Original Research

Hematological Changes in Different Stages of Canine Chronic Kidney Disease

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Abstract

Chronic kidney diseases are one of the most commonly encountered problems in small animal practice. Kidney plays crucial role in production of red blood cell through production of erythropoietin hormone. Present work was carried out to study major hematological changes in dogs suffering with chronic kidney disease. In dogs suffering with different stages of CKD, normocytic normochromic anemia was observed along with leukocytosis. Severity of anemia was increased with advancement of CKD.

Key words: Anemia, CKD, Canine, Hematology

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Introduction

Chronic kidney disease (CKD) is a general term for heterogeneous disorders affecting kidney structure and function (Levey and Coresh, 2012). CKD is defined as irreversible and progressive deterioration of renal function, resulting from a decreased number of functional nephrons (Foster, 2013). Irrespective of initiating causes CKD is slowly progressive condition leading to alteration in hematological parameters. Many authors reported anemia in dogs suffering with CKD (Sumit *et al.*, 2018, Rudinsky *et al.*, 2018). With this background present work was undertaken to study hematological changes in different stages of CKD.

Material and Methods

The dogs with chronic kidney disease were staged as per guidelines of IRIS Board as Stage I (serum creatinine value of <1.4 mg/dL), Stage II (serum creatinine value of 1.4 to 2.0 mg/dL), Stage III (serum creatinine value of 2.1 to 5.0 mg/dL) and Stage IV (serum creatinine value of >5.0 mg/dL). Blood sample was collected by venipuncture of saphenous or cephalic vein into two ml tubes containing EDTA and transferred to the Department of Veterinary Medicine Laboratory analyses. Hematological parameters like

hemoglobin, hematocrit, total erythrocyte count, total leukocyte count were analyzed using BC 2800 Mindray Hematology Analyzer and peripheral smears were made for Differential leukocyte count. Statistical analyses of collected data were performed with GraphPad Prism 7.00 (GraphPad Software, CA, USA).

Result and Discussion

Total of 176 dogs were recorded with CKD and were categorized based on serum creatinine concentration as Stage I, Stage II, Stage III and Stage IV as per guidelines of International Renal Interest society (IRIS). Hematological changes observed in different stages of CKD were compared with healthy control animal and were presented in Table 1.

Table 1: Mean ± SE of Hematological parameters observed in different stages of CKD in dogs

Parameter	Control (n=6)	CKD Stage I (n=32)	CKD Stage II (n=43)	CKD Stage III (n=44)	CKD Stage IV (n=57)
Hemoglobin (g%)	13.17 ± 0.29	11.41 ± 0.23	10.09 ± 0.05	9.87 ± 0.05	8.87 ± 0.05
Hematocrit (%)	40.33 ± 0.67	35.31 ± 0.54	30.86 ± 0.23	28.21 ± 0.15	26.41 ± 0.215
TEC ($x10^6$/µl)	6.03 ± 0.09	5.31 ± 0.02	4.58 ± 0.04	4.16 ± 0.02	3.98 ± 0.04
MCV (fL)	66.84 ± 0.23	66.49 ± 0.17	67.31 ± 0.81	67.80 ± 0.23	66.37 ± 0.21
MCHC (g/dL)	32.67 ± 0.77	32.32 ± 0.77	32.65 ± 0.28	34.46 ± 0.3	33.56 ± 0.3
MCH (pg)	21.83 ± 0.47	21.46 ± 0.44	22.02 ± 0.4	23.70 ± 0.17	22.28 ± 0.18
WBC ($x10^3$/µl)	9.97 ± 0.28	11.93 ± 0.26	17.86 ± 0.26	17.88 ± 0.21	19.83 ± 0.26
Platelets (lakhs/µl)	3.1 ± 0.13	3.09 ± 0.13	3.05 ± 0.05	2.73 ± 0.04	2.65 ± 0.07
Neutrophils (%)	80.17 ± 0.54	84.16 ± 0.54	87.46 ± 0.31	88 ± 0.2	88.6 ± 0.4
Lymphocytes (%)	14.67 ± 0.49	10.11 ± 0.43	9.67 ± 0.22	9.63 ± 0.16	9.50 ± 0.14
Monocytes (%)	5.17 ± 0.87	5.73 ± 0.67	2.88 ± 0.2	2.37 ± 0.16	1.90 ± 0.16

In the present study there was significant reduction in mean ± SE values of hemoglobin, hematocrit and total erythrocytes count in CKD stage I, CKD stage II, CKD stage III and CKD stage IV was observed when compared with control group. There was no much variations in mean ± SE of mean corpuscular volume, mean corpuscular hemoglobin concentration and mean corpuscular hemoglobin values in CKD stage I, CKD stage II, CKD stage III and CKD stage IV when compared with control group. MCV, MCHC and MCH values were in the normal range as indicated by Weiss and Wardrop (2010). These findings were indicative of normocytic normochromic anemia in different stages of chronic kidney disease and severity of progressively increased as CKD advances. These observations are in accordance with Shruti *et al.* (2017) and Nakang *et al.* (2019).

Anemia in CKD may be because of impaired production of erythropoietin from diseased kidneys, nutritional imbalances because of hyporexia/ anorexia, reduced red blood cell life span, and blood loss due to uremic gastroenteritis as indicated by Polzin *et al.* (2005). Neutrophilic leukocytosis was observed in all

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stages of CKD, which is mainly due to stress reaction during CKD (Coles, 1986) or may be due to leucocytic reaction to microbial agents. Thrombocytopenia in later stages of CKD may be due to insufficient thrombopoietic activity (Gafter *et al*., 1987) due to accumulation uremic toxins. Depending on degree of uremic crisis animal develops thrombocytopenia.

Conclusion

In CKD normocytic normochromic anemia is commonly seen in all stages and severity of anemia increases as condition progresses to advanced stages of CKD.

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