

## Hemato-Biochemical Evaluation of Chronic Kidney Disease (CKD) Affected Dogs under Anti-Hypertensive Medication

S. Nethaji<sup>1</sup>, M. Chandrasekar and M. Balagangatharathilagar

Department of Veterinary Clinical Medicine  
Madras Veterinary College  
Tamil Nadu Veterinary and Animal Sciences University (TANUVAS)  
Vepery  
Chennai - 600007 (Tamil Nadu)

### Abstract

Thirty Chronic Kidney Disease (CKD) affected dogs with hypertension undergoing antihypertensive therapy including Enalapril, Amlodipine and Telmisartan that were selected and ten apparently healthy dogs were selected randomly for our study. Blood was collected from these dogs for checking complete blood count (hemoglobin, packed cell volume, RBC, WBC, platelets), erythrocyte indices (MCV, MCHC and MCH) and serum biochemistry (blood urea nitrogen, creatinine, phosphorus and potassium) and evaluated.

**Keywords:** Biochemistry; CKD; complete blood count; hypertension

### Introduction

Progressive non-regenerative anemia commonly develops in dogs with Chronic Kidney Disease (CKD) secondary to shortened red blood cell life span, erythropoietin deficiency and intestinal blood loss (McGrotty, 2008). Impaired production of erythropoietin due to loss of renal parenchyma, increase hemolysis, suppression of bone marrow erythropoiesis, hematuria and gastrointestinal blood loss are associated with anemia. Decreased values of MCV and MCH might be due to hemolysis of red blood cells which results in loss of blood as melena and hematemesis, hematuria and also decreased value might be due to deficiency of erythropoietin production by the diseased kidneys (Sumit *et al.*, 2018). Phosphate retention is an inevitable consequence of gradual decline in renal phosphate clearance which starts at an early stage of CKD resulting in hyperphosphatemia while azotemia might be due to decreased ability of kidneys to eliminate creatinine as there will be reduced GFR (Martin and Gonzalez, 2011).

### History and Observation

Thirty chronic kidney disease (CKD) affected dogs with hypertension were presented with history of inappetance, vomiting, melena, emaciation, polyurea and polydipsia were selected randomly and their blood samples were collected before treatment, 7

days post treatment, 14 days post treatment and 28 days post treatment period. Also blood samples were collected from ten apparently healthy dogs and the values obtained were subjected for statistical analysis.

### Treatment and Discussion

Blood samples were collected from CKD dogs with hypertension and apparently healthy dogs for analyzing hematological and serum biochemistry parameters (Table 1-4).

CBC count and serum biochemical profile showed decreased hemoglobin, PCV, RBC, MCV and MCH values (group II, group III and group IV) when compared to group I. A significant increase in BUN, creatinine, phosphorus and potassium was recorded in all three treated groups (Group II, III and IV) throughout the study period when compared to group I.

Similar findings were noticed by Crivellenti *et al.*, 2017; Sumit *et al.*, 2018, who also recorded a decrease in levels of Hb and PCV in dogs treated for CKD. The present findings correlated with that of Sumit *et al.* (2018), who also recorded decreased values of MCV, MCH and MCHC in CKD treated dogs. However in our study, no significant difference was observed in MCHC. The present study were in accordance with that of Hokamp *et al.* (2016) and McGrotty (2008) who also recorded similar findings in dogs treated for CKD.

1. Corresponding author.

E-mail: nethajisekaran@gmail.com

**Table 1: Mean  $\pm$  S.E values of hematological values**

Parameters	Days	Healthy dogs	CKD dogs with Enalapril medication	CKD dogs with Amlodipine medication	CKD dogs with Telmisartan medication	F value
Hemoglobin (g/dl)	Before treatment	13.13 <sup>B</sup> $\pm$ 0.32	8.7 <sup>A</sup> $\pm$ 1.61	9.32 <sup>A</sup> $\pm$ 0.98	9.3 <sup>A</sup> $\pm$ 0.83	3.721 <sup>*</sup>
	7 <sup>th</sup> day	13.21 <sup>B</sup> $\pm$ 0.11	8.55 <sup>A</sup> $\pm$ 1.42	9.14 <sup>A</sup> $\pm$ 0.82	8.72 <sup>A</sup> $\pm$ 0.83	5.38 <sup>**</sup>
	14 <sup>th</sup> day	13.18 <sup>B</sup> $\pm$ 0.33	8.48 <sup>A</sup> $\pm$ 1.30	9.37 <sup>A</sup> $\pm$ 1.089	9.014 <sup>A</sup> $\pm$ 2.287	6.68 <sup>**</sup>
	28 <sup>th</sup> day	13.18 <sup>B</sup> $\pm$ 0.16	9.1 <sup>A</sup> $\pm$ 2.77	5.50 <sup>C</sup> $\pm$ 0.01	8.48 <sup>A</sup> $\pm$ 1.18	5.916 <sup>**</sup>
PCV (%)	Before treatment	38.3 <sup>B</sup> $\pm$ 1.16	24.6 <sup>A</sup> $\pm$ 4.20	27.22 <sup>A</sup> $\pm$ 2.99	27.610 <sup>A</sup> $\pm$ 2.42	4.313 <sup>**</sup>
	7 <sup>th</sup> day	38.2 <sup>B</sup> $\pm$ 1.16	23.34 <sup>A</sup> $\pm$ 3.29	45.92 <sup>A</sup> $\pm$ 18.62 <sup>a</sup>	28.030 <sup>A</sup> $\pm$ 2.80	1.126 <sup>**</sup>
	14 <sup>th</sup> day	38.7 <sup>B</sup> $\pm$ 1.23	26.24 <sup>A</sup> $\pm$ 3.80	28.91 <sup>A</sup> $\pm$ 3.14	37.1 <sup>A</sup> $\pm$ 12.44	1.19 <sup>**</sup>
	28 <sup>th</sup> day	38.9 <sup>B</sup> $\pm$ 1.81	29.8 <sup>A</sup> $\pm$ 3.80	16.6 <sup>A</sup> $\pm$ 0.01	23.34 <sup>A</sup> $\pm$ 3.29	2.802 <sup>**</sup>
RBC (millions/cmm)	Before treatment	5.23 <sup>B</sup> $\pm$ 0.21	4.03 <sup>A</sup> $\pm$ 0.65	4.36 <sup>A</sup> $\pm$ 0.46	4.07 <sup>A</sup> $\pm$ 0.46	0.103 <sup>**</sup>
	7 <sup>th</sup> day	5.14 <sup>B</sup> $\pm$ 0.16	3.97 <sup>A</sup> $\pm$ 0.52	4.17 <sup>A</sup> $\pm$ 0.34	3.75 <sup>A</sup> $\pm$ 0.49	0.267 <sup>**</sup>
	14 <sup>th</sup> day	5.22 <sup>B</sup> $\pm$ 0.22	3.66 <sup>A</sup> $\pm$ 0.55	4.05 <sup>A</sup> $\pm$ 0.49	4.25 <sup>A</sup> $\pm$ 0.58	0.346 <sup>**</sup>
	28 <sup>th</sup> day	4.50 <sup>B</sup> $\pm$ 0.28	3.88 <sup>A</sup> $\pm$ 1.06	3.34 <sup>A</sup> $\pm$ 0.01	3.66 <sup>A</sup> $\pm$ 0.34	0.387 <sup>**</sup>
WBC(/cmm)	Before treatment	11210.1 $\pm$ 725.1	11640.1 $\pm$ 2277.33	19160 $\pm$ 3805.73	13760 $\pm$ 194.20	1.412 <sup>NS</sup>
	7 <sup>th</sup> day	11210.1 $\pm$ 725.1	9600 $\pm$ 1435.038	17888 $\pm$ 3231.64	16170 $\pm$ 4833.54	1.709 <sup>NS</sup>
	14 <sup>th</sup> day	11210.1 $\pm$ 725.1	10957 $\pm$ 1376.65	10317 $\pm$ 719.19	10442.86 $\pm$ 598.35	1.626 <sup>NS</sup>
	28 <sup>th</sup> day	11210.1 $\pm$ 725.1	11005.3 $\pm$ 1989.9	11000 $\pm$ 719.36	10345.68 $\pm$ 598.35	0.376 <sup>NS</sup>

(A, B) Mean values bearing the same superscript in the rows (upper cases) do not vary significantly.

<sup>\*</sup> - Statistically highly significant (P<0.01) <sup>\*</sup> - Statistically significant (P<0.05) <sup>NS</sup> - Statistically non significant (P>0.05)

**Table 2: Mean  $\pm$  S.E values of differential leucocyte count**

Parameters	Days	Healthy dogs	CKD dogs with Enalapril medication	CKD dogs with Amlodipine medication	CKD dogs with Telmisartan medication	F value
Neutrophils (%)	Before treatment	72.2 <sup>A</sup> $\pm$ 0.69	78.4 <sup>B</sup> $\pm$ 2.22	80.6 <sup>B</sup> $\pm$ 2.177	79.7 <sup>B</sup> $\pm$ 2.46	3.535 <sup>*</sup>
	7 <sup>th</sup> day	72.8 <sup>A</sup> $\pm$ 0.20	75.1 <sup>AB</sup> $\pm$ 0.98	77.9 <sup>BC</sup> $\pm$ 1.05	80.5 <sup>C</sup> $\pm$ 2.48	5.847 <sup>*</sup>
	14 <sup>th</sup> day	72.5 <sup>A</sup> $\pm$ 0.69	75.5 <sup>AB</sup> $\pm$ 1.95	76.43 <sup>AB</sup> $\pm$ 1.81	78.29 <sup>B</sup> $\pm$ 1.72	3.240 <sup>*</sup>
	28 <sup>th</sup> day	73.1 <sup>A</sup> $\pm$ 0.61	72.33 <sup>AB</sup> $\pm$ 1.33	75.00 <sup>B</sup> $\pm$ 0.96	77.9 <sup>B</sup> $\pm$ 1.05	3.255 <sup>*</sup>
Lymphocyte (%)	Before treatment	24.4 <sup>B</sup> $\pm$ 0.4	16.6 <sup>A</sup> $\pm$ 2.05	14.2 <sup>A</sup> $\pm$ 1.98	15.4 <sup>A</sup> $\pm$ 2.28	6.625 <sup>*</sup>
	7 <sup>th</sup> day	24.4 <sup>B</sup> $\pm$ 0.4	18.5 <sup>A</sup> $\pm$ 2.007	17.3 <sup>A</sup> $\pm$ 0.87	14.7 <sup>A</sup> $\pm$ 2.39	6.317 <sup>**</sup>

CKD affected dogs

Parameters	Days	Healthy dogs	CKD dogs with Enalapril Medication	CKD dogs with Amlodipine Medication	CKD dogs with Telmisartan Medication	F value
	14 <sup>th</sup> day	24.4 <sup>B</sup> ±0.4	20.43 <sup>AB</sup> ±2.81	19.14 <sup>A</sup> ±1.85	18.57 <sup>A</sup> ±1.58	2.756 <sup>**</sup>
	28 <sup>th</sup> day	24.4 <sup>B</sup> ±0.4	22.67 <sup>A</sup> ±1.20	21.00 <sup>A</sup> ±0.91	18.5 <sup>A</sup> ±2.023	3.599 <sup>**</sup>
Monocyte (%)	Before treatment	3.60 ±0.4	4.9 ±0.623	4.8 ±0.29	4.3 ±0.3	2.156 <sup>NS</sup>
	7 <sup>th</sup> day	3.76 ±0.2	3.11 ±0.67	4.4 ±0.16	4.0 ±0.4	2.377 <sup>NS</sup>
	14 <sup>th</sup> day	3.54 ±0.3	3.43 ±0.36	4.14 ±0.34	3.43 ±0.52	0.707 <sup>NS</sup>
	28 <sup>th</sup> day	3.34 ±0.4	3.67 ±0.66	4.00 ±0.12	3.54 ±0.3	0.121 <sup>NS</sup>

Mean values (A, B) bearing the same superscript in rows (upper cases) do not vary significantly.

<sup>\*\*</sup> - Statistically highly significant (P<0.01) <sup>\*</sup> - Statistically significant (P<0.05) <sup>NS</sup> - Statistically non significant (P>0.05)

Table 3: Mean ± S.E values of RBC indices

Parameters	Days	Healthy dogs	CKD dogs with Enalapril Medication	CKD dogs with Amlodipine Medication	CKD dogs with Telmisartan Medication	F value
MCV (fL)	Before treatment	91.9±0.36 <sup>aB</sup>	60.6±0.19 <sup>Ca</sup>	62.4±0.22 <sup>ca</sup>	71.8±2.505 <sup>aA</sup>	9.690 <sup>**</sup>
	7 <sup>th</sup> day	91.9±0.36 <sup>aB</sup>	31.2±0.14 <sup>bA</sup>	31.9±0.09 <sup>ba</sup>	34.9±0.268 <sup>aA</sup>	200.60 <sup>**</sup>
	14 <sup>th</sup> day	91.9±0.36 <sup>bB</sup>	73.2±0.51 <sup>aA</sup>	72.2±0.96 <sup>aA</sup>	76.3±0.98 <sup>aA</sup>	1.128 <sup>**</sup>
	28 <sup>th</sup> day	91.9±0.36 <sup>aB</sup>	74.9±0.39 <sup>aA</sup>	49.7±0.03 <sup>ba</sup>	73.2±0.51 <sup>aA</sup>	5.171 <sup>**</sup>
	'F' value	0.00 <sup>NS</sup>	7.48 <sup>**</sup>	9.33 <sup>**</sup>	1.996 <sup>NS</sup>	
MCH (pg)	Before treatment	31.6±0.142 <sup>aB</sup>	21.1±0.09 <sup>aA</sup>	21.4±0.08 <sup>aA</sup>	24.0±0.21 <sup>aA</sup>	11.429 <sup>**</sup>
	7 <sup>th</sup> day	31.6±0.142 <sup>aB</sup>	21.2±0.14 <sup>aA</sup>	21.9±0.09 <sup>aA</sup>	24.9±0.26 <sup>aA</sup>	7.229 <sup>**</sup>
	14 <sup>th</sup> day	31.6±0.142 <sup>aB</sup>	23.2±0.11 <sup>aA</sup>	23.3±0.14 <sup>aA</sup>	22.8±0.27 <sup>aA</sup>	6.743 <sup>**</sup>
	28 <sup>th</sup> day	31.6±0.142 <sup>aB</sup>	23.0±0.11 <sup>aA</sup>	16.4±0.011 <sup>aA</sup>	21.9±0.09 <sup>aA</sup>	7.173 <sup>**</sup>
	'F' value	0.00 <sup>NS</sup>	0.679 <sup>NS</sup>	1.525 <sup>NS</sup>	0.110 <sup>NS</sup>	
MCHC (g/dl)	Before treatment	34.4±0.23	34.8±0.008	34.4±0.009	34.1±0.014	0.071 <sup>NS</sup>
	7 <sup>th</sup> day	34.4±0.23	35.7±0.018	31.8±0.03	31.9±0.005	0.677 <sup>NS</sup>
	14 <sup>th</sup> day	34.4±0.23	32.2±0.01	32.4±0.05	26.1±0.04	2.855 <sup>NS</sup>
	28 <sup>th</sup> day	34.4±0.23	30.7±0.004	33.2±0.001	32.2±0.01	2.719 <sup>NS</sup>
	'F' value	0.00 <sup>NS</sup>	1.652 <sup>NS</sup>	0.209 <sup>NS</sup>	2.077 <sup>NS</sup>	

Mean values (a, b, c and A, B, C) bearing the same superscript in column(lower case) and rows (upper case) do not vary significantly

<sup>\*\*</sup> - Statistically highly significant (P<0.01)

<sup>\*</sup> - Statistically significant (P<0.05)

<sup>NS</sup> - Statistically non significant (P>0.05)

Table 4: Mean  $\pm$  S.E values of kidney function tests

Parameters	Days	Healthy dogs	CKD dogs with Enalapril medication	CKD dogs with Amlodipine medication	CKD dogs with Telmisartan medication	F value
BUN(mg/dl)	Before treatment	23.9 <sup>A</sup> $\pm$ 2.34	93.08 <sup>B</sup> $\pm$ 9.52	71.68 <sup>B</sup> $\pm$ 9.81	80.65 <sup>B</sup> $\pm$ 15.29	8.69**
	7 <sup>th</sup> day	19.3 <sup>A</sup> $\pm$ 0.99	83.96 <sup>B</sup> $\pm$ 11.71	68.95 <sup>B</sup> $\pm$ 29.75	84.93 <sup>B</sup> $\pm$ 16.17	6.732**
	14 <sup>th</sup> day	23.4 <sup>A</sup> $\pm$ 2.33	74.8 <sup>B</sup> $\pm$ 17.06	65.88 <sup>B</sup> $\pm$ 15.38	62.45 <sup>B</sup> $\pm$ 18.5	3.567*
	28 <sup>th</sup> day	24.44 <sup>A</sup> $\pm$ 2.1	79.48 <sup>B</sup> $\pm$ 10.68	65.6 <sup>B</sup> $\pm$ 0.01	68.95 <sup>B</sup> $\pm$ 29.75	7.68*
Creatinine (mg/dl)	Before treatment	0.6 <sup>A</sup> $\pm$ 0.33	10.25 <sup>B</sup> $\pm$ 2.02	6.57 <sup>B</sup> $\pm$ 1.04	9.21 <sup>B</sup> $\pm$ 2.24	7.335*
	7 <sup>th</sup> day	0.43 <sup>A</sup> $\pm$ 0.12	9.69 <sup>B</sup> $\pm$ 2.08	5.80 <sup>B</sup> $\pm$ 1.89	1.6 <sup>B</sup> $\pm$ 11.50	1.055 <sup>ns</sup>
	14 <sup>th</sup> day	0.55 <sup>A</sup> $\pm$ 0.33	5.7 <sup>B</sup> $\pm$ 1.76	6.38 <sup>B</sup> $\pm$ 1.21	6.5 <sup>B</sup> $\pm$ 2.85	3.66*
	28 <sup>th</sup> day	0.7 <sup>A</sup> $\pm$ 0.41	3.22 <sup>B</sup> $\pm$ 1.73	8.86 <sup>AB</sup> $\pm$ 0.11	5.7 <sup>B</sup> $\pm$ 1.32	5.36**
Phosphorus (mg/dl)	Before treatment	4.1 <sup>A</sup> $\pm$ 0.2	12.55 <sup>A</sup> $\pm$ 1.69	11.57 <sup>A</sup> $\pm$ 1.07	9.36 <sup>A</sup> $\pm$ 1.47	1.174*
	7 <sup>th</sup> day	4.6 <sup>A</sup> $\pm$ 1.2	11.66 <sup>B</sup> $\pm$ 1.48	10.18 <sup>B</sup> $\pm$ 0.92	9.98 <sup>B</sup> $\pm$ 1.73	7.339*
	14 <sup>th</sup> day	4.5 <sup>A</sup> $\pm$ 1.1	9.76 <sup>B</sup> $\pm$ 2.14	9.75 <sup>B</sup> $\pm$ 1.08	8.14 <sup>B</sup> $\pm$ 1.52	5.49**
	28 <sup>th</sup> day	4.1 <sup>A</sup> $\pm$ 1.3	7.94 <sup>B</sup> $\pm$ 1.98	9.15 <sup>B</sup> $\pm$ 0.13	9.76 <sup>B</sup> $\pm$ 2.14	6.25**
Potassium (mg/dl)	Before treatment	3.54 <sup>A</sup> $\pm$ 0.4	5.2 <sup>B</sup> $\pm$ 0.1	5.12 <sup>B</sup> $\pm$ 0.19	5.09 <sup>B</sup> $\pm$ 0.23	17.49**
	7 <sup>th</sup> day	3.45 <sup>A</sup> $\pm$ 0.55	4.92 <sup>B</sup> $\pm$ 0.22	4.84 <sup>B</sup> $\pm$ 0.23	5.11 <sup>B</sup> $\pm$ 0.23	7.836 <sup>ns</sup>
	14 <sup>th</sup> day	3.5 <sup>A</sup> $\pm$ 0.8	5.60 <sup>B</sup> $\pm$ 0.38	4.85 <sup>B</sup> $\pm$ 0.186	5.26 <sup>B</sup> $\pm$ 0.231	15.91**
	28 <sup>th</sup> day	3.5 <sup>A</sup> $\pm$ 1.2	4.19 <sup>B</sup> $\pm$ 0.09	4.99 <sup>B</sup> $\pm$ 0.01	4.85 <sup>B</sup> $\pm$ 0.13	15.63**

Mean values (A, B) bearing the same superscript in the rows (upper cases) do not vary significantly.

\*\* - Statistically highly significant (P<0.01) \* - Statistically significant (P<0.05) <sup>ns</sup> - Statistically non significant (P>0.05)

### Summary

In our study, all CKD dogs undergoing antihypertensive trial with different classes of antihypertensives showed decreased level of hemoglobin, PCV, RBC, MCV and MCH while increased values for BUN, creatinine, phosphorus and potassium.

### References

Crivellenti, L.Z., S. Borin Crivellenti, K.L. Feral, C.M. Contini, C.M. Miranda and A.E. Santana (2017). Occult gastrointestinal bleeding is a common finding in dogs with chronic kidney disease. *Vet. Clin. Pathol.* **46**: 132-37.

Hokamp, J.A., R.E. Cianciolo, M. Boggess, G.E. Lees, S.L. Benali, M. Kovarsky and M.B. Nabity (2016). Correlation

of urine and serum biomarkers with renal damage and survival in dogs with naturally occurring proteinuric chronic kidney disease. *J. Vet. Intern. Med.* **30**: 591-601.

Martin, K.J. and E.A. González (2011). Prevention and control of phosphate retention/hyperphosphatemia in CKD-MBD: what is normal, when to start and how to treat?. *Clin J. Am. Soc. Nephrol.* **6**: 440-46.

McGrotty, Y. (2008). Diagnosis and management of chronic kidney disease in dogs and cats. *In Practice* **30**: 502.

Sumit, P.G., Kumar, P., Gulia, D., Jhambh, R., Sindhu, N. and Chaudhary, R.N. (2018). Hematobiochemical and serum electrolytes alteration in dogs with chronic kidney disease. *The Pharma. Inno. J.* **7**: 302-06.

Received on:02.08.2020  
Accepted on:15.11.2020