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The Bubonic Plague

By: Matthew Morin and Ashton Westbrook



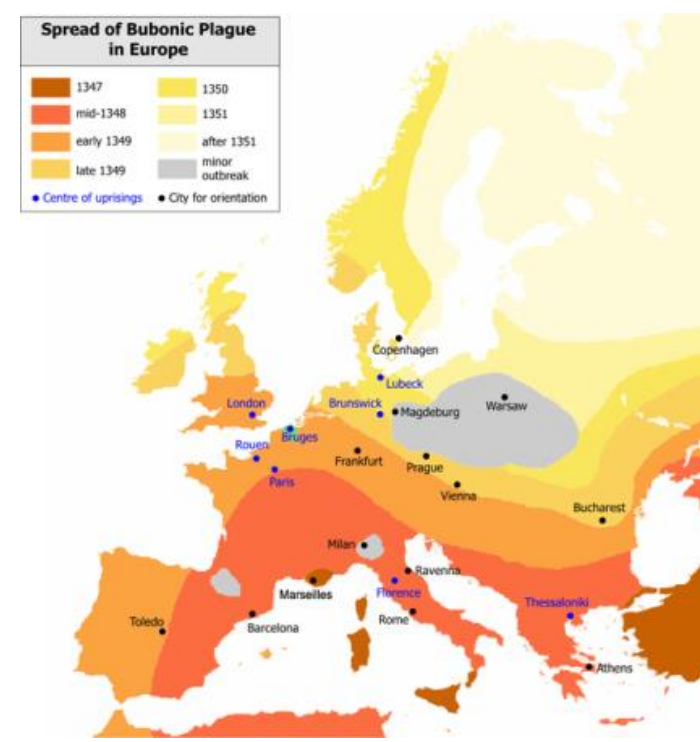
The Plague

Importance and Historical Circumstances

The bubonic plague is a very serious infectious disease caused by the bacterium *Yersinia pestis*. The plague is a zoonotic disease, which means it is usually transmitted to humans by animals. It is commonly transmitted through the bites of infected fleas or coming in direct contact with infected animal tissue (Schoenstadt, 2006). The bacterium can be found in fleas or small rodents such as chipmunks, squirrels, rats, or prairie dogs. The symptoms, including fever, chills, headache, and hemorrhages under the skin causing discoloration, are very harsh and unpleasant. This disease is infectious and extremely severe, and it is deadly if not treated properly and promptly (CDC, 2012).



Yersinia Pestis bacterium



Map of areas in Europe affected by Plague in 1300s

Records of the plague date back to the 14th century. Bubonic Plague is infamous for killing nearly a third of the population in Europe during the Middle Ages (CDC, 2012). The disease is deadly. Without immediate and proper care, the victim will not survive for long. With no antibiotic, vaccine, or sanitary lifestyle, people were not protected and one of the worst epidemics ever occurred. Back in the 14th century when the bubonic plague was rampant, one of the most common ways the doctors thought to cure people was by Aromatherapy, or the treatment of the body by different smells or with religious ceremonies (Shariff, 2013). Today, we have more effective methods of treatment.



One-third of the population in Europe killed by the Plague epidemic.

Disease Classification

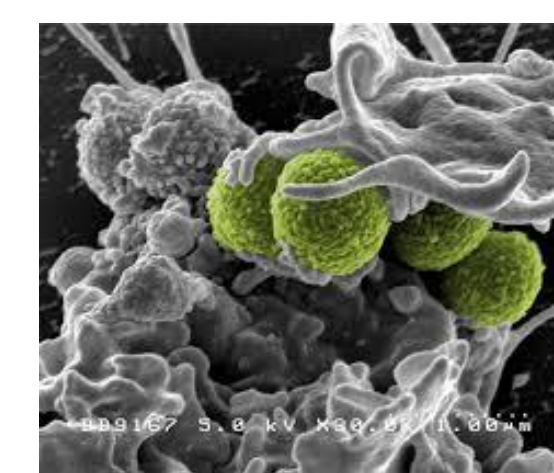
The Black Plague is a bacterium. This bacterium, *Yersinia pestis*, is obtained through a bite from an infected animal, inhaling of infected droplets, or coming in contact with infected body tissue. The bacteria can survive for a long time with a host, and can easily be transmitted airborne. This bacterium reproduces through binary fission, which is a common reproductive method for prokaryotes.

Disease

Bacterial Progression and Immune Response

Once *Yersinia pestis* enters the body, the bacterium travels to the proximal draining lymph nodes where it grows and multiplies between 6 and 36 hours. At this point, the bacterium begins to enter the bubonic stage of the disease. Between 48 and 72 hours later, the bacterium has colonized the blood, spleen, liver, and lymph nodes. The bacterium cannot be detected until the disease has entered advanced stages, which delays immune response. If the bacterium is not treated by an antibiotic, it will advance and become more and more deadly. The plague is fatal unless necessary actions are made.

The bubonic plague has the ability to surpass the first stages of immune response, making the disease deadly because it is already very advanced by the time the immune system begins working. Mammals first respond by regulating inflammatory cytokines that activate phagocyte cells and send them to the site of infection. Almost all of the infected cells are macrophages, neutrophils, or dendritic cells. These cells are the first to respond to a bacterial invasion. Their job is to rush to the infection site, engulf the bacteria, break it up into smaller pieces, and send those pieces to the T-cells and B-cells (University of Chicago Medicine, 2005). The T-cells and B-cells work more slowly, but are powerful and target specifically the smaller pieces of the infected cells.



T-cells and B-cells attacking the Plague bacterium, *Yersinia pestis*.

Prognosis

The bubonic plague is a very severe and extreme disease. If left untreated, the victim will experience very painful and severe symptoms. The plague is rare, but it does occur. People today are fortunate enough to live in a time period where an effective antibiotic is available (CDC, 2012). If a patient is being treated for the bubonic plague properly, the death rate is very low at about 1-15%. If left untreated, the bacteria will continue to develop to more dangerous stages with higher death rates. Cases do not occur very often, especially in the United States.



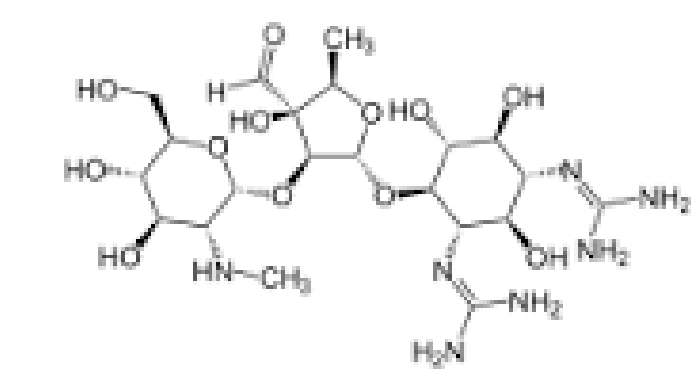
Treatment

Options for treatment

When a person is diagnosed with the bubonic plague, they are immediately started on treatment- an antibiotic. People with whom infected persons have come in contact with are evaluated and are treated as well if they have become infected. The two most commonly used antibiotics when treating someone with the plague are Gentamycin and Streptomycin which are intramuscular or intravenous (Vyas, Zieve, & Black, 1997). It is very important that proper treatment is administered because without it, the disease can advance and become more and more dangerous until it kills the host in as little as 24 hours. In addition to antibiotics, oxygen, intravenous fluids, and respiratory support are also usually helpful depending on how advanced the disease has become (Vyas, Zieve, & Black, 1997). If the disease has developed to pneumonic plague, the patient will be isolated and kept away from others. Because the plague can sometimes be resistant to the antibiotics, the patient may have to take more than one type of antibiotic to effectively kill and get rid of the bacterium.



Streptomycin.



Mechanism of Antibiotic

The antibiotic that a patient is using is usually started when first symptoms appear, before any lab test results come back. The patient is hospitalized to ensure that proper treatment is administered and that the bacterium is not spread to other people. Streptomycin, the most common antibiotic used to treat plague victims, is specifically for bacterial infections or diseases. Streptomycin slows the disease by slowing the synthesis of bacterial proteins.

Emerging of New Vaccine

A plague vaccine is not currently available, but research is being done to possibly find one. The research is currently not very intensive because the plague is very rare and does not commonly occur like it once did. As long as treatment is started immediately and proper care is administered, the victim should recover from the disease and continue a normal life unless the case is extreme.