Leprosy history, symptoms and treatments

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Abstract

Leprosy is an ancient disease that has been well known worldwide. Different cultures and populations term this disease in their own words, but the prognosis of leprosy remains the same. Caused by the rod-shaped bacillus, Mycobacterium leprae (M. leprae), there are two forms of leprosy. Tuberculoid leprosy is the milder of the two with less bacteria count present in and on the skin. Lepromatous leprosy is the more severe condition with excessive bacteria present. The bacteria count is relevant in diagnosis. Gram-stains are done to detect M. leprae, and tuberculoid leprosy patients experience a much more difficult diagnosis procedure. With the limited amount of bacteria present, tuberculoid leprosy patients often do not show M. leprae in their gram stains. The treatment of leprosy requires pharmaceutical drugs and sometimes surgical repair. Leprosy is more prevalent in third-world countries but is definitely not limited to those countries. There are still researchers today figuring out the genome of M. leprae and organizations working on getting leprosy under control by the year 2020 worldwide.

Why Leprosy?

Leprosy has always interested me. In my culture, Hmong people have tales and myths about this disease. Growing up, I have often heard stories and tales about leprosy from my grandparents and parents. My grandmother would tell my siblings and me about a certain family who had leprosy in her village back in Laos when my grandmother was still a child. During those times, there were no internet, electricity, medical clinics or hospitals. Herbal

medicine and religious rituals were the go-to resources for any illnesses or conditions. My grandmother grew up in a small Hmong village in the mountains of Laos. And in that small village there was a Hmong family that had leprosy. All the other villagers would separate themselves from that family and forbid their daughters and sons from dating anyone related to that family. It was a common belief that leprosy would cause one's limbs to fall off spontaneously. In Hmong, leprosy is known as *mob ruas.* Like many other cultures, Hmong people thought leprosy was hereditary. And till this day, my grandparents would still forbid my siblings and me from dating anyone who came from a family with a history of leprosy. They still believe that leprosy can be transmitted genetically. As I became older, I learned about leprosy and quickly realized that it was the same disease as *mob ruas.* With more knowledge and research about leprosy, I look forward to informing my grandparents and parents about the disease they have always dreaded.

Definition of Leprosy

Leprosy is a disease caused by the bacillus Mycobacterium leprae (M. leprae) (Cherath & Frey, 2015). The word " leprosy is derived from either the Indo-European term lap, which means the removal of scales, or the Greek word for scales, lepra," (Holloway, 2014). Leprosy is known for M. leprae attacking a patient's skin and nerves. Without treatment, leprosy can lead to extensive skin lesions, deformities in the face and extremities, disabilities, and even death. The prognosis of leprosy varies depending on what stage the condition has reached when diagnosed. Leprosy progresses slowly and chronically, taking anywhere from six months to 40 years to develop and

become evident (Cherath & Frey, 2015). The affected areas of the body are the peripheral nerves in the hands and feet, skin, upper respiratory tract, and mucous membranes of the nose, throat, and eyes. M. leprae can damage the nerve endings of the affected areas and result in a loss of sensation (Cherath & Frey, 2015). The main regions that become permanently damaged or disfigured are the " outer extremities such as the eyes, nose, earlobes, hands, testicles (in men), and feet," (Cherath & Frey, 2015).

History of Leprosy

Gerhard Armauer Hansen (1841–1912), a Norwegian physician, discovered and identified the rod-shaped bacterium, Mycobacterium leprae, in 1878 (Cherath & Frey, 2015). M. leprae is the bacillus responsible for the cause of leprosy. Due to Hansen's finding, leprosy is also often referred to Hansen's disease. Abnormal changes in the skin are usually the indications of the disease. M. leprae prays on body extremities because the bacterium prefers a cooler temperature for its growing environment (Cherath & Frey, 2015). The core of the body is much warmer compared to the limbs, eyes, nose, and other extremities. Bacterial infections in these areas become flat and red, and then the lesions progressively become larger and widen. These lesions stay on the skin and do not penetrate very deeply underneath the skin to maintain its cool temperature environment. The loss of nerve sensations leads to a high rate of injuries and infection in the affected extremities. Infected open wounds without nerve sensation are then exposed and cause gangrene, death and decomposition of body tissue (Cherath & Frey, 2015).

Leprosy dates back even further into history. During biblical times, those who were infected were shunned by the townspeople and sent away to be kept with others who also had leprosy (Cherath & Frey, 2015). In medieval Europe, people infected were required to carry a bell and ring it in order to announce their presence (Holloway, 2014). They were even required to walk on certain sides of the roads depending on the direction of the wind (Holloway, 2014). Although the disease is highly curable, during these times medicine was not strongly supported by science. Disease explanations were very commonly blamed on spirits, curses, religious acts, omens, and/or the air. People during 1500 B. C. through A. D. 100 also believed that leprosy was highly contagious, fast-acting, and hereditary when in actuality " M. leprae is spread person to person by nasal secretions or droplets," (Davis, 2017). The common cold is much more contagious in comparison to Hansen's disease.

Other countries also date leprosy back into ancient times. The Hawaiians called leprosy " the sickness that is a crime" in the 19 th century (Falasca, 2006). 7, 000 Hawaiians out of 140, 000 died from leprosy (Falasca, 2006). The disease became so common within the Hawaiian population at the time that their government restricted their trading exports in fear of the disease spreading worldwide via product and trading goods (Falasca, 2006). China had an obsession phase of the disease in the early 20 th century. Chinese medical doctors and historians traced the disease back to their ancestors to try and discover what causes and cures leprosy (Leung, 2009). One of the earliest documentations of leprosy is from an Egyptian papyrus document written around 1550 B. C.. Indian writings around 600 B. C. also described a

disease very similar to leprosy (Holloway, 2014). In 62 B. C., leprosy was first recorded after Alexander the Great returned from India.

Mycobacterium leprae

M. leprae is related to Mycobacterium tuberculosis, the causative agent of tuberculosis (Cherath & Frey, 2015). M. leprae can only grow inside human and animal cells because it is an obligate intracellular bacterium. There are two reactions that can occur when M. leprae attacks the human or animal cells. The first reaction is known as tuberculoid leprosy (TT), the milder form of the disease, where " the body's immune cells attempt to seal off the infection from the rest of the body by surrounding the offending pathogen," (Cherath & Frey, 2015). The sealing of the skin is done in the deep skin layers which cause damage to the hair follicles, sweat glands, and nerves. This makes the skin on the surface dry, discolored, and lose sensitivity due to the lack of supply from the deeper skin layers. The death of these skin appendages become enlarged and is easily palpated by a doctor. The amount of M. leprae in the skin is very low even with the dry, rough conditions of the skin. Tuberculoid leprosy is also known as paucibacillary (PB) leprosy. The amount of leprosy cases that fall under tuberculoid leprosy is about 70-80 percent of all leprosy cases (Cherath & Frey, 2015).

Lepromatous (LL) leprosy is the second reaction that can occur if M. leprae invades human or animal cells. This form of leprosy is much more contagious and more resistant towards the body's immune system. Unlike tuberculoid leprosy, the body is not able seal off the infection from the rest of the body, and M. leprae is then able to freely multiple and spread. (Cherath & Frey,

2015). With an abundance of M. leprae present in the skin, lepromatous (LL) leprosy is also known as multibacillary (MB) leprosy. This type of leprosy is indicated by large nodules and lesions throughout the body and face. Membranes of the eyes, nose, and throat may also become infected and impaired. Blindness, drastic voice change, and/or dismemberment of the nose may occur (Cherath & Frey, 2015). These characteristics are referred to by the term

“ leonine facies” due to the lion-like resemblance of a person’s face (Cherath & Frey, 2015). Lepromatous (LL) leprosy is the less common of the two types of leprosy but is seen more often in children.

M. leprae has an incubation period of six months to ten years. This means that one can be infected and show no signs or symptoms for that amount of time because the bacillus is in a dormant state. The average time M. leprae takes to become active is four years, but the bacillus does not develop signs or symptoms for about an average of eight years (Cherath & Frey, 2015). This means that one will not show skin lesions or any signs until about eight years.

Symptoms of Leprosy

Leprosy does not show evident signs in its early stages and may take many years to become apparent. The first symptoms of tuberculoid leprosy are numbness and decreased sensation in determining hot and cold. Lepromatous leprosy’s first symptoms are chronic stuffy noses, nodule presence, and lesions throughout the body and face (Cherath & Frey, 2015). In the later stages of leprosy, “ the sense of touch, pain, and pressure are

decreased and, eventually lost. Skin lesions of hypopigmented macules (flat and pale areas of the skin) also appear," (Cherath & Frey, 2015). Ulcers and dryness of the eyes soon follow. As the lesions and skin damage accumulate, the face begins to scar and become contorted. Along with death in skin tissues, the loss of toes, fingers, and nose occur (Cherath & Frey, 2015).

Transmission of Leprosy

The transmission of leprosy is still not 100 percent sure, but researchers believe M. leprae is communicated by nasal drops or secretions. This usually requires being in close contact with someone who is infected. Researchers also believe that the milder form of leprosy, tuberculoid leprosy, " may be transmitted by insect carriers or by contact with infected soil," (Cherath & Frey, 2015). There are still ongoing studies on how exactly M. leprae invades the body.

However, leprosy is more prevalent in third world countries where environmental factors may play a crucial role in the transmission of the bacteria. Overpopulated areas increase a person's chances of coming into close contact with someone who is infected. Unhygienic

living conditions may promote the growth of bacteria that will infect skin lesions and open wounds. Contaminated water is also a possibility of transmission because although the bacteria cannot multiply, the water may harbor the dormant bacteria. Researchers also believe that malnutrition and other immune-compromising diseases may increase the risk of leprosy.

Diagnosis of Leprosy

The diagnosis of leprosy is done clinically with laboratory work. Leprosy is specified in laboratory testing by “ the presence of AFB (acid-fast bacillus) in smears taken from the skin lesions, nasal scrapings, or tissue secretions,” (Cherath & Frey, 2015). Because of the two different types of leprosy, each type is identified quite differently from one another. For those who have lepromatous leprosy, it is much easier to find the bacteria because there are an abundance of M. leprae. With tuberculoid leprosy, there is a very small amount of bacteria present in the skin lesions and other affected areas (Cherath & Frey, 2015). Doctors typically match one’s clinical signs and symptoms to known tuberculoid leprosy cases to diagnose those infected with the milder type of leprosy. One physical diagnostic method includes the affected muscles and nerves of the feet. Doctors examine a person’s ability to walk. The affected muscles and nerves of the feet result in a foot drop that cannot be flexed up, causing issues in walking properly.

Treatment for Leprosy

Leprosy can be cured with medication depending on how much the disease has progressed. There is no vaccine for leprosy and no immunity shot. The main drug used to treat leprosy is dapsone (DDS). Dapsone has been effective in treating leprosy, but M. leprae has evolved and become resistant towards the drug. This led to the multidrug therapy (MDT) that combines “ dapsone, rifampin (Rifadin; also known as rifampicin), and clofazimine (Lamprene), all of which are powerful antibacterial drugs,” (Cherath & Frey, 2015). Multidrug therapy is often used for those who are diagnosed with the more severe type of leprosy, lepromatous leprosy. Patients with the milder type of leprosy, tuberculoid leprosy, are mostly given rifampin and dapsone.

Dapsone alone may not be effective due to the emergence of dapsone-resistant strains. Most patients stop being contagious after about three months of treatment. Not all patients who begin treatment are necessarily contagious. If patients are diagnosed early on in the course of leprosy, the bacteria may still be dormant in their skin. Treatment duration varies with each patient due to the type of leprosy and stage. Patients may be under medication treatment from six months to two or more years (Cherath & Frey, 2015).

There are side effects that vary with each dug individually and all three collectively. One of the major side effects of these drugs together is an immune system response called a lepra reaction. Lepra reactions occur “ when antibiotics kill M. leprae and antigens (the proteins on

the surface of the organism that initiate the body’s immune system response) are released from the dying bacteria,” (Cherath & Frey, 2015). Lepra reactions do not occur in everyone, but

for those that do experience lepra reactions have another reaction called erythema nodosum. Erythema nodosum is “ when the antigens combine with the antibodies to M. Leprae in the bloodstream resulting in new lesions and peripheral nerve damage,” (Cherath & Frey, 2015).

To treat erythema nodosum, “ cortisone-type medications and, increasingly, thalidomide are used,” (Cherath & Frey, 2015).

Another treatment option that is often done is surgical repair. Surgery can be done to reconstruct faces, limbs, or severe skin lesions. There are times

where ulcers become highly inflamed and infected that surgery must be done to remove the ulcers and then repaired with skin grafts (Cherath & Frey, 2015). There have also been patients who have neural repair and gain minor movements of limbs back. In many third world countries where leprosy is more prevalent, there are very limited treatment options. Surgery is a luxury in those countries. Many infected with leprosy in these rural countries do not receive medical treatment. If there are medical resources available, such as hospitals and clinics, financial costs may hold back those who need treatment.

Prognosis of Leprosy

Leprosy is not known to cause immediate death. The disease, itself, is curable, yet the damages leprosy causes are permanent. Without cosmetic surgery, the disfigured limbs and body extremities are irreversible. New tissue growth will not heal the damages back to normal. Because of the chronic characteristic of leprosy, it is more likely for someone who is infected to become disabled and put at risk for other diseases such as gangrene. The presence of leprosy raises one’s mortality risks because of indirect effects and acquired diseases after contracting leprosy.

Prevention

Leprosy can be controlled if precautions are followed. Although there is no vaccine

for the disease, it is very possible to minimize transmission of leprosy. Those who have been in close contact with someone who is infected should

immediately be tested for leprosy (Cherath & Frey, 2015). Yearly examinations should also be done for at least 5 years if one has had encounters with anyone who has the disease. The long duration of dormancy characteristic of M. leprae requires consistent consecutive checks for leprosy. Doctors can also prescribe dapsone to those who have been in contact with leprosy-infected people. The genome of M. laprae is currently being worked on by scientists. With more discoveries and knowledge about M. laprae will greatly help scientists understand leprosy and invent treatments that may save those who have leprosy in the later stages.

WHO on Leprosy

The World Health Organization (WHO), a worldwide organization that promotes a healthier future for people all over the world, has set an agenda to meet specific goals in regards to leprosy. The Global Leprosy Strategy is program written by national leprosy programmes, technical agencies, independent leprosy experts, public health experts, funding agencies and representatives of affected patients and communities in 2014-2015. There are three strategies

that serve as the backbone for the program: “(i) strengthen government ownership and partnerships; (ii) stop leprosy and its complications; and (iii) stop discrimination and promote inclusion,” (WHO, 2014-15). WHO aims to “ further reduce the global and local leprosy

burden, thereby aiming for zero children with leprosy-affected disabilities, a reduction of new patients diagnosed with leprosy-related deformities to less

than one per million population and a repeal of all laws that allow discrimination of leprosy patients” by the year 2020 (WHO, 2014-15).

Leprosy in America

America currently has about 6, 500 cases of leprosy (Schoenstadt, 2017). This may

seem like a high number for America, but further research has shown that 90 percent of these cases come from immigrants whom migrated from countries where leprosy is endemic or Americans who have recently traveled out of the country (Schoenstadt, 2017). The states with the most leprosy cases are “ California, Texas, Hawaii, Louisiana, Florida, New York, and Puerto Rico,” (Schoenstadt, 2017). 600 cases out of the total cases require medical treatment because of the active disease condition. About 200-250 new cases are reported annually. Out of the new cases, averages of 175 cases are first time contractors of leprosy (Schoenstadt, 2017). Leprosy is twice as common in male adults as female adults. It is very rare to see cases of leprosy in children under the age of one, but 20 percent of leprosy cases are seen in children before the age of ten (Schoenstadt, 2017). America may be far more advanced than third world countries where leprosy is more commonly seen, but the disease still makes its way through to Americans.

Conclusion

Leprosy is an ancient disease that has been seen all over the world. From myths and theories about what the actual cause of the disease is to today’s modern scientific findings about Mycobacterium leprae, treating leprosy has

advanced. Although much more knowledge has been discovered about the disease, researchers and scientists still are not sure how to cure leprosy. There are organizations currently working on ceasing leprosy altogether worldwide. There is no vaccine for leprosy, but there are very effective drug treatments that can cure the disease. The damages and side effects of leprosy may never be repaired back to normal, causing people who have overcome the disease to struggle with social judgement and insecurity. This disease may not be the deadliest, but it comes with a heavy burden and changes one's life drastically. Without proper medical treatment and care, leprosy may become fatal. Other countries surfer from this disease more than others, but this does not mean the most advanced and high-tech country is immune. Primary prevention is significant in order to decrease the number of leprosy cases regardless of location. For those who have been in contact with the leprosy, immediate testing should be done to catch the disease in its earliest stages. Leprosy should not be underestimated.

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