

Small Animal Review

Summary: *Francisella tularensis* is a cause of significant human infection. In endemic areas dogs may be infected with this bacterium but the subsequent disease state appears to be self-limiting. As the organism is endemic on mainland Europe, there is a risk of dogs acquiring infection from wild rodents and rabbits.

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Francisella spp. infection in dogs

Francisella spp. are Gram-negative intracellular coccobacilli that cause the disease tularemia. Four subspecies are known: *F. tularensis*, *F. holarctica*, *F. mediasiatica* (found in central Asia), and *F. novicida*. *F. tularensis* (*sensu lato*) is widely distributed around the Northern hemisphere but is apparently not endemic in the United Kingdom. In Europe, the organism is found in various habitats including forests and grassland and is responsible for epizootics among mammals such as rabbits and hares. Rodents are the principal vertebrate host, and *Dermacentor reticulatus*, *Haemaphysalis concinna*, *Aedes cinereus* and *Ixodes ricinus* are potential arthropod vectors. *F. tularensis* can survive for prolonged periods in cold, moist environments, and routes of infection include ingestion of contaminated water from streams, ponds, lakes and rivers; contact with tissues of infected animals; and by aerosol. In Europe, around 1200 human cases are reported each year and tularemia is a potentially serious zoonosis, often resulting in protracted and debilitating disease with influenza-like signs seen first before localisation in one or more sites determined by the entry route of the bacteria: such as oropharyngeal disease (ingestion), skin and local lymph node (insect bite), ocular disease (conjunctival contamination), pulmonary (aerosol) or a systemic disease (various routes of entry).

Unlike infections in humans, tularemia in dogs appears to occur as a mild disease, presenting with non-specific signs of pyrexia, lethargy, and anorexia, although lymphadenopathy, vomiting, diarrhoea, mucopurulent oculonasal discharge, and skin lesions have been reported; puppies may be more severely affected. A high seroprevalence for *F. tularensis* in dogs suggests that natural infection is not uncommon. Dogs have been implicated in the transmission of tularemia to humans.

As the UK is apparently free of this organism, tularemia presently is a disease we are unlikely to see other than in dogs that may have visited Europe. However, there is no reason why the organism could not become endemic in the UK at some time, and thus may be an issue in the future.

A recent article by Kwit et al highlights the potential for dogs to be infected by this organism (*Francisella tularensis* infection in dogs: 88 cases (2014–2016). *J Am Vet Med Assoc.* 2020;256:220–225. doi: 10.2460/javma.256.2.220). Eighty-eight confirmed cases of tularemia from 87 dogs were included in the study. The dogs varied from 3 months to 14 years old and all showed clinical illness and full recovery. The development of clinical signs were noted in April–June in 55% of dogs, with the commonest clinical signs being lethargy, pyrexia and anorexia. There were six pairs of dogs, from six households, that developed signs within 0–3 days of each other. Haematology documented white cell counts ranging from $5.1\text{--}46.2 \times 10^9$ cells/L and neutrophil counts of $3.4\text{--}32.4 \times 10^9$ cells/L. Leucocytosis was evident in 57% of cases, neutrophilia in 53% of cases. No other clinically important clinicopathological abnormalities were noted. Infection with *F. tularensis* was confirmed serologically by demonstrating a 4-fold or greater increase in the anti-*F. tularensis* antibody titre between acute and convalescent serum samples. The basal sample, taken in most cases between days 0–4 after onset of signs, was seronegative (titre <1:128) in 95% of dogs, while the convalescent sample obtained 10–72 days later showed titres of 1:128–1:4,096. No bacteria were isolated from lymph node aspirates. Thirty-two cases required hospitalisation; five cases were admitted and discharged on the same day, 18 were kept in for 1 day, and nine for 2–3 days. All dogs received at least one antimicrobial agent, with 42% of cases receiving more than one antimicrobial.

Antimicrobial drugs recommended for treatment of tularemia include tetracyclines, fluoroquinolones and gentamicin; these were used in some dogs, but a wide range of other antimicrobials were also prescribed, with some dogs only receiving antimicrobials that are not recommended for treatment of tularemia. The authors consider that the most likely sources of exposure to the bacteria was from contact with small mammals, as owners reported that in 60% of the cases their dog had a history of eating, hunting, or retrieving wild animals, with 44 cases having exposure to rabbits, 10 dogs exposure to rodents; for 10 dogs such exposure was documented as 0–5 days prior to development of clinical signs.

This report highlights that dogs may become infected by *F. tularensis* and that the organism may cause significantly severe signs to warrant a short period of hospitalisation. However, the authors stress the self-limiting nature of infection and lack of the chronic disease that may develop in other species including humans. They also highlight the importance of paired serology in making the diagnosis, as many dogs from endemic areas will be seropositive. Culture of the organism from blood or lymph node is difficult because of its fastidious growth requirements. As antibody titres may not rise for 2–3 weeks, prompt treatment with appropriate antimicrobial agents is recommended (gentamicin, doxycycline and fluoroquinolones) before the diagnosis has been confirmed. Most of the canine cases were seen in the summer months, as is also seen with human infections, and mirrors the time when mammalian reservoirs and arthropod vectors are abundant and outdoor activity of the dogs is high. Dogs may carry *F. tularensis* in their oral cavity or on their coat without showing clinical signs, posing a risk to owners through licking of faces. As endemic tularemia appears to be absent in the UK, concern mainly revolves around dogs that have recently arrived from outside the UK who show non-specific inflammatory illness. In such cases it is important that veterinary surgeons collect a thorough history of potential exposure to zoonotic pathogens including access to wild rodents or a history of insect bites, to assess the risk of tularemia. **CA**