Legionnaires’ Disease

By Kameron Petok

The Legionella family has a total of forty-two identified species and sixty-five serogroups. Legionella is a bacterium that can show up in two forms depending on where it is affecting. The Legionella pneumophila strain that causes ninety percent of Legionnaires’ disease (a form of pneumonia) is by far the most common while the non-pneumonic form is called “Pontiac Fever”. The non-pneumonic form of the Legionella bacterium known as Pontiac fever was first discovered in Pontiac, Michigan in 1968. Pontiac’s health department building apparently had a leaky air duct from a water cooling air conditioning system that let exposed water vapor to enter the building. The lung-affecting or pneumonic form of Legionella showed up later with a widespread outbreak in 1976 at an “American Legion” convention in Philadelphia, Pennsylvania. This is when the first isolated form was found to be Legionella pneumophila. There were around two-thousand people going to this convention and more than two-hundred caught the disease and around twenty actually died from it. The term “Legionnaires’” or “belonging to the legions” comes from the fact that these two hundred “legions” of the convention caught the disease and hence the name belongs to those who were affected.

The Legionella pneumophila that causes Legionnaires’ disease is usually found in fresh water but it develops optimally in warm waters (68 to 122 F with an optimal temperature of 95 F). The most common waters that are exposed are that of hot tubs, air-conditioning units that use water to cool them (such as those in large commercial buildings), hot water tanks, and decorative fountains. The bacterium can also inhabit contaminated water used in humidifiers and nebulizers as well. A person can catch LD from the tiny droplets of water in the air containing the Legionella pneumophila bacterium. Therefore, mist or vapor from various water sources can infect the lungs if it breathed into the lower respiratory tract of the lungs. Though not a mist, if contaminated drinking water goes through a person’s trachea (that horrible phenomenon that makes you cough like crazy) and into the lungs instead of to the stomach where the bacteria cannot thrive, a person may contract LD.

Thankfully, most people who are exposed to Legionella do not catch the disease. Around ten percent of those who get LD will succumb to death from complications due to the ailment, mainly that of lung failure but sometimes mutli-organ failure when it spreads through the bloodstream. While LD can be fatal in this small number, Pontiac Fever usually goes away on its own within a few days. The incubation period for L. pneumophila is about two to ten days. There has been absolutely no evidence of LD spreading from person to person. So if more than one person has LD in a location it is due to something in the environment rather than the people themselves. More cases appear during the Summer and late Fall seasons due to increased need for water during high temperatures.

Preventative measures that people can take relate to water usage, healthy lungs, and the immune system of infected individuals. These include using an adequate amount of chlorine in pools and hot tubs. Keeping these areas clean by draining and refilling the water after cleaning pool and hot tub surfaces further keeps the bacterium from flourishing. This goes the same for cleaning the cooling towers of large commercial buildings A/C systems. Because of the bacterium’s growth in 68-122 F waters, keeping a water source below 68 F or above 122 F
would prevent it from multiplying more. In terms of a person’s lung health, obviously, chronic cigarette smokers are more susceptible to infection of Legionella pneumophila. Avoiding smoking greatly reduces its chances. Older people are more susceptible than younger people because of general health and immunity, especially the elderly (those sixty-five and older). Of the recorded cases, a large portion of infected people are male (60-70%) and over fifty years old (75-80%). Though the disease does occur globally, there is not a lot of information or reported cases besides these few figures. Also along these lines, people with pre-existing conditions such as a chronic lung disease (like COPD or emphysema) and those who abuse alcohol are more prone to catching the disease. And lastly, if a person’s daily job involves cleaning water sources or cooling systems then they are more prone than those who do not.

Legionnaires’ disease can be difficult to diagnose. It has symptoms similar to other types of pneumonia and it looks virtually identical on a chest X-ray of the lungs. Other than X-rays, diagnosis can be established from a urine sample, analyzing phlegm coughed up from the lungs, or taking a physical sample of the lung in a lung biopsy. A general feeling of uneasiness or discomfort (malaise) accompanies several other symptoms. Some of the most common symptoms of LD are high fever, chills, shortness of breath or coughing, muscle aches (myalgia), lack of energy, and headaches. These are similar to flu-like symptoms and acute pneumonia can occur. A more severe presentation may be multilobar (occurring in more than one lobe of the lungs) pneumonia which would require hospitalization and can be fatal if untreated.

Fluoroquinolones and macrolides are the best antibiotics to fight the Legionella pneumophila that causes LD. The majority of people will be fine after a short treatment period but usually need hospitalization. Besides antibiotics, oxygen support can be used along with intravenous fluids containing electrolytes so that the patient does not become dehydrated. Surprisingly, there is no vaccine currently out to prevent contraction of the disease.

The Legionella pneumophila is a very intriguing bacterium with colorful characteristics. It is a pili containing gram-negative-bacteria, meaning that it appears red under a microscope using the Gram staining method because its cell walls lose the violet dye that was first applied while retaining the red dye applied after the second step decolorizing agent. The bacterium itself is anywhere from two to twenty micrometers in length. The microbe is rod-shaped, waterborne, and is not encapsulated. It is also a facultative/obligate aerobe and is known to use a couple of amoeba species as protozoan hosts which are found in its primary environmental reservoir of water. The Acanthamoeba castellanii, hartmanella, and naegelia species can serve as hosts for the bacterium. Interestingly, Acanthamoeba hartmannella can turn into its cystic stage during outside stress which protects the Legionella inside it quite efficiently. Buffered charcoal yeast extract (CYE) is the major medium used to segregate Legionella because it does not grow on conventional agar. Their energy comes from amino acids and the main one for their growth is L-cysteine.

Legionella pneumophila has two phases of growth. The replicative phase shows bacteria that are sodium resistant, non-flagellated, and lowly toxic to their inhabiting cell. The infectious phase’s bacteria are short, have a single motile producing flagellum, and are highly toxic to their inhabiting cells. Specifically, the Legionella bacterium multiplies in the macrophage cells of the alveoli of the lungs. The lysosomes that usually bind to these macrophages are prevented from doing so, allowing the bacterium to exponentially increase in number. This ability to prevent phagosome-lysosome fusion is the basis for the bacteria’s virulence. The macrophage cell is eventually destroyed and more bacteria are released to infect other cells of the lower respiratory
system. Although Legionella are known as “fastidious,” they mature rather slowly in water and then multiply much quicker in the phagocytic cells just mentioned.

Overall, Legionnaires’ disease caused by the culprit Legionella pneumophila has symptoms similar to a flu when affecting the lungs and shows up as pneumonia. This presentation is more dangerous than Pontiac fever. The ideal candidate for LD would be a male over the age of 65, along with being an excessive smoker and drinker and having a current lung disease like COPD, who coincidentally works as a technician cleaning pools and hot tubs. The opposite side for a very unlikely candidate would be a very young female who is totally sober and does not smoke, who has very healthy lungs and is a consistent runner, and who has an irrational fear of mist. Either way, I think I am okay for now being a young male who never drinks, runs three times a week, smokes cigarettes once in a blue moon, and has no pre-existing health conditions and a pretty healthy immune system.

References


