

Case reports

Myocarditis secondary to *Borrelia* infection in a dog: a case report

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ABSTRACT. The aim of this study was to recognise the etiological factor of a disease with symptoms of lameness and cardiac failure, which occurred in one dog 4 weeks after invasion by ticks. A serological examination as well as molecular examination (PCR) was done. In the sample of the serum, the presence of antibodies specific to *Borrelia burgdorferi* were detected. Antibiotic therapy with doxycycline did not cause significant improvement, so the owners of the dog decided about its euthanasia. During the necroscopy, a dilated heart was recognised. In the heart samples, the genetic material of *Borrelia* was detected. The results of serological and molecular examinations showed that in the discussed case, an etiological factor of the disease was spirochetes. In light of the research, veterinary practitioners should keep in mind the presence of Lyme disease in dogs in Poland and include it in differential diagnoses for lameness and cardiological problems.

Keywords: *Borrelia burgdorferi*, dog, PCR, heart, vector-borne diseases

Lyme disease is an endemic, multiorgan disease caused by spirochaete from the group *Borrelia burgdorferi* sensu lato, belonging to Spirochaetaceae [1,2]. The main role in its aetiology in humans and animals is played by bacteria belonging to *B. burgdorferi* sensu stricto, *B. garinii* and *B. afzelii*. The bacteria are transferred from one animal to another by ticks belonging to *Ixodes*, represented in Poland mainly by *Ixodes ricinus* [2,3].

The symptoms in the course of Lyme disease include fever, apathy, arthritis [4] and renal damage [5,6]. The clinical symptoms of Lyme diseases do not appear in all infected dogs. In the endemic areas, only 5–10% of 75% of seropositive dogs develop the symptomatic form of the infection [7]. This could be explained by some of the seropositive dogs being infected with non-pathogenic strains of the

bacteria, or being infected with pathogenic bacteria, but successfully overcoming the infection thanks to a well-functioning immune system [8].

The diagnosis of Lyme disease is difficult, and made on the basis of the coexistence of four indicators: clinical symptoms suggesting Lyme disease, a positive serological test for *Borrelia*, confirmed exposure of the animal to ticks, and improvement as a result of antibiotic therapy [1].

As the number of bacteria in the body of an infected animal is small, detecting them using cultures and microscopic techniques is extremely difficult. It seems that the best material for a *Borrelia* culture is a skin biopsy from the tick attachment site. In patients undergoing antibiotic therapy, the method of choice for the diagnosis of Lyme disease is PCR examination.

The aim of this paper is to describe an atypical clinical case of Lyme disease with cardiac disorders in a dog.

Case presentation

The observed dog was a male Irish setter, aged 1.5 years, with a body weight of 27 kg. The dog was brought to the Clinic of Infectious Diseases of the Veterinary Medicine Department at the University of Life Sciences, with the symptoms of strong dyspnoea and effort intolerance. About two weeks before the onset of effort intolerance, the dog's owners noticed difficulties in walking and shifting limb lameness, which subsided spontaneously. The dog had previously undergone the whole cycle of vaccinations against infectious diseases and was regularly subjected to endo- and ectoparasite prophylaxis. Recently, it had been hunting with its owners, and many times after hunting trips, the owner had to remove ticks attached to its body despite using anti-parasite preparations.

The dog underwent a routine clinical examination. The patient's internal body temperature was 41°C, and the heart rate was 43 bpm. Chest auscultation revealed acute bronchial murmurs and arrhythmia. An ECG showed a ventricular escape rhythm, with a ventricular rate of 43 bpm. In an echocardiogram, dilated cardiomyopathy was observed.

The examination of the hind limbs revealed that both hock joints were painful on palpation. Both joints were hot. However, no lesions in the joints were found in an X-ray. Haematological examination did not reveal any abnormalities apart from leucocytosis (WBC = $26 \times 10^3/\mu\text{m}$). Also, the serum chemistry (AST, ALP, ALT, bilirubin, urea and creatinine) results were in normal ranges. An additional blood sample was collected for the purpose of ELISA serological tests for Lyme disease, ehrlichiosis and anaplasmosis, which revealed the presence of IgG antibodies specific to *Borrelia burgdorferi* (IgG=2.88, the range for borreliosis is: <0.8 U/ml negative; 0.8–1.2 borderline; >1.2 positive). At the same time, DNA was isolated from full blood in order to perform molecular (PCR) tests for ehrlichiosis and anaplasmosis. Both tests gave negative results. On the basis of the examination, it was determined that the patient's symptoms were caused by *Borrelia* infection. The treatment consisted of oral doxycycline (10 mg/kg) and dexamethasone (0.1 mg/kg). It was recommended that the dog

should limit its activity to the absolute minimum. As a result of the treatment, the patient's condition improved. The fever and leg pain subsided. During the first four days of antibiotic therapy, the owners did not observe any attacks of dyspnoea or fatigue. They reappeared on the fifth and subsequent days of the treatment, with a frequency of 3–5 attacks per day. Despite the therapy and limiting the activity of the patient, its condition did not improve significantly in the three following weeks. Therefore, the owners decided to perform euthanasia. The autopsy revealed heart enlargement. The histopathological examination of the samples collected from the heart confirmed myocarditis, while the molecular examination confirmed the presence of the DNA of *Borrelia afzelli* (DQ111061) in the material.

The course of the disease and the results of the additional tests indicated that the dog developed myocarditis caused by *Borrelia* infection.

In conclusion, In dogs, the course of Lyme disease usually involves arthritis, although sometimes it is accompanied by nephritis or dermatitis and skin oedema. After penetration of the host's body, the bacteria usually reside in the skin, urinary bladder, kidney, and synovial membranes [9]. It must be noted that in dogs, Lyme disease is not accompanied by neurological symptoms, and cardiac complications are extremely rare [7]. In human medicine, cardiac disorders in the course of Lyme disease occur in approximately 8% of patients. Usually, they appear at an early stage of the disease (on average after 21 days from the occurrence of the first symptom, erythema migrans) and manifest as atrioventricular blocks, pericarditis or congestive heart failure. On the other hand, dilated cardiomyopathy belongs to late complications of the disease [10].

There is scarce data on the cardiac type of Lyme disease in dogs. A case similar to the one presented in this paper was described by Levy and Duray [11]. The observed animal was a female German shepherd, aged 11, with a diagnosis of total heart block. Serum tests revealed elevated titres of anti-*Borrelia* antibodies. In spite of treatment with amoxicillin, the animal died and pathomorphological examination revealed dilated cardiomyopathy and myocarditis.

Another description of the cardiac form of Lyme disease in dogs was presented by Detmer et al. [4]. During five years of observations, the authors diagnosed such a form of the disease in ten boxer puppies aged 9–16 weeks. In all animals, *Borrelia*

infection was confirmed by immunohistochemical tests. However, molecular tests confirmed the presence of the bacterial genetic material in myocardium samples from only one of the dogs. All of the animals died, and histopathological examination of the hearts revealed granulomatous inflammation with traits similar to myocarditis in the course of Lyme disease in humans.

Both this case study and the literature review show that myocarditis is a possible complication of Lyme disease in dogs, associated with an unfavourable prognosis. Myocarditis may be an effect of the proliferation of the bacteria in the heart, or an effect of a Jarisch-Herxheimer reaction induced by their presence in the body [11]. Regardless of the pathomechanism of the cardiac form of Lyme disease, it is important to monitor the function of the circulatory system in patients with a diagnosis or suspicion of Lyme disease. Moreover, it would be beneficial to examine dogs who had contact with ticks and present cardiac symptoms for vector-borne diseases.

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