Fact Sheet

Francisella tularensis (Tularemia)

Unless otherwise noted, all information presented in this article is derived from Dennis DT, Inglesby TV, Henderson DA, et al., for the Working Group on Civilian Biodefense. Tularemia as a biological weapon: medical and public health management. *JAMA.* 2001;285:2763-2773.

Background

Tularemia is a zoonotic disease caused by the bacterium *Francisella tularensis*, which is a hardy organism capable of surviving for weeks at low temperatures in water, moist soil, hay, straw, or decaying animal carcasses.

F. tularensis is divided into two subspecies: *F. tularensis* biovar tularensis (type A), the most common type in North America, and potentially highly virulent in humans and animals, and *F. tularensis* biovar palaearctica (type B), a relatively avirulent type, responsible for human tularemia infection in Europe and Asia.

Small mammals such as voles, mice, water rats, squirrels, rabbits, and hares are natural reservoirs for *F. tularensis*. These animals acquire tularemia through bites from ticks, fleas, and mosquitos and contact with contaminated environments. Naturally acquired human infection can occur through bites from infected arthropods (usually ticks), contact with infected animal tissues or fluids, direct contact with or ingestion of contaminated water, food, or soil, or inhalation of aerosolized bacteria. Naturally occurring human infection tends to occur predominately in rural areas. *F. tularensis* is so infectious that the simple act of examining an open laboratory culture plate without adequate protective equipment can lead to infection and disease.

Tularemia as a Biological Weapon

F. tularensis is considered to be a dangerous potential bioterrorist threat. According to the James Martin Center for Nonproliferation Studies Chemical and Biological Weapons: Possession and Programs Past and Present resource page, Japan and Canada are suspected to have studied but not weaponized tularemia in the 1930s and 1940s. It was weaponized and stockpiled by the U.S. military in the late 1960s, along with several other agents, all of which were destroyed by 1973. Tularemia was also weaponized by the former Soviet Union, which ended its biological weapons program in 1992. (See Chemical and Biological Weapons: Possession and Programs Past and Present. Updated April 9, 2002. James Martin Center for Nonproliferation Studies: http://cns.miis.edu/research/cbw/possess.htm)

Of the various ways that *F. tularensis* could be used as a weapon, an aerosol release would cause the greatest adverse medical and public health consequences. A World Health Organization (WHO) expert committee reported in 1970 that if 50 kg of virulent *F. tularensis* was dispersed as an aerosol over a metropolitan area with a population of 5 million, there would be an estimated 250,000 incapacitating casualties, including 19,000 deaths.

Tularemia poses a serious concern as a biological weapon mainly because it is one of the most infectious pathogenic bacteria known—inhalation of as few as 10 organisms can cause disease—and it has substantial capacity to cause serious illness and death.

Aerosol dissemination of *F. tularensis* in a populated area would be expected to result in the abrupt onset of large numbers of cases of acute, non-specific respiratory febrile illness beginning 3 to 5 days later. (See "The History of Bioterrorism: Tularemia," a short video from the Centers For Disease Control and Prevention [CDC], available at http://www.bt.cdc.gov/training/historyofbt/07tularemia.asp)

Transmission

Human-to-human transmission has not been documented.

Infection Control Measures

Since tularemia is not spread from person to person, it is not necessary to place patients diagnosed with tularemia in isolation.

Signs and Symptoms

Diagnosis of tularemia is based on clinical presentation of symptoms and confirmation by laboratory testing. Laboratories should be alerted to the need for special diagnostic and safety procedures. Rapid diagnostic tests are not widely available; ancillary confirmatory testing via microscopic demonstration of *F. tularensis* using fluorescent-labeled antibodies is a rapid diagnostic procedure performed in designated reference laboratories in the National Public Health Laboratory Network. Test results can be available within several hours if the laboratory is alerted and prepared. Growth of *F. tularensis* in culture is the definitive means of confirming the diagnosis and usually takes about 24 to 48 hours in ideal conditions. However, in some instances, growth of the bacteria can be delayed up to 10 days.

Physicians who suspect inhalational tularemia in patients presenting with atypical pneumonia, pleuritis, and hilar lymphadenopathy should promptly obtain blood and respiratory cultures, as appropriate, and alert the laboratory to the need for special diagnostic and safety procedures. *F. tularensis* may be identified through direct examination of secretions, exudates, or biopsy specimens using Gram stain, direct fluorescent antibody, or immunohistochemical stains. It can be grown from pharyngeal washings, sputum specimens, and even fasting gastric aspirates in a high proportion of patients with inhalational tularemia. It is only occasionally isolated from blood. Symptoms of tularemia depend on the virulence of the bacteria strain, dose, and site of infection. Symptoms of all forms of tularemia typically include fever, headache, chills, general body aches, sore throat, and malaise. Symptoms usually develop within 3 to 5 days of infection; however, the incubation period can be 1 to 14 days. Naturally-occurring tularemia infection presents in several forms, detailed in the table below.

The overall mortality rate for severe Type A strains has been 5% to 15%, but in pneumonic or septicemic cases, without antibiotic treatment, the mortality rate has been as high as 30% to 60%. With treatment, the most recent mortality rates in the U.S. have been 2%.

Prophylaxis and Treatment

Early antibiotic therapy is recommended for persons deemed exposed to or infected with tularemia. Tetracyclines (eg, doxycycline), fluoroquinolones (eg, ciprofloxacin), and aminoglycosies (eg, streptomycin and gentamicin) are all effective treatments. Treatment recommendations after a biological attack would depend on antibiotic susceptibility of the strain of bacteria used in the attack.

Since person-to-person transmission is not known to occur, post-exposure prophylaxis of close contacts with persons infected with tularemia is unnecessary and not recommended.

Countermeasures

In the U.S., a live-attenuated vaccine derived from the avirulent live vaccine strain (LVS) developed by the Department of Defense (DoD) has been used to protect laboratory personnel routinely working with *F. tularensis* and military high-risk personnel. Vaccination with the LVS vaccine is not available to the general public.

Given the short incubation period of tularemia and incomplete protection of current vaccines against inhalational tularemia, vaccination is not recommended for post-exposure prophylaxis.

Simple, rapid, and reliable diagnostic tests that could be used to identify persons infected with *F. tularensis* in the mass exposure setting are needed. Also needed is research leading to the development of accurate and reliable procedures to rapidly detect *F. tularensis* in environmental samples.

Tularemia: Forms, Routes of Infection, and Symptoms

Form	Typical route of infection	Symptoms
Ulceroglandular	Handling contaminated carcasses or a bite from an infected arthropod	• Formation of an ulcer at the site of infection followed by swollen and painful lymph glands
Glandular	Handling contaminated carcasses or a bite from an infected arthropod	• Swollen and painful lymph glands without the development of ulcers
Oculoglandular	Direct contamination of the eye with *F. tularensis*	• Pain, redness, swelling, and discharge of the eyes • Development of an ulcer on the inside of the eyelid in some cases
Oropharyngeal	Eating or drinking contaminated food or water; inhaling aerosolized *F. tularensis*	• Sore throat or tonsillitis • Vomiting and diarrhea • Possible swelling of the glands in the neck
Pneumonic	Inhaling aerosolized *F. tularensis*; secondary infection from another form of tularemia	• Sore throat and swelling of the lymph nodes in the lungs • Abrupt (in the first 1 to 2 days) onset of fever, chills, headache, muscle aches, joint pain, dry cough, and progressive weakness
Typhoidal	Unspecified	• Systemic illness (fever, chills, headache, etc.) without indication of site of infection or localized symptoms
Septic	Unspecified	• Potentially severe and fatal • Systemic illness (fever, chills, headache, etc.) • Patient typically appears toxic; may develop confusion and coma • Without prompt treatment, may lead to septic shock, acute respiratory distress syndrome, and organ failure

See Also

Chemical and biological weapons resource page. Center for Nonproliferation Studies, Monterey Institute of International Studies. http://cns.miis.edu/research/cbw/index.htm. Accessed October 15, 2007.

Tularemia key facts Web page. Centers for Disease Control and Prevention, Emergency Preparedness and Response. October 7, 2003. http://www.bt.cdc.gov/agent/tularemia/pdf/tularemiafacts.pdf. Accessed October 15, 2007.

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