Tularemia

By Samantha Le

Tularemia; Etiological agent: Francisella tularensis (1)

Transmission: Through tick/deer fly bites, skin contact with infected animals, contaminated water, laboratory exposure, and contaminated dust/aerosols (1)

Reservoirs:
Squirrels, rabbits (2); feces, mud (10).

General Characteristics:
Non-motile, Gram-negative rod-shaped bacterium that is 0.2-0.7 um in size (14). It is fastidious, oxidase negative, catalase positive (weak), and urease negative (14). It is surrounded by a capsule that is high in lipids (14=5).

Key Identification Tests:
F. tularensis can be identified using cysteine-glucose-blood agar growth. The plates are incubated at 37 C for approximately three weeks. It is typically diagnosed based on serology results (antibody detection). These tests are typically latex agglutination, ELISA, or PCR (12) to determine the appearance of hemagglutinins in serum samples, 10-12 days post-infection (2). If the humagglutinins increase in titer (typically a fourfold increase), then the infected person may be diagnosed with tularemia (2).

Signs and Symptoms:
After a person is infected, there is an incubation period of 3-7 days (3). Symptoms include acute high fever, chills, headaches, diarrhea, muscle aches, joint pain, a dry cough, and progressive weakness (5). It may also cause acute septicemia and toxemia (1). The bacterium causes a high fever, acute septicemia and toxemia (1). In addition, abscess formation is noted in the Peyer's patches and mesenteric lymph nodes (2). It may cause secondary bacterial pneumonia (4).

Historical Information
Francisella tularensis was originally called Bacterium tularense. It was originally isolated in 1911 from ground squirrels in Tulare County, CA, USA. However, it was later allocated to the genus Francisella to commemorate the man who researched the organism, Dr. Edward Francis. (6). It is currently on CDC's list of potential biological weapons (13).

Virulence Factors
Although Francisella tularensis is a Gram-negative bacterium, its virulence is not due to exotoxins. Instead, virulence comes from its ability to reproduce massive populations in host tissues an organisms. This proliferation disrupts normal cellular function and causes a significant host inflammatory response that contributes to the disease (6). Furthermore, Francisella tularensis has a remarkable ability to escape macrophage digestion. It produces an acid phosphatase (AcpA), which inhibits macrophage burst-killing abilities. (13).
Control/Treatment & Prevention/Vaccines

Treatment includes a 'fever watch' (3) and doxycycline or streptomycin (14). An alternative to doxycycline is ciprofloxacin (3). Fluroquinolones are currently being tested as another alternative to doxycycline, as they were found to be successful in in vitro trials (14). A live to tularemia exists, but was used to treat laboratory workers, and is not available to the public (14). Insect repellent is recommended when venturing outdoors, as well as proper hand-washing hygienic techniques. Lastly, food must be properly cooked, and drinking water must be from a safe source. (5)

Outbreaks & Figures

Since the 1950s, outbreaks have generally decreased (8), with the highest incidence in 1939 when 2,291 cases were reported (11). From 1990-200, there was an average of 124 cases/year in the United States. The cases were highest in children and the elderly (11). The incidence rate of tularemia in the United States from 2004-2013 was 0.06. There were 203 cases overall per 100,000 residents. In Texas, there was 1 case reported out of 100,000 (7). It is noticeably absent in Hawaii, but is more common in the Pacific Northwest and Masacchussetts (7). Globally, the incidence of disease is highest in Russia and Scandinavian countries (9).

References:


<http://www.cdc.gov/tularemia/statistics/state.html>


<http://www.cdc.gov/tularemia/resources/whotularemiamanual.pdf>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5109a1.htm>

