p≤0,01). The number of lymphocytes decreased in
average for 27 % (p≤0,01) as compared to those at
healthy animals.

We found changing of forms of neutrophils,
this is proved by increase of the square of neytrofilny
granulocytes at calves, sick with bronchopneumonia.
So, the square of young neutrophils was in average
124,75 ± 12,64 mkm², palochkoyaderny– 117,52 ±
6,61 mkm², segmentoyaderny – 151,19 ± 5,17 mkm².
The same tendency we saw as for kernel of studied
cells. Increase of neutrophils’ size can point to
deformation of upper architectonics and change of the
whole cell’s metabolism.

In basis of protectional function of
neutrophils is the phagocyte process that means the
capability of understand, absorb, kill and digest
microbe’s cells. While investigating the phagocyte
function of circulating neutrophils leukocytes we
proved the decrease of number of active phagocytes in
sick animals from 39,6 to 7,0 % and phagocyte
number from 10,1 to 2,5 % that we can explain by
changing both neutrophils square and exhaustion of
bacterial potential of these cells.

Desaptational processes seen by us in blood
system probably are because of high stage of fever
developing process in respiratory organs and
intoxication of organism [1, 16].
Conclusion

Both in animals’ and men’s organism the base level of number of erythrocytes and neutrophils really exists. Under the influence of different etiological factors bronchopneumonia develops; it’s the associating with stimulation of ones and inhibition of the other parts of immune system [8, 17, 18]. While the change of inner world organism takes place.

We know, that diskocytes can be very deformative and elastical; it lets them move both in large and small capillaries. This form of erythrocytes make the most adequate supply of tissue by oxygen and in many ways forms the affectivity of physiological processes functioning. Erythrocytes with abnormal form are characterized by high resistance to deformation [10, 19, 20].

At the same time an increase of number of changed forms of red blood cells (echinocytes and ovalocytes) is connected with increase of blood viscosity and erythrocytes’s aggregational capability, the increase of speed of subsidence of erythrocyte proves it.

Changes of geometrical characteristics of erythrocytes, which we’ve found (the decrease of middle square of circulating erythrocytes and decrease of hemoglobin’s filling cells) are coming from fever developing process in bronchi and lungs and appearance of hypoxia, that can strengthen the hardness of pathological process and clinical state of sick animals. The decrease of erythrocytes and interchange of quality of erythrocytes are connected with change of physical and chemical characteristics of red blood during bronchopneumonia. We showed earlier that at peak of bronchopneumonia at calves the osmotic resistance was increased, the same to acid stability and sorption ability of erythrocytes that means the damage of structural qualities of erythrocytes’s membranes [1, 16]. So, the development of bronchopneumonia leads to change of both quality and quantity characteristics of erythrocytes at sick animals; this probably means the change of speed of erythropoiesis and blood viscosity.

As all the most possible reasons the reason of distortion of structural and functional state of erythrocyte membrane may be the activation of process of free radical oxidation [21, 22, 23, 24, 25]. So, in calves erythrocytes the activity of catalas from 3,42 to 3,65 mkmol/min/ml and simultaneously the common general antioxidant activity of erythrocytes was decreased from 83,8 to 69,0 % that means intensification of process perekisny oxidation of lipids and depression antioxidant system of cells of red blood [1, 16].

The growth of the area of neutrophils can indicate violation of physical and chemical properties of membranes of these cages. It corrects the assumption of oxidizing destruction of membrane lipids and decrease in functional activity of neutrophils as a consequence of that. In our research testing phagocytosis at leukocytes circulating the neutrophilny’ granulocytes showed the reduction of quantity of active phagocytes at sick calves [26].

The increase of number of leukocytes and decrease of number of erythrocytes in sick calves’ blood is connected with increase of low-new dialdegid in plasm from 1,42 to 2,21 mkmol/ml that is connected with generation of free-radical connection by leukocytes and their emission in blood.

The start of bronchopneumonia at calves led to accumulation of toxic products generated in the perekisny oxidation of lipids both in plasma, and in erythrocytes that was accompanied by change of a structurally functional condition of erythrocytes and neutrophils and strengthening of pathological processes in all organism.

Summary

1. The development of acute bronchopneumonia at calves’ population is connected with change of quality and quantity characteristics of erythrocytes and neutrophils and can serve as some really new predictive indicators for determination the severity of a disease.
2. Given results deepen our understanding of mechanism of destroy of erythrocytes and neutrophils during animals’ bronchopneumonia.

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References

Microbiological Investigations on Tracheally Aspirated Bronchoalveolar Fluid and Acute Phase Protein Response. Veterinary Microbiology, 137.: 165-171.


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