CANINE LEPTOSPIROSIS IDENTIFICATION IN SMALL ANIMAL PRACTICE

Erni Sulistiawati1,2*, Zulfira Utami Putri1, Cucu K. Sajuthi3, Dongin Sajuthi4, and Nurul Oktaviani5

1School of Vocational Studies, IPB University, Bogor, Indonesia
2Internal Laboratory Diagnostic of drh Cucu K. Sajuthi Joint Veterinary Practice, Jakarta, Indonesia
3drh Cucu K. Sajuthi Joint Veterinary Practice, Jakarta, Indonesia
4Department of Clinic, Reproduction, and Pathology, Faculty of Veterinary Medicine, IPB University, Bogor, Indonesia
5Siera Pet Dermatology Clinic and Laboratory, Bogor, Indonesia
*Corresponding author: e_sulistiawati12@apps.ipb.ac.id

ABSTRACT

Leptospirosis is an infectious disease caused by bacteria from the genus Leptospira with various serovars and often presents with a wide range of clinical signs from mild to severe conditions, particularly it presents with a mild fever to asymptomatic infection-causing animal death. The purpose of this study was to identify the characteristics of canine leptospirosis through laboratory examinations supported by medical record data in a small animal practice at the drh Cucu K. Sajuthi Joint Veterinary Practice, in Jakarta. The study was conducted on serum samples of sixteen dogs from drh Cucu K. Sajuthi Joint Veterinary Practice patients, which presented varied clinical signs of leptospirosis, and which had been accompanied by hematological examination, blood biochemistry, and Microscopic Agglutination Test (MAT) against various serovars such as Bataviae, Icterohaemorrhagiae, and Javanica. The collected data was analyzed descriptively. The results showed that canine leptospirosis was more commonly derived from Bataviae serovar and was accompanied by clinical signs such as vomiting, jaundice, anorexia, abdominal pain, lethargy, pale mucosal membrane, diarrhea, dehydration, dyspnea, and polyuria/polydipsia. A predisposition of gender and age was commonly found in male dogs less than 5 years old. Abnormalities found from hematological examination were leukocytosis, granulositosis (neutrofilia), anemia, thrombocytopenia, and lymphopenia, while blood chemistry showed azotemia, an increase in liver enzymes (AST, ALT, ALP), hyperbilirubinemia, hyponatremia, hyperphosphatemia, and hypoalbuminemia.

Key words: blood biochemistry, clinical sign, dog, Leptospira sp., MAT

INTRODUCTION

Leptospirosis is an infectious disease caused by a bacterial infection with any of the serovars of the genus Leptospira (Sykes 2014). There are more than 300 serovars of Leptospira identified and these are arranged in 25 serogroups in the worldwide distribution (OIE 2018). Leptospirosis is a zoonotic pathogen agent and may infect any mammalian species (Ettinger et al. 2017). According to current research from the Department of Veterinary Microbiology, College of Veterinary and Animal Sciences, Mannuthy, Karala (India) it was found that an increase of incidences of canine leptospirosis, around 71.12% sample, were confirmed to have been positively infected by more than one serovar Leptospira (Ambily et al. 2012). Canine leptospirosis can be transmitted by direct contact (urine, bite, or ingestion from a host) and indirect (through contaminated water, soil, or host’s cage) (Thammitiyagodage et al. 2017). The clinical signs of canine leptospirosis are variable with varying severity, ranging from self-limiting febrile illness or asymptomatic infections to severe conditions that can cause animal death (Miotto et al. 2018).

Leptospirosis is found in areas with high temperatures and humidity, as well as a lot of soil and water with pH approaching neutral (Mulyani et al. 2017; Thammitiyagodage et al. 2017). In addition to temperature and humidity factors, vaccination programs are also very important in limiting the incidences of leptospirosis in humans and animals in tropical areas (Weese and Evason 2020). Unvaccinated puppies (under 1-year-old) suffer from the most severe forms of the disease typically with fatal outcomes, while vaccinated dogs can reduce the risk of infection especially from the specific serovar that is commonly found in commercial vaccines such as L. canicola and L.icterohaemorrhagiae (Thammitiyagodage et al. 2017). Canine leptospirosis often goes unrecognized or is misdiagnosed due to its variable presentation, and...
accurate diagnosis depends on the stage of disease and non-specific clinical signs (Lizet et al. 2017).

The purpose of this study was to identify the characteristics of canine leptospirosis through laboratory examinations supported by medical record data at drh Cucu K. Sajuthi Joint Veterinary Practice, Jakarta. The results of this study also aim to reduce the risk of disease transmission to other dogs, animal owners, or veterinary technicians, and veterinarians.

MATERIALS AND METHODS

The study was conducted at Internal Diagnostic Laboratory of drh Cucu K. Sajuthi Joint Veterinary Practice from January 2019 to March 2020. The sample used in this study consisted of 16 cases of leptospirosis. The information regarding gender, age, and clinical signs of dog-related canine leptospirosis were obtained from the medical records of drh Cucu K. Sajuthi Joint Veterinary Practice patients, while the Microscopic Agglutination Test (MAT) serology test was conducted in a private laboratory out of the Internal Diagnostic Laboratory of drh Cucu K. Sajuthi Joint Veterinary Practice. Hematology was analyzed using Nihon Kohden Celltac α and Abaxis VetScan HM5 and blood biochemistry using Photometer 5101 V 5+. Antigens used in MAT serological tests were Leptospira interrogans with serovar Icterohaemorrhagiae, Javanica, Celledoni, Canicola, Ballum, Pyrogenes, Cynopteri, Rachmati, Australis, Pomona, Grippotyphosa, Hardjo, Bataviae, and Tarassovi.

RESULTS AND DISCUSSION

The rate of canine leptospirosis was found to be relatively higher in male dogs (69%) compared to female dogs (19%) (Table 1). This result is in accordance with a previous study by Rad et al. (2004) that MAT positive leptospirosis was found more often in the serum of male dogs compared to females. This is due to the natural behavior of wild male dogs (Azócar-Aedo et al. 2014). In agreement with a retrospective study by Ward et al. (2004), the seroprevalence of leptospirosis was found to be higher in male dogs compared to female dogs because male dogs were widely used as working or shepherding dogs and thus more at risk of disease infection.

The rates of canine leptospirosis in dogs less than 5 years of age were higher (57%) compared to dogs over 5 years old (31%) (Table 1). This can be related to the vaccination history of the dogs. As expected, unvaccinated dogs have a higher risk of infection. Similar results were also reported by Shi et al. (2012) who found the prevalence of leptospirosis in dogs aged 1-4 years was 9.2%, less than 1 year as much as 6.3%, and over 4 years as much as 5.8%, although statistical analysis showed no significant difference from that age group. According to Ward et al. (2004), animals between 4 to 6.9 years old were at a greater risk of contracting leptospirosis compared to animals under one year of age. These results indicate that age, breed and gender were risk factors for leptospirosis, followed by environmental factors such as increased rainfall and temperature (Meeyam et al. 2006).

A total of 16 dogs (53%) that were diagnosed with canine leptospirosis showed clinical signs of vomiting as the highest percentage (23%) followed by jaundice (17%) and anorexia (14%) (Figure 1). These results are similar to the results of a previous study by Claus et al. (2008) which found that from 5 to 7 dogs that were diagnosed with leptospirosis showed clinical signs of vomiting and anorexia. These conditions were found in acute-subacute infections caused by the presence of antigenic stimulation of the gastrointestinal organs that cause pancreatitis and enteritis which was subsequently followed by kidney and liver disorders which presented jaundice (Sykes et al. 2011).

Clinical signs of jaundice were due to the activity of pathogenic Leptospira which can cause hepatocytes damage. Simultaneously with the spread of necrosis in the liver tissue this can be followed by an increased production of bilirubin as a result of extravascular erythrocyte destruction. Jaundice is also one of the symptoms that appear in response to the presence of hepatic necrosis. This condition can occur in single or multiple with other clinical signs and it can also occur due to the presence of chronic infections. If an infected dog has chronic hepatitis or hepatic fibrosis, other clinical signs that can also be found are anorexia, weight loss, ascites or hepatic encephalopathy (Schuller et al. 2014). This result is in accordance with the results of a previous study by Shah et al. (2018), that found that the clinical signs of dogs infected with Leptospira included lethargy, anorexia, diarrhea, vomiting, jaundice, abdominal pain, dehydration and polyuria. Animals infected with Leptospira will initially experience fever caused by the presence of antigenic stimulation of the Leptospira pathogen. This condition will be followed by anorexia, vomiting, diarrhea, lethargy, and polyuria/polydipsia. Polyuria/polydipsia

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Total cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>11</td>
<td>69</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>Unknown</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>&lt; 5 years old</td>
<td>9</td>
<td>57</td>
</tr>
<tr>
<td>2</td>
<td>&gt; 5 years old</td>
<td>5</td>
<td>31</td>
</tr>
<tr>
<td>3</td>
<td>Unknown</td>
<td>2</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 1. Percentage of gender and age of dogs infected with canine leptospirosis from the medical records of drh Cucu K. Sajuthi Joint Veterinary Practice from January 2019 to March 2020.
occurs due to a progressive decrease in renal function and/or liver insufficiency (Azócar-Aedo et al. 2014).

Abnormalities of clinical pathology examination results from hematology and blood biochemistry found leukocytosis, granulocytosis (neutrophilia), anemia, thrombocytopenia, lymphopenia, azotemia, increased alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT) with hyperbilirubinemia, hyperphosphatemia, hyponatremia, and hypoalbuminemia. Based on Table 2, 69% of dogs show leukocytosis accompanied by granulocytosis (neutrophilia) as much as 63%.

Leukocytosis is a common change found in dogs with acute infection especially related to acute renal failure (Claus et al. 2008). Leukocytosis granulocytosis (neutrophilia) indicates antigenic stimulation of bacterial infections and indicates the occurrence of infection and disease development (Willard and Tvedten 2012). Shah et al. (2018) found that 18-68% of dogs infected with Leptospira were found to have anemia either in the form of non-regenerative or regenerative anemia. This can be caused by bleeding in the gastrointestinal or urinary tract and is also associated with thrombocytopenia, coagulopathy or vasculitis. Thrombocytopenia was reportedly found in 20-50% of dogs infected with Leptospira, which is also accompanied by neutrophilia and/or lymphopenia (Reagan and Sykes 2019). Thrombocytopenia can be caused by increased platelet consumption related to the presence of adhesion and aggregation of the vascular endothelial, phagocytosis of Kupffer cells, immune-mediated platelet destruction or splenic sequestration (Thrall et al. 2012). The infected dogs have anemia (56%), thrombocytopenia (50%) and lymphopenia (44%) (Table 2). This result was similar to a previous study by Sharun et al. (2019) that dogs infected by Bataviae serovar had hematologic results in the form of leukocytosis, granulocytosis (neutrophilia), anemia and thrombocytopenia.

An abnormality of blood biochemical examination results was almost found in all dogs infected with Leptospira is azotemia (94%). Azotemia may indicate kidney injury (renal failure). Renal failure can occur in cases of subacute leptospirosis due to the destruction of

**Figure 1.** Percentage of the clinical signs of canine leptospirosis from the medical records of drh Cucu K. Sajuthi Joint Veterinary Practice from January 2019 to March 2020

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter</th>
<th>Total cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leukocytosis</td>
<td>11</td>
<td>69</td>
</tr>
<tr>
<td>2</td>
<td>Granulocytosis (Neutrophilia)</td>
<td>10</td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td>Anemia</td>
<td>9</td>
<td>56</td>
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<tr>
<td>4</td>
<td>Thrombocytopenia</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Lymphopenia</td>
<td>7</td>
<td>44</td>
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<tr>
<td></td>
<td><strong>Blood Biochemistry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Azotemia</td>
<td>15</td>
<td>94</td>
</tr>
<tr>
<td>2</td>
<td>Increase ALP</td>
<td>12</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>Increase AST</td>
<td>9</td>
<td>56</td>
</tr>
<tr>
<td>4</td>
<td>Hyperbilirubinemia</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Increase ALT</td>
<td>6</td>
<td>38</td>
</tr>
<tr>
<td>6</td>
<td>Hyponatremia</td>
<td>6</td>
<td>38</td>
</tr>
<tr>
<td>7</td>
<td>Hyperphosphatemia</td>
<td>6</td>
<td>38</td>
</tr>
<tr>
<td>8</td>
<td>Hypoalbuminemia</td>
<td>5</td>
<td>31</td>
</tr>
</tbody>
</table>

ALT= Alanine aminotransferase, AST= Aspartate aminotransferase, ALP= Alkaline phosphatase
renal tubular epithelial cells in the renal tubule by Leptospira bacteria. Moreover, acute interstitial nephritis and parenchymal swelling can cause a decrease in renal perfusion and glomerular filtration rate (GFR) (Stockham and Scott 2008). This condition can be exacerbated by the presence of renal ischemia that causes secondary hypoxia that can result in nephropathy in infected animals (Sykes et al. 2011). Azotemia is commonly found alongside an increase in liver enzymes ALT, AST, ALP and in cases of Leptospira infection in dogs (Azócar-Aedo et al. 2014). This statement was supported by the results of the research found in 6 samples, while 10 other samples showed only an increase in ALP and total bilirubin. Impaired liver function was caused by the presence of endotoxins which disrupts the transport flow of the liver and hepatocyte apoptosis (Schuller et al. 2014). Liver function disorders accompanied by damage of hepatocytes can result from an increase in liver enzymes that are also accompanied by hyperbilirubinemia, but an increase in ALP and hyperbilirubinemia was more common than an increase in ALT (Sykes et al. 2011). This statement is consistent with the results of a study showing that dogs that experienced an increase in ALT (38%) was fewer than dogs with increase ALP (75%) and hyperbilirubinemia (50%). Hypoalbuminemia has also been reported in dogs infected with chronic Leptospira followed by albuminuria due to glomerulonephritis/renal disorders (Claus et al. 2008; Sykes et al. 2011; Shah et al. 2018). Dogs infected with Leptospira are also reported to have frequent changes in electrolyte values such as hyperphosphatemia, hyponatremia, and/or hypochloremia caused by fluid loss in the gastrointestinal or kidneys (Sykes et al. 2011; Schuller et al. 2014).

Previous research has shown a correlation between the clinical signs of the disease and the infectious serovar. Sharun et al. (2019) found that dogs infected by Canicola and Gripotyphosa serovar showed clinical signs more related to renal dysfunction, but in cases of infection by Icterohaemorrhagiae and Pomona serovar clinical signs were more related to liver disorders. One of the characteristics of an animal infected by Leptospira oficterohaemorrhagiae serovar is jaundice and bleeding followed by acute interstitial nephritis (Claus et al. 2008; Sykes et al. 2011). The results of a study by Mulyani et al. (2017) confirmed the findings of Sharun et al. (2019) which indicated that the presence of liver, kidney, and hemorrhagic disorders in dogs infected by Bataviae serovar showed symptoms in the form of vomiting and jaundice. The results of the study were similar to this study which showed that cases of canine leptospirosis that presented clinical signs were dominated by vomiting and jaundice and were generally infected by Bataviae serovar (Table 3).

The results showed 29% of positive cases of leptospirosis were caused by Bataviae serovar, 23% Icterohaemorrhagiae serovar, 18% Javanica serovar, 9% Calledoni serovar, 6% Canicola and Rachmati serovars and 3% Tarrasovi, Ballum, and Pyrogenes serovars. The results of this study illustrate that Bataviae serovar is the dominant Leptospira serovar infecting dogs at drh Cucu K. Sajathi Joint Veterinary Practice.

This result was in accordance with previous research that found that 100% of dogs infected with Leptospira in the Special Region of Yogyakarta were infected with Bataviae serovar (Mulyani et al. 2017). However, each region can have a different dominant Leptospira serovar that infects the dogs of that region due to several factors. As a preventive measure, vaccinations need to be tailored to different regions depending on the infection rates of a specific serovar. Conditions related to the migration of wildlife that act as a reservoir of leptospirosis also need to be taken into account in order to prevent the spread of disease (Ellis 2010). The main reservoirs for Bataviae serovar are dogs, rats, and mice that are found in Jakarta. This condition is suspected to cause a high prevalence of Leptospirosis due to the number of Bataviae serovar infections found in this study.

**CONCLUSION**

Based on the results of the analysis of the data the highest percentage of Leptospira bacterial infections from MAT examinations are mostly from Bataviae, Icterohaemorrhagiae, and Javanica serovars. Characteristics of clinical signs of leptospirosis infection consists of vomiting, jaundice, anorexia, abdominal pain, lethargy, pale mucosal membrane, diarrhea, dehydration, dyspnea, and polyuria/polydipsia, while the clinical pathology data from hematology and blood biochemistry was leukocytosis, granulocytosis (neutrophilia), anemia, thrombocytopenia, and lymphopenia, accompanied by azotemia, increased liver enzymes (AST, ALT, ALP), hyperbilirubinemia, hyponatremia, hyperphosphatemia, and hypoalbuminemia. The predisposition of the gender and vulnerable age was in male dog less than 5 years.
REFERENCES


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