



A Retrospective Study of Dogs Infected with *Ehrlichia canis* from 2017-2019 in the Thonburi Area of Bangkok Province, Thailand

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ABSTRACT

Ehrlichia canis is a tick-borne rickettsia. It can cause canine monocytic ehrlichiosis (CME). Infected dogs are often reported to have changes in their blood values, such as anemia, thrombocytopenia, increased liver enzymes, and increased kidney function values. This study aimed to collect data that may be related to infected dogs, including age, gender, breed, weight, close-open housing system, the use of ectoparasiticide products. The sample comprised 57 infected dogs. Collecting hematology and serum biochemistry changes in comparison with the reference values of dogs detected with *Ehrlichia canis* from 2017-2019, Thonburi District, Bangkok, Thailand was also carried out. In summary, dogs infected with *Ehrlichia canis* mostly included mixed-breed dogs aged between 1 and 10 years. There were no differences in body weight or housing systems. Dogs that had never used ectoparasiticide products or used them intermittently were infected more often (by 7.14 times) than protected. Clinical hematology and serum biochemistry found anemia, thrombocytopenia, and increased liver enzymes.

Key words: *Ehrlichia canis*, Dogs, Clinical hematology, Serum biochemistry

INTRODUCTION

Ehrlichia canis is a form of rickettsia belonging to the family Anaplasmataceae. It is found worldwide in dogs that are infected, called canine monocytic ehrlichiosis (CME). In Thailand, this infection is typically caused by tick bites (*Rhipicephalus sanguineus*) and triggers various clinical symptoms in infected dogs, including loss of appetite, fever, weight loss, weakness, vomiting, petechial hemorrhage, epistaxis, etc. Some dogs with severe infections may experience seizures, melena, and hematuria (Waner and Harrus, 2013; Moonarmart *et al.*, 2014; Kottadamane *et al.*, 2017).

In infected dogs, histopathologic findings have been identified many organs, including the central nervous system, eyes, lymph nodes, spleen, liver, kidneys, urinary bladder, and pancreas (Panciera *et al.*, 2001; Mylonakis *et al.*, 2010; Silva *et al.*, 2016). This results in hematology and serum biochemistry variations, such as anemia, thrombocytopenia, leucopenia, hypoalbuminemia, hyperglobulinemia, and hypergammaglobulinemia (Waner and Harrus, 2013; Bhadesiya and Raval, 2015).

The risk factors for infection that may have been reported in previous reports include age, gender, breed, and housing pattern. Reported data from Anand, Gujarat found

that the German shepherd breed had a high incidence rate. Further, females were particularly susceptible (Bhadesiya and Raval, 2015). However, other information in this study area is unclear.

For the above reasons, the objective of this research is to study the incidences of CME that may be related to the factors of age, breed, weight, close-open housing pattern, and consistent use of ectoparasiticide products, including the change of clinical hematology and serum biochemistry in naturally infected dogs with *Ehrlichia canis* from 2017-2019 at an animal hospital in Thonburi area, Bangkok Province, Thailand.

MATERIALS AND METHODS

Data collection

From 2017 to 2019, fifty-seven dogs were brought to an animal hospital in Thonburi area, Bangkok Province, Thailand (establishment license 01-957/2562, latitude 13.707529, and longitude 100.478054). Clinical signs included anorexia, depression, weakness, and fever. A veterinarian collected data such as age, gender, breed, weight, rectal temperature, close-open housing pattern, and use of ectoparasiticide products. Diagnoses of dogs infected with *Ehrlichia canis* was carried out by blood

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collected from the cephalic vein 1 ml in EDTA tube for clinical hematology and 1.5 ml in heparin tube for serum biochemistry. Thin blood smear and rapid enzyme immunoassay test system containing specific antibodies (IDEXX SNAP® 4Dx®) was used following the manufacturer's directions for diagnosis of blood parasites. Clinical hematology detects white blood cells (WBC), hematocrits (Hct), and platelets (PLT), while serum biochemistry is used to detect alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), blood urea nitrogen (BUN), and creatinine. Both clinical hematology and serum biochemistry were tested by the Veterinary Clinic Research Unit, Faculty of Veterinary Science, Mahasarakham University.

RESULTS

Fifty-seven naturally-infected dogs comprised of 19 females (33.33%) and 38 males (66.67%) were examined. The incidences of age-related infections are as follows: 8.77% in dogs younger than 1 year; 35.09% in dogs between 1 and 5 years; 43.86% in dogs older than 5 to 10 years; 10.53% in dogs between 10 to 15 years; 1.75% in dogs older than 15 years. Rectal temperatures averaged 103.11°F. Weight information is divided into 5 groups: weight groups 0.1-5.0kg, found 17 dogs (29.83%), weight groups 5.1-10.0kg found 16 dogs (28.07%), weight groups 10.1-15.0kg found 7 dogs (3.99%), weight groups 15.1-20.0kg found 12 dogs (21.05%) and weight groups greater than 20.1kg found 5 dogs (8.77%). For the housing pattern, the incidence rates for open and close were 28 (49.12%) and 29 dogs (50.88%), respectively. The use of external anti-parasitic products consistently 7 dogs (12.28%) and some time or never prevention 50 dogs (87.72%). Breed-related incidences were recorded in 49.12% of mixed breed dogs, followed by 10.53% in Shih Tzu and Poodle, 8.77% in Pomeranian, 7.02% in Siberian Husky, 5.26% in Thai Ridgeback and Chihuahua, and 1.75% in Beagle and Italian Greyhound (Table 1). For the clinical hematology and serum biochemistry, it was found that WBC, Hct, PLT, ALT, AST, ALP, BUN, and Creatinine averaged 12.86cells/ μ L, 33.78%, 132,760cells/ μ L, 173.63U/L, 79.02U/L, 315.71U/L, 24.23mg/dL, and 1.36mg/dL, respectively (Table 2).

DISCUSSION

From the data collection results, it was found that age was a significant factor for likelihood to be infected among dogs between the ages of 1-5 years and 5-10 years (35.09% and 43.86% respectively). Gender factors were found in males more than females (66.67 and 33.33%), which is different from a previous report that stated it was more often found in females than males (Bhadesiya and Raval, 2015). Weight factors found that the weight group of 0.1-5 kg (29.83%), 5-10 kg (28.07%) and 15-20 kg (21.05%) had an incidence of infection than 10-15 kg (12.28%) and group more than 20kg (8.77%). The housing system found that closed and open systems have incidences of similar infections at 50.88 and 49.12%, respectively. It was found that the incidence of infection was not different, but there were reports that dogs in open housing systems were at greater risk of Infection than dogs in close housing

Table 1: Factors associated with *Ehrlichia canis* infection in dogs

| Criteria | Natural ehrlichiosis | |
|--------------------------|----------------------|-------|
| | No. | % |
| Age (years) | | |
| <1 | 5 | 8.77 |
| >1-5 | 20 | 35.09 |
| >5-10 | 25 | 43.86 |
| >10-15 | 6 | 10.53 |
| >15 | 1 | 1.75 |
| Gender | | |
| Male | 38 | 66.67 |
| Female | 19 | 33.33 |
| Weight (kg) | | |
| 0.1-5.0 | 17 | 29.83 |
| >5.0-10.0 | 16 | 28.07 |
| >10.0-15.0 | 7 | 12.28 |
| >15.0-20.0 | 12 | 21.05 |
| >20.0 | 5 | 8.77 |
| Housing pattern | | |
| Close | 29 | 50.88 |
| Open | 28 | 49.12 |
| Prevention ectoparasites | | |
| Consistent | 7 | 12.28 |
| Never/Sometimes | 50 | 87.72 |
| Breed | | |
| Shih Tzu | 6 | 10.53 |
| Pomeranian | 5 | 8.77 |
| Poodle | 6 | 10.53 |
| Thai Ridgeback | 3 | 5.26 |
| Chihuahua | 3 | 5.26 |
| Siberian Husky | 4 | 7.02 |
| Beagle | 1 | 1.75 |
| Italian Greyhound | 1 | 1.75 |
| Mixed breed | 28 | 49.12 |

Data collection (n=57).

systems (Gadahi *et al.*, 2008). Regarding the use of ectoparasiticide products, the data shows that dogs that have never used them or used them intermittently had an incidence rate of infection 7.14 times higher than the dogs that received them regularly (87.72% compared to 12.28%), which agreed with the article of Sainz *et al.* (Sainz *et al.*, 2015) on the use of ectoparasiticides regularly according to each company's introduction. Breed factors found that mixed-breed dogs have the highest incidence of infection at 49.12%, followed by Shih Tzu and Poodle at 10.53%. However, it was rare in the Beagle and Italian Greyhound breeds at 1.75%. It may be possible that the study area is popular for these breeds.

Clinical hematology and serum biochemistry values data showed that WBC had an average value of 12.86 cells/ μ L compared with the reference values, which is still within the normal range. From the raw data, however, some dogs had a low WBC at 4.20cells/ μ L, while others were higher than normal at 38.40cells/ μ L. Low WBC may be suggestive of myelosuppression, high WBC may be suggestive of acute infection (Waner and Harrus, 2013). The average hematocrits (Hct) from the data is 33.78%, which is lower than the reference value. The platelets from the data show that the mean value is 132.67×10^3 cells/ μ L, which is lower than the reference value. Low Hct and platelets may indicate a condition of myelosuppression and abnormalities of blood coagulation. The values of ALT, AST, and ALP were higher than the reference values, which were 173.63, 79.02, and 315.71U/L, respectively. This agreed with research reported by Bhadesiya and Raval (2015), they reported higher enzyme values it is

Table 2: Clinical hematology and serum biochemistry of canine ehrlichiosis cases from animal hospital in Thonburi area, Bangkok Province, Thailand

| Parameters | Units | Data collection (n=57) | | Reference* | |
|------------|------------------------------|------------------------|---------------|------------|---------------|
| | | Mean | Observation | Mean | Range |
| WBC | cells/ μ L | 12.86 | 4.20-38.40 | 12.05 | 5.00-14.10 |
| Hct | % | 33.78 | 16.60-50.00 | 63.5 | 35.00-57.00 |
| PLT | $\times 10^3$ cells/ μ L | 132.76 | 58.00-346.00 | 416 | 211.00-621.00 |
| ALT | IU/L | 173.63 | 10.00-2516.00 | 64.5 | 10.00-109.00 |
| AST | IU/L | 79.02 | 19.00-278.00 | 14 | 13.00-15.00 |
| ALP | IU/L | 315.71 | 16.00-2537.00 | 58 | 1.00-114.00 |
| BUN | mg/dL | 24.23 | 9.00-240.00 | 18 | 8.00-28.00 |
| Creatinine | mg/dL | 1.36 | 0.60-17.38 | 1.1 | 0.50-1.70 |

*March 2012: Reference ranges, 10th Ed. The Merck Veterinary Manual

values it is related to abnormal function of the liver when there is an infection. In addition, there was a previous report documenting the cause centrilobular fatty degeneration or necrosis and perivascular and periportal plasmacytosis (de Castro *et al.*, 2004; Mylonakis *et al.*, 2004; Waner and Harrus, 2013). The mean blood urea nitrogen (BUN) and creatinine values were 24.23mg/dL and 1.36mg/dL, respectively, which is normal when compared to the reference values. BUN values are often increased in dogs with kidney disease, but not specific to the disease because this value can be high from foods that are high in protein. An increase in creatinine values is often associated with kidney disease in dogs, but may also be high from dehydration or muscle breakdown (Finco and Duncan, 1976). However, some dogs have BUN values up to 240mg/dL and creatinine up to 17.38mg/dL when considering the raw data. It may be possible that the dog has immune complex-mediated glomerulonephritis (Day, 2011). Documented infection can infiltrate plasma cells and histiocytes, then enter the outer cortex of the kidney and expand to the corticomedullary junction, which can cause edema of the periglomerular and perivenular parts (Reardon and Pierce, 1981; Waner and Harrus, 2013).

Conclusion

In summary, the study of dogs infected with *Ehrlichia canis* in the Thonburi area of Bangkok, Thailand, showed mixed-breed dogs aged between 1 and 10 years were susceptible. There was no difference in body weight or housing system information. Dogs that had never used ectoparasiticide products or used them intermittently were infected more often (7.14 times) than protected. Clinical hematology and serum biochemistry found anemia, thrombocytopenia, and increased liver enzymes.

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