Legionnaires' Disease

By Samantha Ashmead

Legionnaire’s disease; Etiological agent- *Legionella pneumophila* (1).

**Transmission:**
Transmission of *L. pneumophila* is mainly through contaminated aerosols that are inhaled through the respiratory system. *L. pneumophila* can be found in potable and nonpotable water systems such as air conditioning cooling towers, humidifiers, hot tubs, and showers. The disease is considered noncontagious because there is no human-to-human transmission (1,2).

**Reservoirs:**
Water is the main reservoir

**General Characteristics:**
Gram-negative bacillus. *L. pneumophila* stains poorly and therefore it can appear in different forms of bacilli (3,4). For example, the bacterium appears as a short rod in sputum samples but also appears as a filamentous bacillus when cultured in nutrient-deficient media (3). The bacterium is non-encapsulated with a single polar flagellum and is surrounded by a gram-negative cell wall comprised of a lipopolysaccharide membrane (4). The outer membrane is also composed of a single, major protein which acts as a porin and target for human complement fixation (4).

**Signs and Symptoms:**
Legionnaires’ disease is the pneumonic form of infection with *Legionella*. It has an incubation period of 2-10 days with initial symptoms of fever, loss of appetite, headache, and malaise. Some patients also exhibit symptoms of myalgia, diarrhea, and confusion. The individuals then develop a mild cough with 50% of patients producing phlegm. The cough can progress to blood-streaked phlegm production or hemoptysis occurs in 1/3 of infected individuals. Legionnaires’ disease ranges in severity from a mild cough to death from respiratory failure and/or shock (1).

**Virulence Mechanisms:**
*L. pneumophila* is a non-spore forming intracellular pathogen and unlike other pneumonic bacteria does not affect an individual’s upper respiratory systems (4). Instead the bacterium is small enough that it travels to the alveolar sacs and is brought
into the alveolar sacs by macrophages (4). This leads to one of \textit{L. pneumophila}'s most important virulence factors, the ability to prevent phagosome-lysosome fusion (4,5). This allows the bacterium to invade and replicate inside alveolar macrophages within a protective phagosome and prevent phagocytosis of the microbe (4,5).

The bacterium also has many other virulence factors that contribute to its pathogenicity. For example, the bacteria’s flagella enhance its invasion abilities. Also, \textit{L. pneumophila} has the same endotoxin production as other gram-negative bacterium by the lipopolysaccharides found within the outer membrane. Furthermore, \textit{L. pneumophila} has a type IV pili on its surface which allows for adherence to the host cell thus increasing pathogenicity and virulence of the bacterium (5). This invasive bacterium has several virulence factors and many others currently under investigation.

**Control/Treatment:**
There is no vaccine available for this disease. Patients with Legionnaires’ disease always require antibiotic treatment and recovery can take several weeks or months to complete. Due to the intracellular nature of the bacterium, the antibiotic must be capable of intracellular penetration to be effective. This includes the macrolides, quinolones, tetracyclines, and rifampin with the first choice falling between macrolides and quinolones (6).

Of the macrolides, erythromycin has traditionally been used to treat the infection in the past; however, it has been found that clarithromycin and azithromycin are more effective against the bacterium with azithromycin coming out on top (6). Azithromycin was found to exert a post-antibiotic effect in the alveolar macrophages which includes regrowth inhibition of \textit{L. pneumophila} 5 days after completing the antibiotic treatment (6). Also, there has been no antimicrobial resistance to azithromycin in clinical isolates of \textit{L. pneumophila} (6).

Quinolones readily penetrate the intracellular compartments within alveolar macrophages (6). Many antibiotics of the quinolones have been proven effective against \textit{L. pneumophila} such as ciprofloxacin, levofloxacin, moxifloxacin, gemifloxacin, and trovafloxacin (2).

While it is impossible to eradicate the source of infection, many control mechanisms can be implemented to significantly decrease the public health threat posed by \textit{L. pneumophila}. These measures include regular maintenance, cleaning, and disinfection of water systems such as those found in cooling towers, spa pools, hot/cold water systems, and taps (1).
Current Information:
Over the past decade, the number of reported cases to the CDC has been on the rise with a 286% increase demonstrated in the United States between 2000-2014 (7). The CDC speculates this increase is due to several reasons such as an older U.S. population, more at-risk/immunosuppressed individuals, or aging plumbing infrastructure but these are simply speculation (7).

Each year, there is now approximately 5,000 cases of Legionnaires’ disease reported in the United States alone (7). While outbreaks of the disease are identified, most the cases reported are sporadic (7). Of the reported cases, 75-80% are over 50 years old with other risk factors including smoking, history of heavy drinking, acute/chronic pulmonary-related illness, and immune-suppression (1).

Legionnaires’ disease is believed to occur worldwide; however, many countries lack the appropriate methods of diagnosing the infection or surveilling its incidence so the rate of occurrence in other countries is unknown (1).

Works Cited:


