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# CLINICO-HEMATO-BIOCHEMICAL AND ULTRASONOGRAPHIC ALTERATIONS IN DOGS WITH NON INFECTIOUS HEPATIC DISORDERS ASSOCIATED WITH HYPOALBUMINEMIA

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**ABSTRACT**
The present work was undertaken to study the clinical signs, hematological, biochemical and ultrasonography alterations associated with non-infectious hepatic disorders associated with hypoalbuminemia in dogs. The overall occurrence was 0.23%. Breed-wise occurrence showed highest occurrence in Labrador retriever (38.88%) followed by Golden Retriever (22.22%), Great Dane (11.11%) and lowest was in Pomeranian (5.55%). Age -wise occurrence showed highest occurrence (44.44%) in the adult dogs (> 2-7 years). Ascites (90%) and hind leg edema (77.7%) were the most observed clinical signs. Hematological investigation revealed decreased mean levels of Hb (9.87g/dl), PCV (37.69%), TEC ($6.084\times10^6$/µl) and platelet count ($241\times10^3$/µl). Serum biochemical findings showed increased mean levels of ALT (138.9 U/L), AST (100.1 U/L), ALP (232 U/L), and GGT (15.22 U/L). Total protein (4.68g/dl) and serum albumin (1.31g/dl) was decreased in dogs with hepatic disorders associated with hypoalbuminemia. All the dogs were observed with anechoic structure (ascitic fluid) in the abdominal cavity followed by ten dogs (55.55%) with diffused hyper echoic liver parenchyma and six dogs (33.33%) showed focal hyper echoic liver parenchyma, Liver cirrhosis was appreciated in two dogs (11.11%) with generalized hyper echoic hepatic parenchyma with rounded and irregular liver margin.

**KEY WORDS**: Ascites, hypoalbuminemia, cirrhosis.

## INTRODUCTION

Liver is the most important vital organ and the largest parenchymal gland of the body with vast reserves of function and it has an embryonic capacity to regenerate and perform adequately despite often extensive pathological damage to its integrity. Albumin synthesis occurs exclusively in the liver and approximately 75% to 85% of normal plasma colloid oncotic pressure is provided by albumin (Weil *et al.*, 1979). Albumin is one of the extensively studied proteins in human medicine because of its multiple roles in maintaining colloid osmotic pressure, carrying endogenous and exogenous substances, mediating coagulation, and inhibiting oxidative damage. Hypoalbuminemia is often consequence of critical illnesses, sepsis, systemic inflammatory response syndrome (SIRS), burns, end stage hepatic failure. However, serum hypoalbuminemia is most often seen in chronic hepatic disorders (Mazzaferro *et al.*, 2002). The common diagnostic approach to hepatic disorders includes clinical examination, laboratory estimations of blood and urine, liver function tests, imaging techniques like radiography, ultrasonography, nuclear scintigraphy, computed tomography and magnetic resonance imaging.

## MATERIALS & METHODS

Clinical cases presented to Veterinary college hospital, Bangalore were used for the study.

Clinical signs suggestive of liver disorders such as anorexia, lethargy, anaemia, vomiting, melena, icterus, abdominal pain, weight loss, ascites, pulmonary edema, dependent part edema, polyuria and polydipsia were considered while selecting cases. Eighteen dogs with non infectious hepatic disorders selected based on history, clinical signs, hematology, biochemistry, ultrasonography and with an albumin concentration of less than 2g/dl were selected for the study.

History of each dog was noted in relation to breed, age, sex, and body weight etc for epidemiological study. The samples of urine, faeces and venous blood samples were obtained and analysed on the same day.

***Hematology:*** Hemoglobin, PCV, total erythrocyte count, platelet count, and differential leukocyte count was determined using automated blood cell analyser and the values were recorded.

***Serum biochemistry:*** Serum was analyzed for biochemical parameters namely Creatinine, ALT, AST, ALP, GGT, Total protein, Total bilirubin, albumin and globulin within six hours.

***Urinalysis:*** Urine sample was collected by catheterization of bladder and was analyzed using urinalysis reagent strips for the following parameters viz., glucose, bilirubin, ketone bodies, specific gravity, blood, pH, protein, urobilinogen, nitrites, and leucocytes.

***Ultrasonography:*** Ultrasonography was performed in all cases by using ultrasound scanner with 3.5/7.5 MHz mechanical transducer.

***Statistical analysis:*** Descriptive statistics for the different data were analysed as per Snedecor and Cochran procedures (1989).

## RESULTS

***Occurrence:*** Total number of dogs brought to Veterinary college Hospital Bangalore irrespective of the nature of diseases were 7800 during the period of study ( January 2016-June 2016). Among these, 18 dogs (0.23%) were with hepatic disorders associated with hypoalbuminemia. Highest (38.88%) occurrence was recorded in Labrador retriever followed by Golden Retriever (22.22%), Great Dane (11.11%), German Shepherd (5.5%), Irish Setter (5.5%), Dobermann Pinscher (5.5%), Pomeranian (5.5%), and Rottweiler (5.5%) as depicted in Fig 1. Among them (44.44%) were adults (>2-7 years), (27.77%) were young adults (>1-2 years), (16.66%) were puppies (< 1 year), and (11.11%) were old dog (>7 years). In the present study, male dog had higher occurrence (55.55%) when compared to females (44.45%).

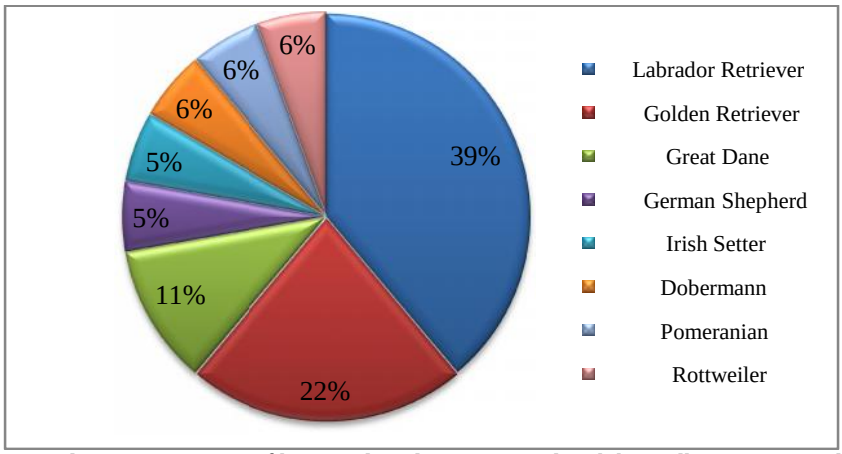


**FIGURE 1:**Breed-wise occurrence of hepatic disorders associated with hypoalbuminemia in dogs (n=18)

***Clinical signs:*** The clinical signs observed in the eighteen cases were ascites in sixteen dogs (90%), hind leg edema in fourteen (77.7%), anorexia in twelve (66.6%) lethargy in eleven (61.1%), melena in two (11.1%), weight loss in two (11.1%), polyuria and polydipsia in two (11.1%), and, vomiting & icterus in one case (5.5 %).

***Hematology:*** It can be observed from the Table 1 that among eighteen dogs diagnosed with hepatic disorders associated with hypoalbuminemia there was decrease in hemoglobin, packed cell volume, total erythrocyte count and platelet count whereas total leukocyte count was in the normal range.

**TABLE 1:** Hematological profile in dogs with hepatic disorders associated with hypoalbuminemia (n=18)

| Sl. No. | Parameters | Cases (n=18) | Normal range |
|---|---|---|---|
| 1 | Hb (g/dl) | 9.87±0.48 | 12-18 |
| 2 | PCV (%) | 37.69±1.62 | 37-55 |
| 3 | TEC ($\times10^6$/µl) | 6.084±0.19 | 5.5-8.5 |
| 4 | TLC ($\times10^3$/µl) | 10.73±0.655 | 6-12 |
| 5 | Platelet ($10^3$/µl) | 241±21.02 | 200 -900 |
| 6 | Neutrophil (%) | 74± 2.29 | 60-70 |
| 7 | Lymphocyte (%) | 23.56±2.05 | 12-30 |
| 8 | Monocyte (%) | 1.05±0.30 | 3-10 |
| 9 | Eosinophil (%) | 1.05±0.23 | 2-10 |
| 10 | Basophil (%) | 0.33±0.11 | rare |

***Serum biochemistry:*** From Table 2 it is evident that there is increase in the activities of enzymes like ALT, AST, ALP and GGT whereas decrease in the levels of total protein and albumin were observed. All the dogs had blood urea nitrogen and creatinine values were well within the normal range.

**TABLE 2:** Biochemical profile in dogs with hepatic disorders associated with hypoalbuminemia (n=18)

| Sl. No. | Parameters | Cases (n=18) | Normal range |
|---|---|---|---|
| 1 | ALT (U/L) | 138.9±24.20 | 8.2-57 |
| 2 | AST (U/L) | 100.1±13.80 | 8.9-49 |
| 3 | ALP (U/L) | 232±34.56 | 232± 34.56 |
| 4 | GGT (U/L) | 15.22±1.78 | 1-9.7 |
| 5 | TP (g/dl) | 4.68±0.13 | 5.5-7.5 |
| 6 | Albumin (g/dl) | 1.31±0.06 | 2.6-4 |
| 7 | Globulin (g/dl) | 3.51±0.21 | 2.1-3.7 |
| 8 | BUN (mg/dl) | 16.90±1.75 | 8.8-26 |
| 9 | Creatinine (mg/dl) | 0.84±0.08 | 0.5-1.6 |

***Urinalysis:*** The Mean ± SE specific gravity and pH of the eighteen cases diagnosed with hepatic disorders associated with hypoalbuminemia was found to be 1.026 ±0.002 and 7±0.12 respectively. Out of the eighteen cases none of the urine sample was positive for glucose, bilirubin, ketone bodies, blood protein, nitrites and leukocytes.

***Fecal sample examination:*** Fecal examination of the eighteen cases diagnosed with hepatic disorders associated with hypoalbuminemia did not show any ova/cyst.

***Ultrasonography:*** Ultrasonography was done in the eighteen dogs with hepatic disorders associated with hypoalbuminemia. All the 18 dogs were observed with anechoic structure (ascitic fluid) in the abdominal cavity followed by ten dogs (55.55%) with diffused hyper echoic liver parenchyma and six dogs (33.33%) showed focal hyper echoic liver parenchyma, Liver cirrhosis was appreciated in two dogs (11.11%) with generalized hyper echoic hepatic parenchyma with rounded and irregular liver margin. (Fig. 2 and 3)

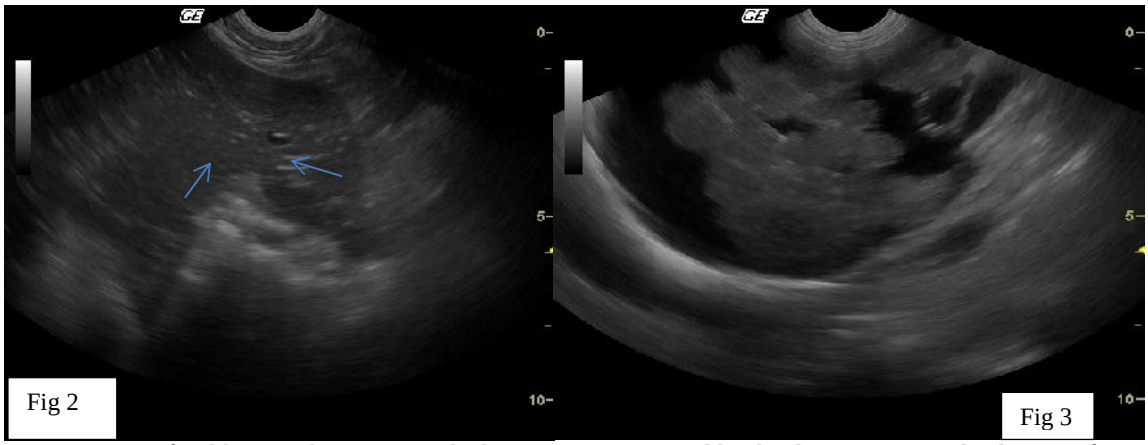


**FIGURE 2–3** USG: focal hyper echoic spots in the liver in a seven year old Labrador Retriever with a history of vomiting and inappetance (sagittal view). **3.** USG: liver showing generalized hyper echoic hepatic parenchyma with multiple hyper echoic lesions, and irregular margins (cirrhosis) in ten year old German Shepherd with a complaint of distended abdomen and melena.

## DISCUSSION

***Occurrence:*** The occurence of non infectious hepatic disorder associated with hypoalbuminemia was 0.23% and these findings are not in agreement with the findings of Saravanan *et al*. (2014) who has recorded occurrence of hepatic insufficiency as 2%. Similarly, Chandlin (1968) and Vijaykumar *et al*. (2003) reported the incidence of hepatic disorders as 3% and 3.01 % respectively. The variation noticed in the present study could be due to the selection of cases with hepatic disorders which were non infectious and associated with hypoalbuminemia.

There is paucity of information as regards to the occurrence of hepatic disorders associated with hypoalbuminemia with respect to the different age group. However, Anderson and Sevelius (1991) found high incidence of chronic liver disease in Cocker Spaniel, Labrador Retriever and West High Land White Terrier. Similarly, Sevelius (1995) found high incidence of chronic hepatitis and cirrhosis in American Cocker Spaniel, English Cocker Spaniel, West High Land White Terrier and Dobermann Pinscher. Variation in the present findings may be due to the difference in the proportion of various breeds in different geographical areas and these breeds are not popular in this part of the country as indicated by the kind of breeds presented to the Veterinary College Hospital based on the records.

***Clinical signs:*** In the present study, ascites (90%) and hind leg edema (77.7%) were the most observed clinical signs in the dogs with hepatic disorders associated with hypoalbuminemia. These observations are similar to the observations of Saravanan *et al*. (2014), Tantary *et al*. (2014), Elhiblu *et al*. (2015) and, Lathamani & Nalinikumari (2015) who recorded, the common clinical signs as ascites and hind leg edema in their study. Ascites and hind leg edema is being considered to be a common complication of chronic hepatitis in dogs (Raffan *et al*, 2009) due to decreased production of albumin, since it is

exclusively produced in the liver and is a major determinant of plasma and tissue oncotic pressure.

***Hematology:*** The decrease in hemoglobin may be attributed decreased nutrient uptake which is due to inappetance or anorexia and reduced availability of micronutrients from liver for the synthesis of hemoglobin as opined by Bush (2002) whereas the decrease in total erythrocyte count could possibly be attributed to reduced production of erythropoietin and other factors required for erythropoiesis by the ailing liver as opined by Washabau (2010).

Seven out of eighteen dogs showed mild leukocytosis and these findings are similar to the findings of Tantary *et al*. (2014), Saravanan *et al*. (2014) and Elhiblu *et al*. (2015). This mild leukocytosis reported may be due to stress. Further, this could also be substantiated by the normal globulin levels as indicated in the present study. (Table 2)

***Serum biochemistry:*** The reason for increase in the mean AST and ALT value may be due to altered hepatocellular membrane permeability, hepatocellular necrosis and inflammation (Kramer and Hoffman, 1997). In fifteen dogs the serum ALP concentration was above the normal. These findings corroborated with the findings of Saravanan *et al*. (2014), Tantary *et al*. (2014) and Elhiblu *et al*. (2015) who all observed significant increase in the serum concentration of ALP in dogs with hepatocellular diseases. However, three dogs had very high serum concentration of ALP indicating primary hepatic disease which is also evidenced by USG findings. . In fifteen dogs the serum GGT concentration was above the normal. This indicates that GGT could be used as a regular parameter in evaluating hepatic disorder associated with hypoabuminemia as compared to the conventional enzyme ALT.

In sixteen dogs the total serum protein concentration was below the normal. The findings of the present study are in agreement with the findings of Rutgers *et al*. (1993), Lucena *et al*. (2001), Saravanan *et al*.(2014), Tantary *et al*. (2014), Elhiblu *et al*.(2015) and, Lathamani & Nalinikumari (2015) who all reported the significant decrease in the total serum protein concentration in dogs with various hepatic disorders. The decrease in the total serum protein could be due to the primary role of liver in the synthesis of major plasma protein as well as the site of degradation and synthesis of many other proteins that is influenced by hepatic diseases in many ways (Webster, 2005). In all eighteen dogs serum albumin concentration was below the normal (2.6-4 g/dl, Boyd, 1984) since the selection of hepatic disorder cases was based on the albumin value(<2g/dl).

***Urinalysis/Faecal examination:*** As indicated by the urinalysis, these animals did not have an apparent renal disease and further the results also indicated that there was no hepatic disorder associated pigment metabolism. Faecal examination of the eighteen cases did not show any ova/cyst which indicated that there was no parasitic infestation contributing to hypoalbuminemia. Based on all this, in the present study the eighteen cases included were confirmed as hepatic disorder associated with hypoalbuminemia.

***Ultrasonography of liver:*** All the eighteen dogs were observed with anechoic structure (ascitic fluid) in the abdominal cavity followed by ten dogs (55.55%) with diffused hyper echoic liver parenchyma and six dogs (33.33%) with focal hyper echoic liver parenchyma in dogs with hepatic disorder associated with hypo albuminemia. The findings of the present study are in agreement with the findings of Saravanan *et al*. (2014) who conducted an ultrasonographic study on 72 dogs suffering from ascites due to various hepatic disorders and recorded 18 dogs (25%) with focal hyperechoic liver parenchyma and 33 dogs (45.8%) with diffused hyper echoic liver parenchyma. The USG findings of chronic hepatitis in the present study is similar to the observation of Tantary *et al*. (2014), who observed hyper echoic bright liver with normal size and diffuse hyper echoic liver parenchyma associated with peritoneal fluid accumulation. Liver cirrhosis was appreciated in two dogs (11.11%) with generalized hyper echoic hepatic parenchyma with rounded and irregular liver margin as illustrated in Plate 5.These findings are in concurrence with findings of Saravanan *et al*. (2014), Tantary *et al*. (2014) and Elhiblu *et al*. (2015) who all appreciated the sonographic changes in hepatic cirrhosis as generalized hyper echoic lesions, irregular margins and small nodules on the surface.

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