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Study on haematological alterations in canine lymphoma

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Abstract
The present study was conducted to find out the haematological alterations in dogs affected with lymphoma. Whole blood samples were collected from 41 dogs affected with lymphoma. Complete blood counts were estimated. There was a significant decrease in the packed cell volume (PCV), total erythrocyte count (TEC), haemoglobin (Hb), total leucocyte count (TLC) and platelets ($P<0.001$). Decreased haemoglobin in 30 cases, TEC in 33 dogs, PCV in 32 dogs, platelets in 16 dogs and TLC in 3 dogs and elevated TLC in 9 cases were observed. Morphological classification of anemia was made based on the Mean corpuscular volume (MCV) and Mean corpuscular haemoglobin concentration (MCHC). In conclusion, normocytic and normochromic anemia was the major morphological classification of anemia in dogs with lymphoma with decreased values of haemoglobin, PCV, and TEC. Both leucocytosis and leucopenia and thrombocytopenia were also observed.

Keywords: Dog, lymphoma, haematology, anemia

1. Introduction
Canine lymphoma accounts for nearly one quarter of all cancers in dogs. Lymphoma is diagnosed in up to 24% of all dog neoplasms and 83% of all hematopoietic neoplasms in dogs [1, 2, 3]. Although most dogs had only slight anaemia, it was a common finding in canines, occurring up to 38% of the cases [4, 5]. Ninety-six percent dogs had normocytic normochromic anemia and only 4% had microcytic, normochromic anemia [6]. Approximately 30% - 50% of patients were anaemic at diagnosis and most commonly, the anaemia was nonregenerative being normocytic and normochromic. Thrombocytopenia was also freuently reported [7]. With this background the study was planned to assess the haematological alterations in dogs with lymphoma.

2. Materials and Methods
A total of 41 dogs with lymphoma were considered for this study. Blood samples, about 2ml, were collected using EDTA vacutainer and processed. Haematological parameters were determined using commercial kits (Agappe diagnostics, India) in BC-2800 Vet Auto Haematology Analyzer (Mindray Medical Instrumentation, China). DLC and appearance of erythrocytes were analysed from peripheral blood smears. Complete plate count including, Packed cell volume (PCV), haemoglobin (Hb), total erythrocyte count (TEC), total leukocyte count (TLC) and platelets were determined. Mean Corpuscular Volume (MCV) and Mean Corpuscular Haemoglobin Concentration (MCHC) were calculated using standard formula.

2.1. Statistical analysis
The data obtained were statistically analysed by using independent student T- test in SSPS software (IBM®SPSS®Ver20.0 for Windows®).

3. Results
Complete blood count (CBC) was done in 41 dogs with lymphoma (Tables 1 and 2). Among those, 33 dogs showed anemic changes with a morphologic type of normocytic normochromic anemia. Eight dogs did not show any anemic changes.

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Table 1: CBC values in lymphoma (N=41)

Parameters	Range	Mean $\pm$ S.E.	Reference range (Rizzi *et al.*, 2010)
Haemoglobin (g/dL)	2.5 - 17.6	9.32 $\pm$ 0.59	12.0 - 18.0
RBC (x10^6/µL)	0.86 - 7.16	4.15 $\pm$ 0.23	5.5 - 8.5
PCV (%)	7.8 - 47.6	27.32 $\pm$ 1.66	37 - 55
WBC (/µL)	3500 - 96600	19736.60 $\pm$ 3232.10	6000 - 17000
Platelets (/µL)	20000 - 519000	236341 $\pm$ 18731.90	200000 - 500000
MCV (fL)	65.80		60 -77
MCHC (%)	34.40		32 - 36

** Significant at 1% level (*P*<0.01)

Table 2: Altered CBC values in lymphoma (N=41)

Parameters	Status	No. of dogs	Range	Mean$\pm$ SE	Incidence (%)
Haemoglobin (g/dL)	Decreased	30	2.5 - 11.0	7.4$\pm$ 0.12**	73.17
RBC (x10^6/µL)	Decreased	33	0.86 - 5.29	3.59$\pm$ 0.05**	80.49
PCV (%)	Decreased	32	7.8 - 36.0	22.73$\pm$ 0.76**	78.05
WBC (/µL)	Decreased	3	3500 - 5900	4866.68$\pm$ 179**	7.32
WBC (/µL)	Increased	9	17900 - 67200	30088.89 $\pm$ 13542	21.95
Platelets (/µL)	Decreased	16	20000 - 198000	124750 $\pm$ 16754**	39.02

** Significant at 1% level (*P*<0.01)

Decreased haemoglobin in 30 cases, TEC in 33 dogs, PCV in 32 dogs, platelets in 16 dogs and TLC in 3 dogs and elevated TLC in 9 cases were observed.

4. Discussion
Anemia was the most frequently encountered abnormality in this study, occurring in 80.49% of the animals. Others studies detected anemia in 32 to 57% of dogs with lymphoma [3, 6]. The increased number of anemic patients in this study was most likely due to their more advanced clinical stage and sub-stage. Anemia detected in dogs with lymphoma is generally consistent with a chronic disease, but can also be related to haemolysis or be of bone marrow origin [8] or due to complex interactions between tumour cells and the patient's homeostatic control of erythrocyte manufacture and metabolism mediated via inflammatory cytokines [9].

In this study, all the anaemic dogs (80.5%) had normocytic and normochromic anemia (100%) and none had microcytic, normochromic anemia. While it was reported that 96% (26/27) of lymphoma cases showed normocytic normochromic anemia and only 4% (1/27) showed microcytic, normochromic anemia. The mean PCV observed in this study was 22.73%, which is much lower than other's [6] report of 35% in lymphoma cases with anaemia. Among the anaemic dogs, 73.17% animal showed decreased haemoglobin values (mean 7.4 g/dL) and 80.49% dogs showed decreased erythrocyte count (mean 3.59 x10^6/µL).

Other frequent alterations observed in the CBC of dogs with lymphoma included leukocytosis (9/41; 21.95%) and thrombocytopenia (16/41; 39.02%). Leukocytosis was often detected in dogs with lymphoma, reflecting the inflammatory condition related to the tumor. Thrombocytopenia occurs in 15 to 56% of dogs with lymphoma and was related to the immune-mediated destruction and / or bone marrow involvement [7]. Leukopenia (22%) was also found in this study and was encountered more often than leukocytosis (7%) and occurred due to sequestration of lymphocytes because of lymph stasis [10].

The reasons for such anaemia was thought to be due to complex interactions between tumour cells and the patient's homeostatic control of erythrocyte manufacture and metabolism mediated via inflammatory cytokines [9]. In a retrospective study incorporating clinicopathologic abnormalities of canine lymphoma patients, anaemia was found to be the most common haematologic disturbance but leukocytosis was observed only in 32% of cases with half of those being due to a neutrophilia, monocytosis, eosinopenia and lymphopenia [3].

5. Conclusion
We conclude that, normocytic and normochromic anemia was the major morphological classification of anemia in dogs with lymphoma with decreased values of haemoglobin, PCV, and TEC. Thrombocytopenia, leucocytosis and leucopenia were also observed.

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