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Typhoid Fever

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Background

Typhoid fever is a waterborne disease. There are a reported 16 million illnesses and 600,000 deaths annually (Crump, 2010). Most cases occur in developing countries; however, citizens of developed countries who visit developing ones are at risk of catching this disease (CDC, 2013).

The disease is caused by *Salmonella typhi*, which infects the lymph nodes, necessary for immune response. Basic symptoms include a prolonged fever, interruptions in proper bowel function (constipation and diarrhea), severe cough, and in some cases, rose-colored spots on the patient. *Salmonella typhi* is a gram-negative bacteria that can only be carried by humans. There is also a similar, but less deadly form of this pathogen named *Salmonella typhimurium* (WHO, 2003).

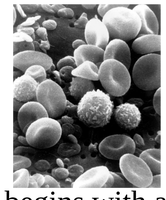
Salmonella typhi
http://www.cdc.gov/media/subtopic/library/DiseaseAgents/img18.jpg

Typhoid fever was also believed to be the cause of The Plague of Athens. The symptoms of the disease that caused The Plague were recorded by Thucydides, a philosopher, and have been compared to the symptoms of known diseases. Typhoid fever has been ruled out as a cause because only two, possibly three symptoms match up (Cunha, 2004).

Infection/ Disease

The human immune system consists of three lines of defense. The first line of defense is nonspecific and consists of barriers such as skin, mucus, cilia, tears, and digestive enzymes. The second line of defense is also nonspecific and consists of inflammation, fever, general granulocytes, and clotting. The third line of defense is the more specialized T cells, and B cells. B cells produce plasma cells, and B memory cells. Plasma cells produce antibodies that clump together pathogens for easier eating by macrophages and dendritic cells; B memory cells "remember" past pathogens for an even faster reaction time. Helper T cells activate B cells, while Killer T cells destroy cells infected with viruses, bacteria, and cancer by dissolving the cell membrane (Nobel Prize.org, 2004).

Blood cells under a scanning-electron microscope.
(CC-BY-AA)



The first week of Typhoid fever begins with a steadily climbing fever that starts low and increases until it reaches 103°-104°F. Other symptoms include headache, weakness and fatigue, dry cough, loss of appetite, abnormal pain, diarrhea and constipation, and a rash. The second week will result in continuing high fever, either diarrhea or extreme constipation, considerable weight loss, and an extremely distended (swollen) abdomen. In the third week, delirium may set in and infected person may lie motionless and exhausted with eyes half-closed in what is known as the typhoid state. Week three is also when life threatening conditions such as intestinal bleeding or holes, inflammation of the heart lining, muscles and valves, pneumonia, inflammation of the pancreas, gallbladder, and membrane and fluids surrounding the central nervous system may occur. In week four, fever begins to drop steadily until broken, however, symptoms may reappear after two weeks. Typhoid fever will often kill its victim or recur a few weeks after symptoms disappear. Those who survive usually have no lingering effects (Mayo Clinic Staff, 2012).

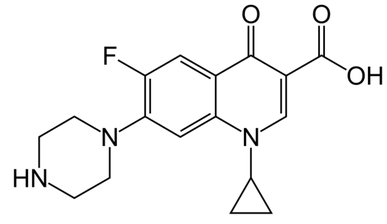
Treatment options

Current treatments are antibiotics, primarily ciprofloxacin and ceftriaxone (for pregnant women and young children) (Mayo Clinic Staff, 2012).

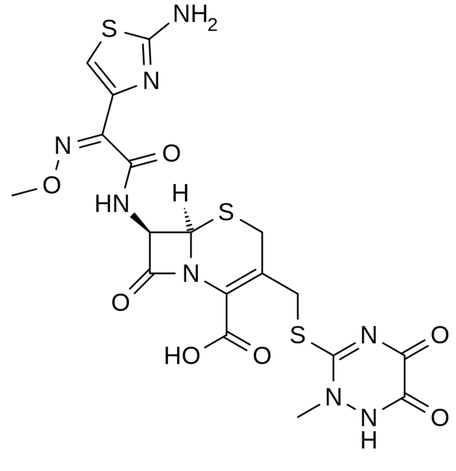
Antibiotics in general inhibit the growth of or assist the immune system in killing invasive bacteria (Oxford University Press, 2015). *Salmonella typhi* has built up a resistance to antibiotics, such as chloramphenicol, tetracycline, streptomycin, and sulfonamides (Olarte, 1973) which is why ciprofloxacin and ceftriaxone are used.

There are not many emerging treatments, probably because current treatments work well, and there is not as much publicity, or a need for a cure as, say, malaria or Ebola.

Ciprofloxacin
stick model



Ceftriaxone
stick model



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References available upon request.