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Short Communication

Lyme Disease-An Emerging Metazoonosis of Public Health Concern

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Recent decades witnessed the emergence of several zoonotic diseases, such as bird flu, Ebola disease, Nipah virus disease, severe acute respiratory syndrome, swine flu, COVID-19 and others [1]. The emergence of these zoonoses attracted the attention of national and international health authorities throughout the world. Emerging zoonoses caused by a variety of organisms like viruses, bacteria, fungi, Rickettsia, protozoa, and helminths, are significant causes of morbidity and mortality in humans as well as in animals. These diseases can occur in sporadic as well as epidemic form and are encountered in both sex, all age groups, in all seasons, in rural and urban settings, and in all climatic zones [1]. Several factors like rapid urbanization, industrialization, agricultural intensification, globalization of trade and travel, deforestation, natural disasters, social upheaval, construction of dam, and natural disasters etc. are driving the emergence of zoonotic diseases [1,2].

Metazoonosis is an infectious disease that is transmitted biologically by an invertebrate vector (mosquito, tick, mite, sand fly, rat flea, tsetse fly) in which the agent develops, multiplies or both [1]. There are several metazonoses, such as babesiosis, borreliosis, chikungunya fever, Crimean-Congo haemorrhagic fever, dengue fever, eastern equine encephalitis, filariasis, Japanese encephalitis, Kayasanur forest disease, leishmaniasis, murine typhus, plague, rickettsial pox, Rift Valley fever, scrub typhus, trypanosomiasis, West Nile fever and yellow fever that can cause considerable morbidity and mortality [1,3-5]. These diseases are important from public health and economic point of views, and are reported from developed as well as developing countries of the world [1]. The incidence of vector-borne disease involves a complex interplay of multiple factors that affect the humans, animals and vectors [2].

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According to the WHO (2017), 1.7 million people are affected annually by vector-borne illnesses in the world [6].

Lyme disease also known as erythema chronicum migrans, Lyme arthritis, Lyme borreliosis, is an infectious, emerging, multisystem, life threatening bacterial disease of public health importance and is caused by the spirochete *Borrelia burgdorferi*, a gram-negative microorganism [1,2,7]. Disease gets its name after a cluster of cases, which occurred in and around Lyme, Connecticut, USA in 1975. The etiologic agent of Lyme disease was first described by Burgdorfer and co-investigators in 1982. The disease is reported many countries of the world, such as Canada, China, Europe Japan, Russia, United Kingdom, and USA [1,7,8]. Lyme disease is transmitted by the bite of an infected tick of the genus *Ixodes* [1]. Transovarian transmission is observed in ticks. The role of the tick in the transmission of Lyme disease to human beings was recognized in 1982 [9]. Presently, deer tick (*Ixodes scapularis*) is acknowledged as the chief vector of the disease. The persons who are involved in outdoor activities are at a greater risk of acquiring the infection [10]. The natural infection is described in humans and also in animals including deer, dog, horse, and others [1]. Raizman, et al., in 2013 reported that White-Tailed deer (*Odocoileus virginianus*) can act as a potential sentinel for human Lyme disease in Indiana, USA [11]. It is considered as an occupational zoonosis of farmers, animal handlers, wildlife curators, veterinarians, hunters, forest workers, besides who are engaged in camping and hiking [10].

It is estimated that over 300,000 cases of Lyme disease are reported of every year in North America [12]. One study conducted by Dumic and Severnini (2018) reported that climate change may have effects of the epidemiology of Lyme disease [13]. The impact of climate change on the increase of vector borne diseases in humans and animals is described by Pal (2017). The relationship between deer density, tick abundance, and human cases of Lyme disease in a residential community in USA was investigated by Kilpatrick, et al. [2]. The occurrence of disease coincides with the activity of ticks. Most new cases are reported to occur during summer months [10].

Lyme disease in humans present a variety of symptoms that include erythema, macule, papule, fever, malaise, myalgia, headache, stiff neck, numbness, facial palsy, lymphadenopathy, arthritis, weakness, memory loss, pain, paresthesias, visual disturbance, myocarditis, and meningoencephalitis [1].

Disease in animals is characterized by loss of condition, depression, fatigue, weakness, lachrymation, muscular weakness, lameness, polyarthritis, lymphadenopathy, weight loss, and reduced milk yield [1].

Clinical signs and history of tick bite may help in tentative diagnosis. However, laboratory tests that include isolation of the organism from clinical specimens (blood, CSF, skin biopsy, synovial fluid) on modified Kelley's medium, immunological methods like ELISA, demonstration of pathogen in tissues and joint fluid by FAT, and identification of the bacterium

by molecular tools, such as PCR, DNA hybridization, and restriction endonuclease analysis are employed to make an unequivocal diagnosis of Lyme disease [1].

A number of antibacterial antibiotics, such as amoxicillin, ampicillin, cefotaxime cefuroxime, cephalosporin, doxycycline, erythromycin, and tetracycline are used for the management of Lyme disease [1,14]. Doxycycline 100 mg twice daily orally for 10 to 21 days is recommended in most patients. In this context, Hu (2018) mentioned that amoxicillin (50 mg/kg daily divided into three daily doses) should be given as first-line treatment in pediatric patients with early disease. Moreover, intravenous administration of cephalosporin with cerebrospinal fluid penetration is advised in case of meningitis [14]. It is reported that most patients can be cured within 2 to 4 weeks course of oral antibiotic therapy [10].

Currently, there is no safe and potent vaccine available commercially to prevent disease in human beings. Therefore, some of the measures, such as early correct diagnosis and prompt institution of therapy, use of protective wear like apron, foot wears, etc, avoid visiting endemic areas, application of repellents on the clothes, environmental sanitation, tick control, taking bath immediately after outdoor activities, checking of clothes for the presence of ticks, washing of clothes in hot water, and health education to the people about the transmission of infection, and severity of disease may be helpful to mitigate the incidence of this life threatening vector borne bacterial zoonosis [1]. It is important to mention that the application of permethrin on the clothing and boots gives good protection against ticks [15,16]. It is suggested to screen some plants to develop natural repellents that can be safely applied on the exposed parts of the body.

It is emphasized that persons in endemic areas with erythema, and fever besides the history of tick bite should be meticulously investigated for Lyme disease. It is recommended that diagnostic kit and drugs should be provided at cheaper prices in endemic regions of poor resource nations to minimize the incidence of life threatening vector borne disease. Attempts should be directed to develop the potent, safe, and low cost vaccine to immunize the susceptible population against Lyme disease.

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