

Lymphocytic Choriomeningitis: An Important Rodent Borne Viral Zoonosis

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Rodents belonging to the order Rodentia are the largest group of mammals, which have specialized large, sharp front teeth for gnawing. There are over 1500 species of rodents, and are found throughout the world except Antarctica. The example of the rodents include agoutis, auchis, beaver, cavie, chinchilla, chipmunk, degus, dormice, gerbil, guinea pig, gundis, hamster, jerboas, mouse, pacas, squirrel, rat, nutria, viscachas and vole. Some of the rodents, such as mice, rats, guinea pig, and hamsters are kept as pet in many parts of the world. Few rodents like rat, mice, and squirrel act as domiciliated animal as they prefer to live in and around human habitation. The rodents are known to transmit many zoonotic infections to humans through direct and indirect contact. There are many rodent borne zoonotic diseases, such as campylobacteriosis, capillariasis, coxillosis, dermatophytosis, eastern equine encephalitis, echinostomiasis, encephalomyocarditis, epidemic typhus, Hantavirus infection, Haver Hill fever, hymenolepiasis, Lassa fever, leptospirosis, leishmaniasis, Lyme disease, Lymphocytic choriomeningitis, Mayaro fever, melioidosis, murine typhus, Omsk hemorrhagic fever, plague, paragonimiasis, rickettsial pox, Rift valley fever, Rocky mountain spotted fever, Rossa river fever, salmonellosis, sudoku, scrub typhus, toxoplasmosis, trichiniasis, tularaemia and yersiniosis. These rodent borne zoonoses involve multiple etiologies, transmitted through various routes, affect both sexes, all age groups, occur in sporadic and epidemic form, and cause significant morbidity and mortality in immunocompetent and immunosuppressed individuals of developing as well as developed nations of the world. Lymphocytic choriomeningitis (Armstrong's disease) is a direct viral anthroozoonosis of public health concern. Disease is reported from Argentina, Australia, Europe, Japan, and USA. Based on the serological surveys, around 1 - 5% of the people in the U.S. and Europe have antibodies to lymphocytic choriomeningitis virus. Since the disease is underreported and poorly diagnosed, the exact data on the incidence and prevalence of lymphocytic choriomeningitis is grossly inadequate. Besides humans, the other hosts of lymphocytic choriomeningitis virus are mice, rat, hamster, guinea pig, monkey, dog, and pig. Certain occupational groups, such as rodent breeders, rodent suppliers, rodent catchers, rodent handlers, animal house technicians, pet rodent keepers, and veterinarians may have a risk of getting infection.

The disease is caused by lymphocytic choriomeningitis virus, which belongs to the genus *Arenavirus* and family *Arenaviridae*. It is an enveloped single stranded RNA virus. There are many strains of the virus that vary in pathogenicity. The virus is susceptible to many disinfectants and detergents, such as formaldehyde, 70% ethanol, 1% sodium hypochlorite, and 2% glutaraldehyde. In addition, the virus can also be inactivated by heat, ultraviolet light or gamma irradiation. The virus has been recovered from ticks, mosquitoes, fleas, and cockroaches. The common house mouse (*Mus musculus*) is recognized as the natural host and reservoir of lymphocytic choriomeningitis virus. In the United States, 5 percent of house mice carry the virus.

Humans can acquire the infection by several transmission routes, such as direct contact with infected rodents or handling of dead mice, inhalation of infectious dust in contaminated habitat, ingestion of contaminated food by faeces/urine of mice, accidental inoculation of virus through abraded skin/conjunctiva and the bite of mice. The contamination of some cell cultures by virus may result in laboratory-acquired infections. Transplacental transmission is reported in humans and also in rodents. The women, who develop illness during

pregnancy, may pass the infection on to the fetus. The virus can shed in the saliva, nasal secretions, faeces, urine, semen, and milk of the infected rodents. There is a report of transmission of lymphocytic choriomeningitis in humans from hamster. It is mentioned that monkeys get infection after eating infected mice.

The incubation period of disease is 7 to 14 days. The immune system plays an important role in the pathogenesis of lymphocytic choriomeningitis. In immunocompetent subjects, the infection is either asymptomatic or mild. Clinical symptoms of disease in humans include headache, vomiting, fever, anorexia, sore throat, coughing, chest pain, malaise, fatigue, photophobia, stiff neck, myalgia, arthritis, orchitis, paralysis, hearing loss, parotitis, epicarditis, meningitis, and meningoencephalitis. Headache is the most frequently observed sign in patients. Congenital infection in infants is manifested with hydrocephalus, microencephaly, macroencephaly, chorioretinitis, and mental retardation. Disease is often fatal in patients who are undergoing solid organ transplantation. It is mentioned that about 90% of children with hydrocephalus were diagnosed to have prenatal infection with lymphocytic choriomeningitis virus. Infection is observed particularly in prenatal and immunocompromised persons. If central nervous system is involved, fatality rate may be high. In the majority of cases, the symptoms resolve without therapy within a few days.

Diagnosis can be confirmed by isolation of virus from cerebrospinal fluid (CSF), blood, brain, lung and other tissues by intra-cerebral inoculation in laboratory mice, guinea pig and tissue culture, and demonstration of rising antibodies titer in sera samples by complement fixation test (CFT), and indirect fluorescent test (IFT).

There is no specific chemotherapeutic agent to treat this viral disease. Some researchers suggest that ribavirin may be tried as antiviral therapy. Patients with meningitis, encephalitis, and meningoencephalitis may require hospitalization and supportive treatment.

Lymphocytic choriomeningitis can be controlled by adopting certain measures, which include maintenance of sanitary conditions in home and laboratory animal house, application of rodenticide or rat trap to eliminate mice/rats from human dwellings, incineration of dead rodent to prevent spread of infection, proper hand washing with soap and water after handling rodents, their cages, and bedding, thorough cleaning of mice cages, periodic virological surveillance of infection in mice colonies, use lymphocytic choriomeningitis free mice for experimental work in laboratory, wearing of protective clothes while dealing with mice, and health education to public about the source of infection, mode of transmission, severity of disease and importance of sanitation in home, will certainly minimize the incidence of disease. It is imperative that immunocompromised persons and pregnant women should avoid direct contact with pet and wild rodents and their droppings. It is recommended that infants with neurological disorders should be investigated for lymphocytic choriomeningitis infection. Further studies should be done to elucidate the role of other rodents and invertebrate vectors in the transmission cycle of lymphocytic choriomeningitis virus. Since more than 300 zoonotic diseases of diverse etiologies are transmitted from animals to human beings, there is an acute need to create better awareness among the physicians by including the Zoonoses in the course curriculum of human medicine.

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