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Marin Olson Beal

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Lyme Disease

By: Marin Olson Beal



Background

Importance:

When asked to think of headlining diseases, many would choose bubonic plague, smallpox, Ebola, or leprosy. However, Lyme disease makes up for more confirmed diagnostic cases in the United States than all the aforementioned diseases combined. In 2014 alone, in the United States, 119 diagnostic cases were confirmed of bubonic plague, smallpox, Ebola, and leprosy altogether, while there were over 25,000 confirmed cases of Lyme disease (CDC, 2015). More information is needed to understand Lyme disease and how to treat it, before any more lives are lost.



The carrier of *Borrelia burgdorferi*, the Lyme disease causing spirochete; the black-legged tick (Public Health Image Library).

Historical:

Looking back on history, there has been no massive outbreak of Lyme disease, only a consistent number of cases in the quintuple and sextuple digits. However, Lyme disease was first discovered and documented in 1975 after a mysterious outbreak of arthritis in children, a common symptom of Lyme disease, who lived near Lyme, Connecticut. The framework for understanding Lyme disease is still under construction; the disease itself is not diagnosed or treated well. The symptoms of Lyme disease, in the beginning, are very similar to a large crop of other viruses and conditions. Lyme disease is viewed with confusion by both the public and the medical community (NIH, 2012).

Microorganisms:

Lyme disease is classified as a bacterial infection. The bacterium, *Borrelia burgdorferi*, is transmitted through a black-legged tick attached to a host for a duration between 36 and 48 hours. Black-legged ticks are normally found in the northeast/mid-Atlantic/upper mid-western United States and only become infected with pathogens when larvae take a blood meal from infectious animal hosts. Most cases of Lyme disease are transmitted between the months of May and July due to the black-legged ticks' life cycle. The fact that in each mobile state of a black-legged ticks' life cycle they feed on a different host animal only makes Lyme disease harder to combat and eradicate (CDC, 2014).

Infection/Disease

Immune Response:

When *Borrelia burgdorferi*, the Lyme disease causing spirochete, enters the body, factors in its saliva coating can hide it from the human immune system. Often weeks may go by before antibodies are produced to attack the bacterium. Once the immune system begins to react to the presence of the spirochete, the 1st line of defense is an inflammatory response. During the second line of defense, the immune system sends dendritic cells, macrophages, monocytes, and neutrophils to attack the invader. By the time this 2nd line of defense takes place, *Borrelia burgdorferi* has already changed and altered the proteins that line its cell walls, once again camouflaging itself from the human immune system. *Borrelia burgdorferi* continue to stay one step ahead by changing form, and escape even the 3rd line of defense in the human immune system, when inflammation and killer T cells are continuously sent out to attack the spirochete (Web MD, 2015).



The 'bull's-eye' rash that is characteristic for Lyme disease (CC-BY).

Progression:

Without treatment, Lyme disease begins to progress into 3 stages; localized Lyme disease, early disseminated Lyme disease, and late disseminated Lyme disease. During localized Lyme disease, one may experience fever, aching, joint pain, muscle pain, and stiff neck. If a patient that has contracted Lyme disease continues without treatment, the disease will progress into stage II, early disseminated Lyme disease. During this stage there may be numbness, paralysis, or heart palpitations. Next comes stage III, late disseminated Lyme disease. Stage III is characterized by abnormal spasms, joint swelling, weakness, speech and cognitive problems (Web MD, 2015).

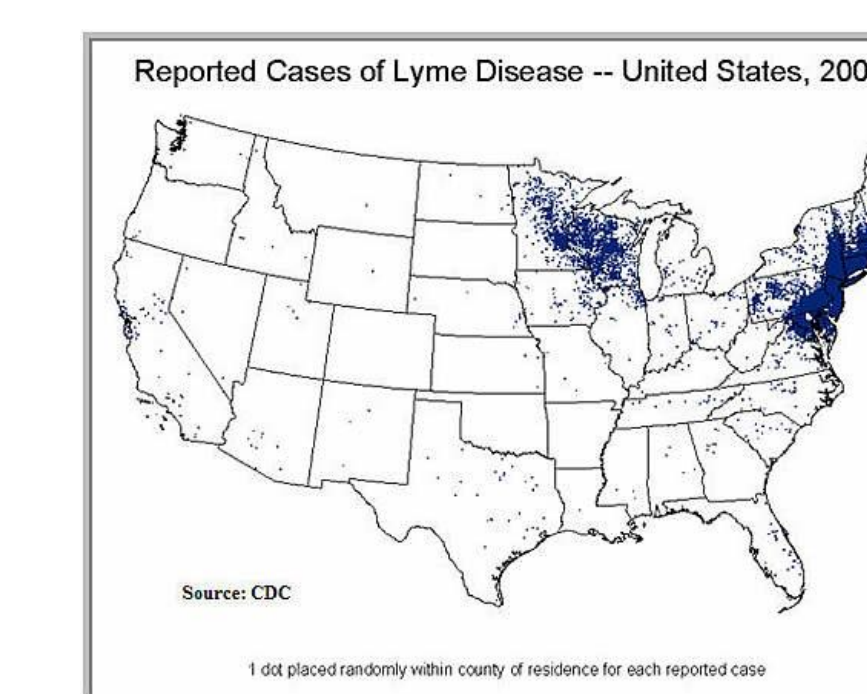
Prognosis:

Lyme disease is very treatable, when found. Those who live with Lyme disease can spend years trying to regain their full health, and in doing so, their quality of life could be labeled "unpredictable"; one never knows when reoccurrence of symptoms could take place. There is a high fatality rate amongst patients of Lyme disease, but Lyme disease is hardly ever listed as the cause of death (Web MD, 2015).

Treatment

Options:

The medical community is amidst a debate upon treatment for Lyme disease, and there is still no agreement. The two schools of thought on Lyme disease, one sponsored by the Infectious Disease Society of American (IDSA) and the other the International Lyme and Associated Disease Society (ILADS) have different opinions; IDSA recommends treatment for early Lyme disease for two weeks, and ILADS prefers an individualized treatment based upon the patient. Both of these suggested plans have their advantages and downfalls. However, universalized treatment begins with two to four weeks of antibiotics, such as doxycycline or amoxicillin. For more serious cases, intravenous antibiotics may be used. In most cases, the use of antibiotics yields full recovery (CDC, 2011).



Map of the diagnosed cases of Lyme disease in the United States.

Mechanism:

Treatment for Lyme disease consists of antibiotics taken either orally or intravenously, depending on how far the disease has progressed. The most commonly used antibiotics are doxycycline, amoxicillin, cefuroxime axetil, ceftriaxone, or penicillin. Patients who are diagnosed and treated in the early stages of Lyme disease generally recover entirely and completely. However, those who are diagnosed and treated in the late stages of Lyme disease may spend years combating the infection, and if they are able to recover, their full health may not be restored until years following (CDC, 2011).

Emerging:

Some believe that complementary and alternative therapies, paired with antibiotics, may aid in the treatment of Lyme disease. These therapies include nutrition and supplements, herbs, and homeopathy. Supplements can combat the negative effects of the antibiotics, and although no studies prove this method effective, the fiber 'beta-glucan' is used to fight Lyme disease by strengthening the immune system (CDC, 2014).