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Maria Grazia Pennisi, Herman Egberink, Katrin Hartmann, Albert Lloret, Diane Addie, Sándor Belák, Corine Boucraut-Baralon, Tadeusz Frymus, Tim Gruffydd-Jones, Margaret J Hosie, Hans Lutz, Fulvio Marsilio, Karin Möstl, Alan D Radford, Etienne Thiry, Uwe Truyen and Marian C Horzinek

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FRANCISELLA TULARENSIS INFECTION IN CATS

ABCD guidelines on prevention and management

Maria Grazia Pennisi, Herman Egberink, Katrin Hartmann, Albert Lloret, Diane Addie, Sándor Belák, Corine Boucraut-Baralon, Tadeusz Frymus, Tim Gruffydd-Jones, Margaret J Hosie, Hans Lutz, Fulvio Marsilio, Karin Möstl, Alan D Radford, Etienne Thiry, Uwe Truyen and Marian C Horzinek



Agent properties

Francisella tularensis is a small, Gram-negative, non-spore-forming, vector-borne zoonotic bacterium.¹ Two biovars have been described as causing disease in the cat: type A or *F tularensis tularensis*, present in North America (virulent, associated with a tick/rabbit cycle), and type B or *F tularensis holarctica* (used in the past for the human live attenuated vaccine), with a broader distribution. The latter has a more complex cycle involving lagomorphs and ticks or mosquitoes, as well as contaminated water. *F tularensis* has a very wide host range involving more than 100 mammals, birds, fish, reptiles and amphibians. Cats are more susceptible than dogs but rodents (including pet hamsters) and lagomorphs are considered the most susceptible mammalian hosts, suffering from an often fatal disease.²

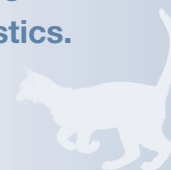
Epidemiology and vectors

Tularaemia is a rural, potentially fatal zoonosis occurring sporadically throughout temperate zones of the northern hemisphere: North America, Eurasia, parts of the Middle East and the north coast of Africa.³ Sometimes outbreaks of the disease are reported.^{1,4}

F tularensis infection may be acquired through different means. Many species of blood-sucking arthropods, including fleas, flies or mosquitoes, are mechanical vectors, but only ticks (*Dermacentor*, *Amblyomma*, *Haemaphysalis* and *Ixodes*) are also long-term reservoirs and pass the infection to a new generation of ticks transovarially.³ Cats may also be infected by their rodent or lagomorph prey carrying the bacteria.

Overview: Disease in cats after infection with the zoonotic bacterium *Francisella tularensis* has been reported only from North America; rodents and lagomorphs are the more susceptible hosts. Tularaemia is transmitted by ticks, but also acquired by direct contact, bite, scratch, ingestion or inhalation. Clinical signs range from mild chronic localised infections to fatal acute disease; antibiotic therapy is efficient. Acquiring the infection from cats is a risk for owners of outdoor cats, veterinarians and technicians.

Lesions and signs of tularaemia can be similar to those of plague, and the two bacteria also have similar epidemiological characteristics.



European Advisory Board on Cat Diseases

The European Advisory Board on Cat Diseases (ABCD) is a body of experts in immunology, vaccinology and clinical feline medicine that issues guidelines on prevention and management of feline infectious diseases in Europe, for the benefit of the health and welfare of cats. The guidelines are based on current scientific knowledge of the diseases and available vaccines concerned.

The latest version of the *Francisella tularensis* infection in cats guidelines is available at www.abcd-vets.org



European Advisory Board
on Cat Diseases
www.abcd-vets.org
Corresponding author: Maria Grazia Pennisi
Email: pennipet@unime.it



Infected domestic cats may transmit tularaemia to humans by bites and scratches but also by direct contact between infected body fluids or tissues and the skin. Humans can also be infected by ingestion of contaminated food or water, by contact with lagomorphs or by inhalation in the case of farming activity.³

In the USA, the human incidence is about 120 cases per year and the infection has been reported in all states (with the exception of Hawaii).⁵ According to serological investigations performed in the USA, 12–24% of client-owned cats have antibodies reacting with *F tularensis*.⁶

In Europe, Scandinavian countries are more interested in the human disease – feline cases have never been reported. A study of an outbreak in Sweden showed that human cases were linked to mosquito bites as the main risk factor, but contact with cats was also thought to be important. In that outbreak, pneumonia was related to farm work.⁷ Tularaemia has been reported in Norway after a cat bite.⁸ Based on the number of reported cases, the risk of tularaemia is considered small, even in endemic areas.

The risk for free-roaming cats is related to tick exposure and to hunting rodents or lagomorphs.

Clinical signs

Most feline cases have been reported retrospectively in cats suspected of transmitting tularaemia to humans, because clinical signs are often uncharacteristic. Severity is variable, ranging from a mild chronic localised infection (the ulceroglandular form) to an acute fatal disease (systemic). Kittens develop a more severe systemic disease (typhoidal) associated with fever, marked depression, enlargement of lymph nodes, liver and spleen, and jaundice.^{9,10} The localised form manifests with chronically draining subcutaneous abscesses.¹¹ Some cats show oral and/or lingual ulcera-

Severity in cats is variable, ranging from a mild chronic localised infection to an acute fatal disease.



tions.¹ Laboratory abnormalities may include leukocytosis or panleukopenia, thrombocytopenia, increased serum aminotransferase and alkaline phosphatase activities, and hyperbilirubinaemia. Hyperplasia is revealed by lymph node cytological evaluation.¹

Lesions and signs may, therefore, be similar to those of plague and the two bacteria also have similar epidemiological characteristics.² Tularaemia should be included in the differential diagnosis of fever of unknown origin in cats with tick exposure in endemic areas, as well as of chronic subcutaneous infections or affected draining tracts.

Diagnosis

Specific antibodies can be detected by microagglutination tests as well as an indirect fluorescent antibody test, but antibodies are not found until about 3 weeks after infection, giving negative results at the onset of clinical signs.¹² A fourfold rise in antibody titre or a positive titre of 160 is considered suggestive of acute infection.¹ In seropositive cats, bacterial DNA could not be detected by polymerase chain reaction (PCR) in all cases, which suggests residual antibody from prior subclinical or undiagnosed infections [EBM grade III].⁶

Definitive diagnosis requires bacterial culture, which appeared to be more sensitive than immunohistochemistry in one case report [EBM grade IV].¹¹ Culture requires specialised media but, above all, biosafety measures to protect against the risks of handling infected tissues.

Treatment

Information on treatment of tularaemia in cats is limited. Gentamicin is the treatment of choice in humans. Tetracycline (doxycycline) and fluoroquinolones for about 2 weeks are considered good second choices [EBM grade III].¹

EBM grades

The ranking system for grading the level of evidence of various statements within this article is described on page 533 of this Special Issue.

Disease in humans

Tularaemia is a potentially fatal zoonosis. Various clinical syndromes occur, but most patients present either with a localised infection of the skin and draining lymph nodes (ulceroglandular form) or with a systemic infection (typhoidal tularaemia).

The oropharyngeal and pneumonic forms are more rare.

Zoonosis
F tularensis is the causative agent of tularaemia.



Recommendations for avoiding zoonotic transmission from the cat

The risk of acquiring the infection from cats is low, but certainly not negligible for owners of outdoor cats or veterinarians and technicians.¹³ Regular external parasitocidal treatment to prevent tick infestations is recommended for outdoor cats. When handling animals with suppurative or draining skin or lymph node lesions in endemic areas, gloves and goggles should be worn. Gloves should also be worn when there is any direct contact with the oral mucosa. Handling of diagnostic samples by laboratory staff should follow biosafety procedures.¹

KEY POINTS

- ❖ *F tularensis* is a zoonotic bacterium infecting a wide range of animal species including cats; rodents and lagomorphs are the more susceptible hosts.
- ❖ Feline disease is reported in North America only, where a more virulent biovar of *F tularensis* is found.
- ❖ Transmission can be vector-borne, but tularaemia is also acquired by direct contact, bites, scratches, ingestion or inhalation.
- ❖ Outdoor cats are more exposed to the risk of disease and of being involved in human infection.
- ❖ Tularaemia in cats ranges from a mild chronic localised infection (ulceroglandular form) to a fatal acute disease (systemic).
- ❖ Kittens develop a more severe systemic disease (typhoidal).
- ❖ Tularaemia should be included in the differential diagnosis of fever of unknown origin in cats with tick exposure in endemic areas, as well as of chronic subcutaneous infections or affected draining tracts.
- ❖ Diagnosis can be confirmed by serology: a fourfold rise in antibody titre or a titre of ≥ 160 is suggestive of acute infection.
- ❖ Culture requires specialised media and appropriate biosafety measures.
- ❖ Gentamicin, doxycycline and fluoroquinolone treatments for 2–4 weeks are good choices.
- ❖ The risk of acquiring the infection from cats is low, but certainly not negligible for owners of outdoor cats, veterinarians and technicians.

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Conflict of interest

The authors do not have any potential conflicts of interest to declare.

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