

## HEMATOLOGICAL AND BIOCHEMICAL VARIABLES IN CONGESTIVE HEART FAILURE IN DOGS

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**Abstract:** The present study was undertaken in the Veterinary College Hospital, Bangalore. Blood samples from dogs suffering from congestive heart failure (CHF) were collected and routine haematological and blood biochemical analysis were done. Most animals had values within the normal range except for a few outliers. Important changes included leucocytosis, anemia and azotemia in few dogs. Leukocytosis resolved without the use of antimicrobial agents once treatment for CHF was initiated. The results of the study indicated that hematology and biochemistry were more useful in ruling out CHF or diagnosing concurrent diseases rather than diagnosing CHF.

**Keywords:** congestive heart failure, leukocytosis, azotemia.

### Introduction

The diagnosis of congestive heart failure is generally accomplished by electrocardiographic, radiographic and echocardiographic examination of those animals with compatible clinical signs like coughing, ascites, dyspnoea, exercise intolerance, tachypnoea, orthopnoea and syncope (Reynolds and Oyama, 2008). Hematology and biochemistry have not been particularly useful for the diagnosis of heart disease; however, they can be helpful to investigate potential concurrent diseases (de Morias, 2000). Routine blood analysis may be within normal range with prerenal azotemia indicating low cardiac output. Circulating neurohormones are increased (Dukes-McEwan et al., 2003). Hematology and biochemistry panels are unremarkable in mild cases, but serious cases may have mildly elevated liver enzymes and prerenal azotemia (Olsen et al., 2010). So the present study was undertaken to evaluate if any significant hematological or biochemical changes occur in dogs with CHF.

### Materials and Methods

The dogs presented to Veterinary College Hospital, Bangalore during the year 2014 with clinical signs referable to congestive heart failure like cough, ascites, exercise intolerance, tachypnoea, syncope, orthopnoea and dyspnoea were subjected to thorough

physical examination, routine blood tests, electrocardiography, radiography and echocardiography. Cases were confirmed as congestive heart failure based on radiographic findings of cardiomegaly and pulmonary edema and echocardiographic evidence of decreased systolic function (for dilated cardiomyopathy) and mitral regurgitation and valve thickening along with left atrial enlargement (for mitral valve disease).

Blood was collected in ethylene diaminetetraacetic acid (EDTA) for hematology and plasma separation and without any anticoagulant for serum. Erba Mannheim® alanine aminotransferase (ALT), creatinine, total protein, albumin, potassium and sodium kits were procured from TransasiaBiomedicals Ltd, Himachal Pradesh. Fully automatic Blood Cell Counter PCE 210 (Erma Inc., Tokyo) was utilized for hematology and TrivitronLabmate 10 Plus semi-automatic biochemical analyzer (Trivitron Health Care, Bangalore) was utilized for biochemical analysis.

## Results

Seventy eight dogs were diagnosed with congestive heart failure in the year 2014 and their hematology and biochemical panel results (Table 1) are as below:

The total leukocyte count ranged from  $3.5 \times 10^3$  cells/  $\mu\text{L}$  to  $29.0 \times 10^3$  cells/  $\mu\text{L}$  and the mean  $\pm$  S.E. was  $12.12 \pm 0.6 \times 10^3$  cells/  $\mu\text{L}$ . The haemoglobin value ranged from 7.9 g/dL to 19.2 g/dL and the mean  $\pm$  S.E. was  $12.98 \pm 0.27$  g/dL. Total erythrocyte count ranged from  $4.14 \times 10^6$  cells/  $\mu\text{L}$  to  $9.0 \times 10^6$  cells/  $\mu\text{L}$  with the mean  $\pm$  S.E. was  $6.44 \pm 0.11 \times 10^6$  cells/  $\mu\text{L}$ . The packed cell volume ranged from 24.1 % to 58.5% and the mean  $\pm$  S.E. was  $41.69 \pm 0.73$  %. The platelet count ranged from  $0.42 \times 10^5$  cells/  $\mu\text{L}$  to  $8.59 \times 10^5$  cells/  $\mu\text{L}$  and the mean  $\pm$  S.E. was  $2.75 \pm 0.14 \times 10^5$  cells/  $\mu\text{L}$ .

The plasma creatinine values ranged from 0.4 to 2.1 mg/dL and the mean  $\pm$  S.E. was  $1.03 \pm 0.03$  mg/dL. The plasma alanine aminotransferase values ranged from 7.0 to 98 U/L and the mean  $\pm$  S.E. was  $35.81 \pm 2.34$  U/L. The serum proteins ranged from 4.9 to 8.6 g/dL and the mean  $\pm$  S.E. was  $6.25 \pm 0.1$  g/dL. The serum albumin ranged from 2.0 to 4.0 g/dL and the mean  $\pm$  S.E. was  $2.65 \pm 0.04$  g/dL. The serum sodium values ranged from 123 to 161 mg/dL and the mean  $\pm$  S. E. was  $142.2 \pm 0.94$  mg/dL. The serum potassium values ranged from 3 to 6 mg/dL and the mean  $\pm$  S. E. was  $4.28 \pm 0.10$  mg/dL.

## Discussion

It is evident from Table 1 that the haematological and routine biochemical parameters were within normal range except for a few outliers.

Seven dogs had mild leucocytosis ( $> 17000 - 25000/\mu\text{L}$ ) and 4 had moderate leucocytosis ( $> 25000/\mu\text{L}$ ). The levels in subsequent visits were in the normal range even though they were treated for CHF without any antimicrobial agents in the regimen. Twenty one animals had mild to moderate anemia (haemoglobin values ranged from 7.9 g/dL to 11.6 g/dL). The dog with the least haemoglobin in the study group (7.9 g/dL) also had maggot wounds which may explain the decrease in haemoglobin content. Three dogs had platelet count of less than one lakh and in subsequent visits, the level had come back to normal. In the present study, four dogs with moderate leukocytosis had severe to life threatening CHF. Similar to the findings in the present study, Farabaugh et al., 2004 have reported that leukocytes were significantly higher in the CHF group as compared to the controls, and hemoglobin significantly lower. Their study also indicated that the leukocytes increased and the hemoglobin decreased with increase in the heart failure class. They also reported that the clinical implications of these findings are not known, but in human beings, low hemoglobin levels are predictors of mortality in people.

The probable reason for changes in the hematology parameters could be related to enhanced corticosteroid production or other neurohormonal alterations that occur in heart failure and many cases of CHF may present with a stress leukogram and an elevated leukocyte count as stated by Ristic (2004). Farabaugh et al. (2004) also reported significantly elevated platelet counts in CHF dogs which is dissimilar to the findings of the current study. They also indicated that the clinical significance of these changes is unknown and perusal of literature did not shed any light on this issue.

In the present study, four of the dogs had creatinine values more than 1.4 mg/dL. Earlier workers have also encountered increased creatinine which indicates prerenal azotemia or more advanced CHF (Olsen et al., 2010; Boswood and Murphy, 2006).

Twenty three dogs had mild elevated ALT values. Similar findings were reported by Ristic<sup>5</sup> and Olsen et al. (2010) who indicate that such an increase is probably due to hepatic congestion. In the current study, mild variation were seen in both the potassium and sodium values as is depicted in Table 1 but no specific ECG abnormalities could be attributed to them. However hypokalemia and hyperkalemia both have adverse effect on the heart and may produce ECG abnormalities and potassium and sodium may decrease in conditions of advanced heart failure as indicated by Boswood and Murphy (2006).

In the current study, hematology and biochemistry were not very useful for the diagnosis of heart disease though they have been helpful in investigating potential concurrent disease.

This is similar to the findings of earlier workers who have stated that hematology and biochemistry were more useful in ruling out other diseases (de Morias, 2000; Dukes-McEwan et al., 2003; Olsen et al., 2010; Boswood and Murphy, 2006). It is important that the clinician should not over interpret small changes from reference intervals as only slightly more than one third of normal animals are likely to have normal results in all tests of a 20 test profile as stated by Willard and Tvedten (2012).

**Table 1: Hematological and routine biochemical test results in CHF dogs (n=78)**

Parameter	Range	Mean $\pm$ S. E.
TLC ( $\times 10^3$ cell/ $\mu$ L)	3.5 - 29.0	12.12 $\pm$ 0.6
TEC ( $\times 10^6$ cell/ $\mu$ L)	4.14-9.0	6.44 $\pm$ 0.11
Hemoglobin (g/dL)	7.9-19.2	12.98 $\pm$ 0.27
PCV (%)	24.1-58.5	41.69 $\pm$ 0.73
Platelet ( $\times 10^5$ / $\mu$ L)	0.42-8.59	2.75 $\pm$ 0.14
Plasma creatinine (mg/dL)	0.4-2.1	1.03 $\pm$ 0.03
Plasma ALT (U/L)	7.0-98	35.81 $\pm$ 2.34
Total serum protein (g/dL)	4.9-8.6	6.25 $\pm$ 0.1
Serum albumin (g/dL)	2.0 -4.0	2.65 $\pm$ 0.04
Serum sodium (mg/dL)	123 -161	142.2 $\pm$ 0.94
Serum potassium (mg/dL)	3-6	4.28 $\pm$ 0.10

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