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**K Devipriya**

Teaching Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal, TANUVAS, Chennai, Tamil Nadu, India

**C Lavanya**

Teaching Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal, TANUVAS, Chennai, Tamil Nadu, India

**P Selvaraj**

Teaching Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal, TANUVAS, Chennai, Tamil Nadu, India

**R Ezakial Napoleon**

Teaching Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal, TANUVAS, Chennai, Tamil Nadu, India

## Early diagnosis of renal insufficiency in dogs with haemato: Biochemical findings

**K Devipriya, C Lavanya, P Selvaraj and R Ezakial Napoleon**

### Abstract

A total of 150 dogs brought with the history and clinical signs suggestive of renal insufficiency were included in the study. The blood and serum samples were collected from the animals and subjected to haematological and biochemical analysis. Among the 150 dogs, 77 dogs were confirmed for renal insufficiency, and they were further grouped based on sex and age. The study revealed that male dogs were more frequently affected by renal diseases compared to female animals. It was also found that the incidence was more common in dogs aged more than 8 years compared to other age groups. Haematology results showed highly significant reduction in packed cell volume, significant reduction in haemoglobin and total erythrocyte count and increase in total leucocyte count. Serum urea nitrogen, creatinine and phosphorus levels were significantly increased whereas total protein was reduced compared to the healthy dogs.

**Keywords:** Renal insufficiency, haematology, serum biochemistry, age, sex, dogs

### 1. Introduction

Chronic renal insufficiency is a common problem encountered in dogs causing significant morbidity and mortality. Predisposing factors contributing for renal diseases are age, breed, body size and obesity. The causes of renal insufficiency include acute renal injury, pyelonephritis, glomerulonephritis, nephrolithiasis, amyloidosis, neoplasia, hypercalcemia and other hereditary nephropathies [1]. Dogs with renal disease exhibit clinical signs such as, polyuria, polydipsia, anorexia, vomiting, oral ulcers, halitosis, pale mucous membranes, weight loss and neurological complications [2]. Chronic kidney disease can be classified as mild, moderate or severe, based on clinical signs and laboratory findings. Serum creatinine levels less than 1.4 mg/dL is considered to be non azotemic, 1.4 to 2.0 mg/dL is mild azotemic, 2.1 to 5.0 mg/dL is moderate and more than 5.0 mg/dL indicates severe renal insufficiency [3]. Although renal insufficiency cannot be cured completely, early diagnosis by means of haematology and biochemical findings can help in symptomatic and supportive therapy to reduce consequences of renal dysfunction [4]. The aim of this study to find the most susceptible age group and sex involved in renal insufficiency so that more care can be taken by providing adequate and appropriate nutrition during that period to save animal from the adverse effect of the diseases.

### 2. Materials and methods

A total of 150 dogs brought to Teaching Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal with the history and clinical signs suggestive of renal insufficiency such as anorexia, polydipsia, polyuria, urinary incontinence, vomiting, edema, stomatitis, halitosis, oral ulcers were included in this study. Ten apparently healthy dogs were randomly selected as control group for comparing the haematological and biochemical values of affected animals. In addition to the clinical examination, the suspected animals were assessed for the haematological and biochemical parameters pertaining to renal function.

Whole blood samples of approximately 3 ml volume were collected from saphenous vein. 1.5 ml whole blood was used for haematology and remaining blood was used for serum biochemical analysis. In whole blood packed cell volume (PCV), haemoglobin (Hb), total erythrocyte count (TEC), total leucocyte count (TLC), differential leucocyte count (DLC) were estimated manually by following standard operating procedures. In serum, blood urea nitrogen (BUN), creatinine, total protein, albumin, calcium and phosphorus were estimated with readily available standard kits (Span Diagnostics) using semi – automatic UV-Visible

### Correspondence

**C Lavanya**

Teaching Veterinary Clinical Complex, Veterinary College and Research Institute, Namakkal, TANUVAS, Chennai, Tamil Nadu, India

Spectrophotometer (model- Pharmacia LKB ultrospec plus). The statistical data for various parameters were analyzed and compared with control value by using Statistical Package for Social Sciences (SPSS) version 19.0 and the results were expressed as mean and standard error. Based on the results, the number of dogs that are affected by renal insufficiency were categorized according to age (Less than 2 years, 2-4 years, 4-6 years, 6-8 years and more than 8 years) and sex (male and female) to evaluate their influence on occurrence of renal diseases in dogs.

### 3. Results and Discussion

#### 3.1 Demographic distribution

Out of 150 dogs screened for renal diseases, 77 dogs (51.33%) were confirmed for renal insufficiency of various causes based on haematological and biochemical analysis. The affected dogs were further classified according to age and sex and the results are shown in Table 1.

Among the 77 affected dogs, the occurrence of renal insufficiency was highest in dogs aged above 8 years (37.67%) and dogs below 2 years were least affected (5.19%). A male (59.74%) predominance over female (40.26%) was observed. The dogs with age group of 8 to 12 years were more commonly affected by renal insufficiency [4, 5]. Male dogs and cats were most frequently suffered from renal disorders when compared with female animals [6].

#### 3.2 Haematological parameters

The mean haematological values of dogs affected with renal insufficiency compared with healthy dogs are shown in Table 2. The renal insufficiency affected dogs had significantly ( $p < 0.05$ ) lower concentration of packed cell volume ( $94.79 \pm 1.46$ ), haemoglobin ( $9.68 \pm 1.05$ ) and total erythrocyte count ( $4.09 \pm 0.93$ ) than compared to the healthy dogs. The total leucocyte count ( $18.82 \pm 1.44$ ) significantly ( $p < 0.01$ ) increased in renal insufficiency affected dogs compared to

healthy dogs. However the other haematological parameters such as differential leucocyte count did not differ significantly between healthy and affected dogs.

The findings of present study revealed a significant decrease in packed cell volume, haemoglobin and total erythrocyte count [7, 8]. The lowered concentration of packed cell volume, haemoglobin and total erythrocyte count could be associated with reduced renal erythropoiesis, reduced erythrocyte survival, bleeding in the intestines, bone marrow fibrosis and nutritional deficiencies [9]. Out of 31 dogs taken to the study 11 dogs were found to be anaemic [10]. Leucocytosis is a common finding in dogs suffering from chronic renal failure [11].

#### 3.3 Biochemical parameters

The mean serum biochemical values of dogs affected with renal insufficiency are shown in Table 2. The blood urea nitrogen (BUN) ( $97.64 \pm 3.58$ ) and creatinine ( $5.03 \pm 0.21$ ) had significantly ( $p < 0.01$ ) increased compared to the healthy dogs. There was a significant ( $p < 0.05$ ) reduction in total protein level ( $4.28 \pm 0.25$ ) in dogs suffered with renal insufficiency than healthy dogs. There was no significant difference in calcium and albumin levels between the two groups, whereas the phosphorus concentration ( $6.88 \pm 1.24$ ) was significantly ( $p < 0.01$ ) increased in dogs with renal disorders.

The increased concentration of blood urea nitrogen was due to the increased rate of production of urea than the rate of excretion and the excessive urea was accumulated in the blood [12]. Severe renal impairment might be the reason for increased blood urea nitrogen and creatinine level in the blood [3, 13]. The findings of the present study concur with the earlier observations that in dogs affected with renal insufficiency had lower glomerular filtration which might attribute to the higher phosphorus concentrations in serum [7].

**Table 1:** Demographic distribution of dogs with renal insufficiency

Groups	Number of dogs with renal insufficiency	Percentage
Control (10 numbers)	0	0.00
<b>Age</b>		
Below 2 years	4	5.19
2-4 years	11	14.28
4-6 years	16	20.78
6-8 years	17	22.08
Above 8 years	29	37.67
<b>Sex</b>		
Male	46	59.74
Female	31	40.26

**Table 2:** Mean haematological values of healthy dogs and dogs with renal insufficiency

S. No	Parameter	Control	Dogs with renal insufficiency
1.	Packed Cell Volume (%)	$42.56 \pm 0.78$	$34.79 \pm 1.46^{**}$
2.	Haemoglobin (g/dL)	$12.44 \pm 0.19$	$9.68 \pm 1.05^*$
3.	Total Erythrocyte Count ( $\times 10^6/\mu\text{l}$ )	$6.11 \pm 0.68$	$4.09 \pm 0.93^*$
4.	Total Leucocyte Count ( $\times 10^3/\mu\text{l}$ )	$9.48 \pm 1.19$	$18.82 \pm 1.44^{**}$
5.	Neutrophils (%)	$74.10 \pm 2.34$	$79.58 \pm 2.13^{\text{NS}}$
6.	Lymphocytes (%)	$19.87 \pm 1.16$	$14.72 \pm 0.36^{\text{NS}}$
7.	Eosinophils (%)	$2.86 \pm 0.55$	$2.31 \pm 0.23^{\text{NS}}$
8.	Monocytes (%)	$2.79 \pm 0.67$	$2.96 \pm 0.85^{\text{NS}}$
9.	Basophils (%)	$0.38 \pm 0.14$	$0.43 \pm 0.09^{\text{NS}}$

\*\* -  $p < 0.01$  – highly significant

\* -  $p < 0.05$  – significant

NS – Non significant

**Table 3:** Mean serum biochemical values of healthy dogs and dogs with renal insufficiency

S. No	Parameter	Control	Dogs with renal insufficiency
1.	Blood Urea Nitrogen (mg/dL)	28.65 ± 1.93	97.64 ± 3.58**
2.	Creatinine (mg/dL)	1.62 ± 0.19	5.03 ± 0.21**
3.	Total Protein (g/dL)	6.17 ± 0.64	4.28 ± 0.25*
4.	Albumin (g/dL)	3.23 ± 0.26	2.11 ± 0.14 <sup>NS</sup>
5.	Calcium (mg/dL)	9.42 ± 0.23	8.46 ± 0.38 <sup>NS</sup>
6.	Phosphorus (mg/dL)	4.37 ± 0.71	6.88 ± 1.24**

\*\* -  $p < 0.01$  – highly significant

\* -  $p < 0.05$  – significant

NS – Non significant

#### 4. Conclusion

The finding of correlation between age and sex in occurrence of renal diseases in dogs can be a useful guideline to assess the health status of the animal and prevent further progression of disease. Estimation of haematological and serum biochemical parameters in dogs suspected for renal disorders can help in early diagnosis of disease and also aids in providing supportive therapy to the affected animals in order to reduce the clinical consequences of renal failure.

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