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Research Article

Can Leprosy be Considered as a Zoonostic Disease?

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Abstract

Leprosy is a chronic, enigmatic, stigmatising, and potentially disabling bacterial disease, which is caused by *Mycobacterium leprae*. Disease is reported from many countries of the world including India. Currently, about 250,000 new cases of leprosy occurs globally every year. The incidence of disease is highest in the poverty belt of the world. The migration of people from endemic leprosy regions to non-endemic areas may cause re-emergence of disease. The route of transmission of infection is via skin and inhalation. There are evidences to believe that armadillo may act as a source of *M. laprae* to humans. The presence of leprosy in armadillo handlers suggested the zoonotic potential of *M. laprae*. The clinical manifestations of leprosy include skin, peripheral nerve, and eye lesions. Several drugs, such as dapsone, rifampicin, clofazimine, minocycline, and ofloxacin are developed for the effective treatment of disease. It is imperative to continue antibiotic therapy for a long time. Emphasis is laid on early diagnosis and chemotheray to prevent the complications of disease.

Keywords: Armadillo; Leprosy; Mycobacterium Leprae; Public Health; Zoonosis

Introduction

Leprosy (Hansen's diease) is a devastating disease since antiquity, and still poses a significant health risks to people in many regions of the world. The recorded history of disease goes back to year 1873 when Norwegian Physician Dr. Gerhard Armauer Hansen described that leprosy was caused by *Mycobacterium leprae,* which invades the skin and nerves, causing a chronic granulomatous disease [1]. In 1819, lepromin test was first described by Mitsuda [2].This test can be employed to assess the prognosis of disease. Later, Shepard in 1960 discovered that *M. laprae* can multiply into foot pads of mice. The intradermal inoculation of leprosy bacilli into foot pads of mice produced granuloma at the site of injection. Disease is most commonly encountered in tropical and semitropical regions of the world. Globally ,about 250,000 new cases of leprosy are reported annually. Leprosy is a neglected tropical disease, which is frequently observed in people of low socioeconomic status of poor nations [2]. It is important to mention that neglected tropical diseases affect nearly 1.5 billion people in 149 countries of the world. Approximately, only five percent of the world's population is susceptible to *M. laprae* infection. Leprosy is a chronic, progressive disease that affects the skin, peripheral nerve, and mucous membranes of the nose, eyes, and throat. Transmission may occur through direct and indirect contact. The detection of leprosy in armadillo handlers indicates the possibility of transmission of infection from animal to man [3]. Likewise, several workers from USA reported that frequent direct contact with armadillo may be a significant risk factor for leprosy [4-6]. In lepromatous leprosy, many acid fast bacilli are observed in the skin whereas very few acid fast bacilli are demonstrated in tuberculoid leprosy. Disease produces skin ulcers, nerve damage, and muscle weakness. If the therapy is delayed, it can cause severe disfigurement and significant disability [1]. A number of drugs including depsone, rifampicin is recommended to treat the patients. The management of disease requires rehabilitation, reconstructive surgery, comprehensive care, and physiotherapy. The present communication delineates the zoonotic potential of *M. laprae*.

Etiology

The disease is caused by *Mycobacterium laprae*, which is an obligatory intracellular, Gram positive, acid fast organism [1]. It resembles morphologically to tubercle bacilli. The bacterium is known to survive in the environment for up to 46 days [2].

Host

Leprosy is primarily a human disease that is described from many nations of the world [7,8]. In addition, the natural infection is also reported in wild armadillos, and non-human primates [1,9,10].

Transmission

Mycobacterium laprae Infection is acquired by prolonged direct contact with untreated lepromatous patients who discharge the organisms in large numbers in nasal secretions and from skin lesions. The bacteria enter through the nasal mucosa, with subsequent hematogenous spread to the skin and peripheral nerves. Indirect contact with fomites, such as contaminated clothes, and linen may also cause infection. It is mentioned that arthropods may possibly spread the infection [1]. Exposue to armadillo may also transmit infection [4,5]. Further studies are required to establish the exact role of asymptomatic healthy carrier in the transmission of *M. laprae* infection.

Clinical spectrum

Leprosy is a chronic disease with a long, variable incubation period. Clinical manifestations are attributed to the host immune response. Depending on the clinical features of the disease, leprosy may be classified into various forms, such as indeterminate leprosy, borderline leprosy, borderline lepromatous leprosy, lepromatous leprosy, borderline tuberculoid leprosy, and tuberculoid leprosy. However, lepromatous and tuberculoid type are more distinct. The main symptoms include numbness on the affected areas of the skin, thick, dry and discolored skin, enlarged nerves, muscle weakness or paralysis, curling of the fingers and thumb, stuffy nose, eye problem, and ulcers on the soles of feet. In men, the disease can affect the testes [2].

Diagnosis

Diagnosis of leprosy can be made by physician based on the visual recognition of the clinical signs and symptoms. The skin lesions may reveal loss of sensation to pin pick and/or light touch. However, laboratory tests are required to confirm the diagnosis in very few cases. A skin biopsy is commonly used to diagnose leprosy. A lepromin skin test along with a biopsy can also be done to confirm both the presence and type of leprosy [2].

Hitherto, *M. lepra*e has not yet been successfully cultured in vitro on nutrient media. However, it can be grown in the laboratory by injection into the foot pads of mice or nine-banded armadillo. Polymerase chain reaction (PCR) can be used to diagnosis of leprosy and also for drug assessment [2].

Epidemiology

Leprosy is an old neglected tropical disease, which is associated with a high social stigma. Disease still remains a serious public health concern in many countries of the Africa, Asia and Latin America. It is estimated that about 95 % of the new cases in 2013 were documented from Bangladesh, Brazil, Cote d' Ivoire, Democratic Republic of Congo, Ethiopia, India, Indonesia, Madagascar, Myanmar , Nepal, Nigeria, Philippines, Sri Lanka, and Tanzania [2]. Several factors, such as overpopulation, migration, unhygienic living conditions, and malnutrition may predispose the person to the infection. It is pertinent to mention that poor sanitation and hygiene may increase leprosy transmission [11]. Furthermore, immunosuppressed individuals can be at more risk of developing leprosy.

Earlier studies conducted by Truman and Fine [12] demonstrated an environmental reservoir of *M. laprae* in the soil of endemic regions. It seems imperative to undertake extensive studies of various environmental substances to elucidate the saprobic reservoirs of leprosy bacilli. Leprosy is transmitted from person-to-person via close-contact [11]. There is an increased risk of leprosy in males where as high morbidity and complications are observed in females [11]. In this context, Chaptini and Marshman [11] mentioned that low income, poor education, and lack of health care facilities may be associated with leprosy.

It is still not well defined how *M. lepra*e is transmitted from person to person. It is mentioned that about 50% of patients diagnosed with leprosy revealed a history of long term, close contact usually with an infected family member of the family. Since untreated patients have a large number of organims in their nasal secretions, it is thought that transmission may take place via nasal droplets. The milder tubercular form of leprosy may be transmitted by insect carriers or by contact with infected soil [2]. Direct contact with armadillos may also transmit the infection to susceptible individuals [3-6]. However, more studies are needed to investigate the exact role of armadillo and other animals in the transmission of *M. laprae* infection to humans.

Treatment

Leprosy is curable with multidrug therapy. A combination of two drugs namely dapsone and rifampicin is advocated in patients with localized form of leprosy. However, patients with wide spread lesions on the body are treated with dapsone, clofazimine and rifampicin. In order to avoid drug resistance, the World Health Organization recommended multidrug treatment consisting of dapsone, rifampicin and clofazimine [13]. Relapse can occur due to inade-

quate or irregular treatment. Hence, it is important to continuously monitor relapse cases with regard to treatment completion and drug resistance. Clinical experiences have suggested that dapsone treatment is required for people who are in close household contact with leprosy patients. In some cases, severe ulcers caused by leprosy may be treated surgically with small skin grafts [2]. Evidence has demonstrated that an early diagnosis and treatment can prevent morbidity of disease.

Prevention and control

Due to very long incubation period, lack of effective screening tool, and non-availability of potent vaccine, the total eradication of leprosy seems very difficult. However, certain measures, such as early diagnosis and chemotherapy, disinfection of patient's discharges, rehabilitation of patient, contact surveillance of households, and health education of the patient and public about the regular treatment, repeated examination of contacts, segregation of children from infectious patient, prevention of disabilities, personal hygiene and households cleanliness will certainly reduce the incidence of leprosy [1].

Persons who are engaged in gardening or working with soil in regions where armadillos are infected, must wear goves. Frequent contact with armadillo should be avoided [2].

In recent studies, it was demonstrated that an additional dose of BCG given to risk groups in high endemic areas may give some protection against leprosy [2]. However, additional studies are needed to prove the efficacy of BCG vaccine in the control of leprosy. Empasis is given on the development of a more effective, potent, low cost vaccine, which can widely used by poor resource nations to mitigate the incidence of leprosy [14].

Conclusion

Leprosy, an ancient disease, still poses a great risk to human health. The early diagnosis and treatment of leprosy is essential for reducing the burden of the disease. A multidrug treatment regiem is suggested for the effective management of leprosy. It is highly imperative to undertake comprehensive studies to elucidate the role of armadillo and other animals in zoonotic transmission of leprosy. Further research on transmission, pathogenesis, chemotherapy, and vaccinology may be rewarding.

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Conflict of Interest

None

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