

## Detection of *Borrelia burgdorferi* in a Sick Peregrine Falcon (*Falco peregrinus*) – A Case Report

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### Abstract

*Borrelia (B.) burgdorferi*, the causative agent of Lyme disease, is the most important zoonotic pathogen in the northern hemisphere. This report describes a peregrine falcon (*Falco peregrinus*) infected with *B. burgdorferi*. The patient was presented with a swollen intertarsal joint, diarrhoea, and a reduced general condition. Radiographs were inconspicuous. Antibacterial treatment against the bacterium *Escherichia coli* found in the intestine and joint did not lead to success. The serological testing for *B. burgdorferi* was positive. The bird recovered well after a therapy for borreliosis similar to that in humans and mammals. In future, it should be taken into account that raptors are susceptible to *B. burgdorferi*.

**Keywords:** Lyme disease; *Borrelia burgdorferi*; Raptor

### Introduction

The importance of Lyme borreliosis, a tick-borne disease caused by the bacterium *Borrelia (B.) burgdorferi* sensu lato, is constantly increasing. It is the most frequent arthropod-borne disease in the northern hemisphere today. Numerous studies about the prevalence of *B. burgdorferi* in ticks have been published. A review summarising 1,186 abstracts on epidemiological studies of the tick *I. ricinus* infected with *B. burgdorferi* sensu lato between 1984 and 2003 in Europe describes infection rates from 0% (Italy) to 49.1% (Slovakia). The highest infection rates were found in the countries of Central Europe [1]. The annual worldwide number of reported human cases is about 85,000 [2,3]. Lyme disease is a multisystemic infectious disease. It appears that different genospecies have certain organ tropism. The highest risk of infections is posed by infected tick nymphs, as they are easily overlooked due to their small size and wide distribution [4].

### Case Report

A three-year-old female peregrine falcon (*Falco peregrinus*) weighing 980 g was presented with a mildly swollen left intertarsal joint. The owner also observed diarrhoea over the last five days.

The bird was kept at a weathering of about 5×2.5 metres and was trained for falconry. The diet consisted of day-old chickens and miscellaneous hunting prey animals (e.g. pheasant, rabbit, pigeon).

On clinical examination, the falcon showed a reduced general condition and a swollen left intertarsal joint. There were slight signs of diarrhoea.

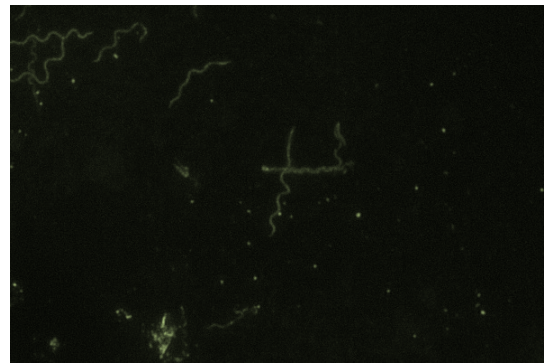
Following these clinical signs, radiographs were taken (latero-lateral and dorso-ventral beam) of the whole bird, which revealed a periarticular soft-tissue swelling without lysis of the articular surfaces of the left intertarsal joint. The walls of the intestinal loops were thickened and showed slight gaseous distention. Blood samples were taken from the brachial vein (*V. ulnaris*) for biochemical and haematological analysis. Interestingly, all parameters were in normal ranges.

The parasitological faecal examinations (direct smear and flotation process) were negative in both cases. Subsequently, bacteriological examinations of the faeces and the periarticular soft-tissue swelling were performed. *Escherichia coli*, a gram-negative, nonspore-forming bacillus was isolated from the cloacal swap and also from the joint in a middle-rate quantity. An antibacterial treatment was administered

based on the bacterial culture and sensitivity (enrofloxacin, 10 mg/kg p.o.). Furthermore, a supportive therapy was carried out: fluid was given via subcutaneous infusions (Stereofundin®). Meloxicam was given for analgesia. In addition to the normal food, the falcon was fed with a eupeptic emergency diet via crop gavage (Carnivore Care®).

Unfortunately, there was no significant clinical improvement during the next six days after starting the treatment.

A new blood sample was taken and tested for *Borrelia burgdorferi* – antibodies according to a modified indirect immunofluorescence-test described by Büker et al. [5]. The bird showed an antibody-titre of ≥ 1:256 (Figure 1). An antibiotic treatment similar to the protocol used in humans and dogs was provided (doxycycline 50 mg/kg p.o.). The



**Figure 1:** Microscopic picture of a positive indirect immunofluorescence-test (630x) of a peregrine falcon (*Falco peregrinus*), titre 1:256.

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falcon recovered well; after ten days, there were no signs of diarrhoea and the joint seemed to be nearly normal in size.

## Discussion

This case reports describes for the first time a presumably clinical borreliosis in a bird. Birds of prey respond immunologically to infections with *B. burgdorferi* and may therefore play a role in the transmission, maintenance, and movement of Lyme disease [5]. It seems that an appropriate treatment similar to that administered in humans and mammals can be effective against *B. burgdorferi*.

It is known that several bacteria, including *Escherichia (E.) coli*, are commonly implicated in bacterial joint diseases and also in enteritis in raptors [6]. Most are secondary pathogens; the treatment is based on bacterial culture and sensitivity, and identification and elimination of predisposing factors and concurrent disease [7]. Interestingly, it seems that the *E. coli* found in this case was not the cause of the clinical findings, because the concerted antibacterial treatment did not prove satisfactory. Nevertheless, it should be considered that the supportive therapy led to the physical recovery. Until now, it appeared that *B. burgdorferi* is asymptomatic in avian species [8]. Further research is necessary to confirm this evidence.

However, infected birds are thought to play a role in the transmission, maintenance, and long-distance movement of Lyme disease [8-10]. A large number of bird species, primarily ground foraging passerines but also sea birds, act as competent reservoirs for *B. burgdorferi* [8,10]. Information about the prevalence of *B. burgdorferi* in different bird species or in birds generally is scarce. Large-scale studies with more than one thousand examined birds have reported values of 4.4%-19% [11-13]. Two different main enzootic cycles for the widespread of *B. burgdorferi* by birds have been described [8]. 1. The Terrestrial Enzootic Cycle: many birds are associated with the dispersal of vector ticks and therefore the distribution of *B. burgdorferi* across their annual migration routes [14-18]. During these routes, migrating birds use different stopover sites where they feed and rest, and at these locations ticks may attach and later detach further along the migration routes or even in breeding and wintering areas. New foci of tick-borne diseases may become established in this way [8]. 2. The Marine Enzootic Cycle: the seabird-associated tick *Ixodes uriae* is the main vector in this cycle. Seabirds often live in large colonies of thousand to millions of individuals, especially during the breeding season. Therefore, ticks and also *Borreliae* can easily be spread [8,19]. A global transmission cycle including a transhemispheric exchange is also assumed, because the same *B. garinii* spirochetes were found in seabirds in the northern and southern polar regions, even on mammal-free islands [8,20]. The relatively low body temperature of seabirds may play a role in the maintenance of spirochetemia [8,19,21].

## Conclusion

Birds should be considered as potential carriers of the Lyme disease; this applies particularly to predisposed persons (e.g. falconers, biologists, zookeepers, hunters, veterinarians).

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