Research on hematological pattern of hemolitic and posthemorrhagic anemia in dogs

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Abstract

In this paper we attempted to perform a haematological characterization of posthemorrhagic and haemolytic anaemia in dogs because these two types of anaemia have an increased incidence in canine pathology. The research was conducted on 20 different breeds of dogs with different ages that were divided into two experimental groups as follows:

- group 1 was made up of 10 dogs with disorders that induce haemolytic anaemia (babesiosis and IMHA),

- group 2 was made up of 10 dogs with diseases that induce posthaemorrhagic anaemia (multiple traumatic injuries after car accidents, tumors that can generate haemorrhages, surgery, etc.).

To perform haematological determinations, we used a Diagon D-cell 30 blood analyzer and we made the following determinations: RBC, Hb, HCT, MCV, MCH, MCHC, WBC, %Neutophils, %Eosinophils, %Basophils, %Lymphocytes and %Monocytes.

Our research has led to the following conclusions:

1. Anaemia induced by haemolytic mechanism was more intense than that one induced by posthaemorrhagic mechanism. Both haematocrit and haemoglobin have lower values in the case of haemolytic anaemia compared to the posthaemorrhagic anaemia;

2. Anaemia induced by haemolytic mechanism was accompanied by statistically significant leucopenia;

3. A statistically significant neutrophilia was found in case of posthaemorrhagic anaemia;

4. A statistically significant eosinophilia was found in case of haemolytic anaemia.

Keywords: *dog, anaemia, haemolytic, posthemorrhagic.*

Introduction

This research paper aims to contribute to the haematological characterization of the anaemia in dogs because, in addition to the already known data, a lot of other particular situations can occur, each type of anaemia being characterized by a certain haematological picture (Champion T. et al., 2011). The animal body has a remarkable compensation capacity, so that anaemia (especially deficiency anaemia and hypoplastic anaemia) is often not suspected and is discovered after routine laboratory tests (Codreanu I., 2018). We mention that nowadays clinical haematology plays an extremely important role in every veterinary laboratory because currently only the diagnosis of anaemic syndrome is not enough to establish an effective therapeutic conduct.

For this reason, our obtained data can help in the early diagnosis of post-haemorrhagic anaemia (especially caused by occult haemorrhages) and haemolytic anaemia (we mention the increasing incidence of immune-mediated anaemia) because these two types of anaemia are more common in the veterinary clinic (Chikazawa S. et al, 2016, Chervier C et al., 2012).

After analyzing the results obtained (including their statistical processing), we noticed interesting differences regarding the analyzed parameters: red blood cells (RBC), haematocrit

(HTC), haemoglobin (Hb), leukocytes and the percentage of neutrophils and eosinophils in the leukocyte formula). These differences may be benchmarks for assessment of the type of anaemia.

In this paper we attempted to perform a haematological characterization of posthemorrhagic and haemolytic anaemia in dogs because these two types of anaemia have an increased incidence in canine pathology. Haematology (blood count) is one of the first types of tests recommended by the veterinarian in order to determine whether or not the patient is suffering from a disease that affects blood cellularity. In this paper, our major concern was the evaluation of the defining parameters for the erythrocyte and leukocyte series.

Materials and methods

The research was conducted on 20 different breeds of dogs with different ages that were divided into two experimental groups as follows:

- group 1 was made up of 10 dogs with disorders that induce haemolytic anaemia (babesiosis and IMHA),
- group 2 was made up of 10 dogs with diseases that induce posthaemorrhagic anaemia (multiple traumatic injuries after car accidents, tumors that can generate haemorrhages, surgery, etc.).

Blood samples were collected from these animals for the haematological examination. Blood samples were analyzed immediately after harvest because in haematological parameters may occur changes during the storage (Lee J.M. et al, 2016, Gâjâilă G., 2003). The medical analysis were studied and compared (haemolytic anaemia and posthaemorrhagic anaemia) in order to detect possible differences in the blood count.

To perform haematological determinations, we used a Diagon D-cell 30 blood analyzer and we made the following determinations: RBC, Hb, HCT, MCV, MCH, MCHC, WBC, %Neutophils, %Eosinophils, %Basophils, %Lymphocytes and % Monocytes.

Results and discussions

The obtained results will be presented in the form of graphs and tables accompanied by comments. We used t test for processing the statistical data.

The average values of the parameters that characterize the red blood cells series for the two experimental batches are presented in Table 1 and Figure 1.

Table 1. The average values of the parameters that characterize the red blood cells series for the two experimental groups

Experimental group category	**RBC** ***(mil/mm^3)***	**HTC** ***(%)***	**Hb** ***(g/dl)***	**MCV** ***(fl)***	**MCH** ***(pg)***	**MCHC** ***(g/dl)***
Haemolytic anaemia	3,76	28,2	11,52	61,8	20,34	33,0
Posthaemorrhagic anaemia	4,42*	38,2*	12,68*	59,6	22,6	34,8

*P<0,05

Based on the statistical analysis which determine the differences between the two groups, regarding the red blood cells/ mm^3 blood, the differences were statistically significant (P <0.05). The value of this parameter was 17.5% higher for the group with posthaemorrhagic anaemia compared to the haemolytic anaemia group.

The differences between the two experimental lots in terms of HTC value were statistically significant (P <0,05). The value of this parameter was 35.45% higher for the group with posthaemorrhagic anaemia compared to the haemolytic anaemia group.

The differences between the two batches in terms of blood's haemoglobin were statistically significant (P <0.05). The value of this parameter was 10.06% lower for the posthaemorrhagic anaemia group compared to the haemolytic anaemia group.

Differences between the two batches in terms of MCV were statistically insignificant (P> 0.05). We mention that the values we get fall within the physiological limits, which makes us affirm that both types of anaemia studied by us are normocytic.

The differences between the two groups in terms of MCH and MCHC values were statistically insignificant (P> 0.05). We mention that the values we get fall within physiological limits, which makes us affirm that both types of anaemia studied by us are normochrome.

By comparing our data with those found in literature (Hiratzka J.L. et al., 2018), we find that there are no major differences because our values fall within the boundaries communicated by other authors.

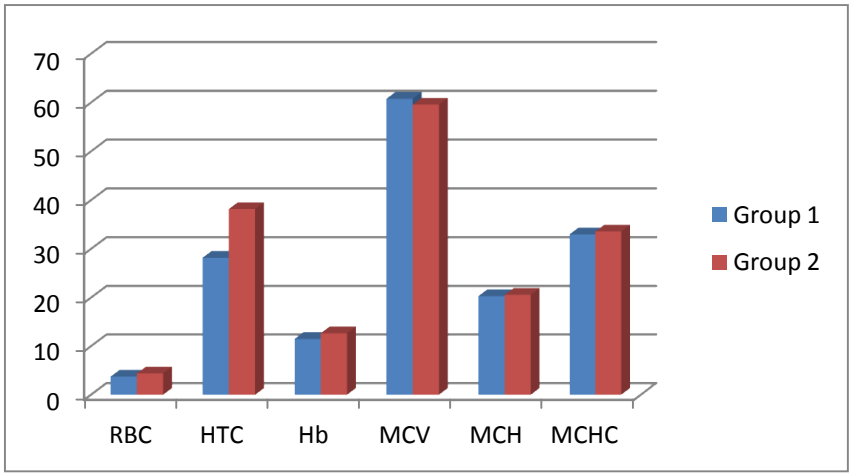

Figure 1. The average values of red blood cell parameters for the two experimental groups

Our results for the purpose of assessing the number of leukocytes / mm^3 blood in dogs in the two experimental groups are presented in Table 2 and Figure 2.

Table 2. The average number of leukocytes for the two experimental groups

Experimental batch category	***WBC (x 10^9/l)***
Haemolytic anaemia	**12,15***
Posthaemorrhagic anaemia	**10,92**

*P<0,05

The differences between the two experimental batches regarding the leucocytes/mm3 were statistically significant (P> 0.05). The value of this parameter was 11.26% higher for the

group of dogs with haemolytic anaemia compared to the group of dogs with posthaemorrhagic anaemia. Our results can be explained by the fact that in posthaemorrhagic anaemia dogs lose both red blood cells and leukocytes, unlike dogs with haemolytic anaemia that lose (by destruction) only red blood cells. The number of leukocytes is almost unchanged as other authors also assert (Owen JL et al., 2012).

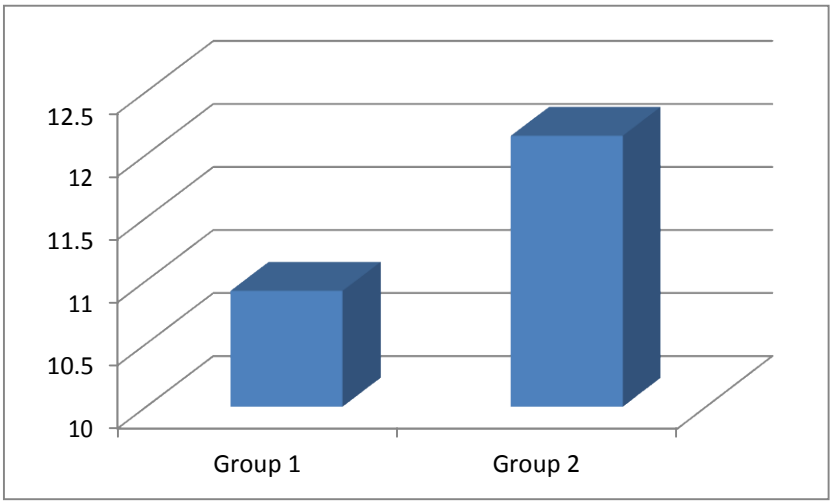

Figure 2. The average number of white blood cells / mm^3 for the two experimental groups

Our results in order to evaluate the average percentages of the white blood cell categories in the leucocyte formula for the two experimental groups are presented in Table 3 and Figure 3.

Table 3. The average values of the percentages of some leukocytes for the two experimental groups

Experimental group category	**Neutrophils** ***(%)***	**Lymphocytes** ***(%)***	**Eosinophils** ***(%)***
Haemolytic anaemia	**59**	**20,2**	**5,6***
Posthaemorrhagic anaemia	**65***	**21,8**	**3,2**

*P<0,05

Based on the statistical analysis of the obtained results, it was found that the differences between the two experimental batches regarding the percentage occupied by the neutrophils in the leucocyte formula were statistically significant (P <0.05). The value of this parameter was 10.16% higher for the group of dogs with posthaemorrhagic anaemia compared to the group of dogs with

haemolytic anaemia. We believe that this fact is due to the causes of anaemia, which was also communicated by other authors (Chervier C. et al., 2012). Posthaemorrhagic anaemia has been caused by major trauma (car accidents) or laborious surgical interventions (splenectomy), stress inducers (neutrophilia is caused by increased plasma glucocorticoid hormones by preventing diapedesis at capillary endothelial levels) (Gâjâilă G, 2003).

Based on the statistical analysis of the obtained results, it was determined that the differences between the two experimental batches in terms of lymphocyte percentage in the leucocyte formula were statistically insignificant (P> 0.05).

Based on the statistical analysis of the obtained results, it was found that the differences between the two experimental batches regarding the eosinophil percentage in the leukocyte formula were statistically significant (P <0.05). The value of this parameter was 42.85% higher for dogs with haemolytic anaemia compared to the group of dogs with posthaemorrhagic anaemia. This fact is due to the producing mechanism of immune-mediated anaemia, which is induced by a type II hypersensitivity reaction, accompanied by a slight increase in the percentage of eosinophils in the leukocyte formula (Kee S.S., et al., 2015). A slight eosinophilia is also produced in the case of babesiosis induced by haemolytic anaemia. This is the way the organism responds to parasitic diseases.

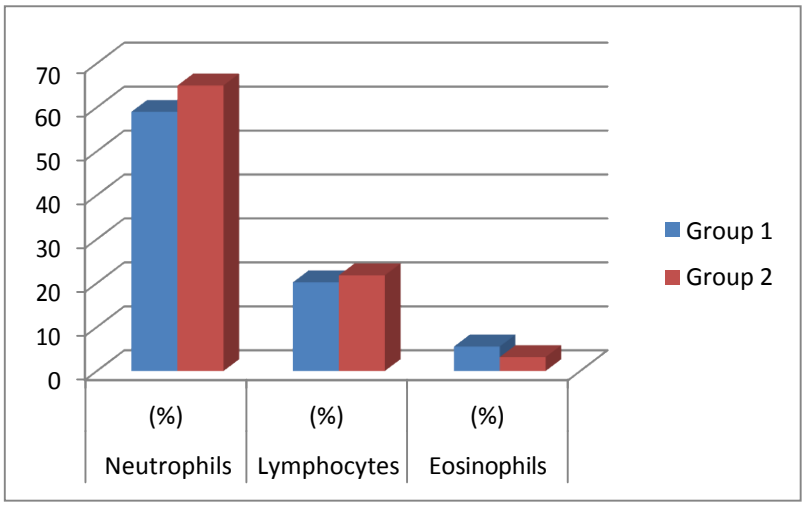

Figure 3. Percentages of neutrophils, lymphocytes and eosinophils in the leukocyte formula for dogs in the two experimental groups

Conclusions

Our research has led to the following conclusions:

1. Anaemia induced by haemolytic mechanism was more intense than that one induced by posthaemorrhagic mechanism. Both haematocrit and haemoglobin have lower values in the case of haemolytic anaemia compared to the posthaemorrhagic anaemia;
2. Anaemia induced by haemolytic mechanism was accompanied by statistically significant leucopenia;
3. A statistically significant neutrophilia was found in case of posthaemorrhagic anaemia;
4. A statistically significant eosinophilia was found in case of haemolytic anaemia.

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