

Rabies Epidemiology and Control Practices: Review

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Abstract: Rabies is a deadly zoonotic disease with world-wide distribution except in some countries where there is strict quarantine system, rigorous eradication program or natural barriers. It is transmitted mostly by carnivores to humans and livestock. The objective of this paper is to review rabies epidemiology and important control measures. The causative agent, *Lyssa* virus enters the body through wounds or by direct contact with mucosal surfaces. The virus may either persist or replicate in the striated muscles of the inoculation site and follow relatively rapid centripetal to the central nervous system. The initial clinical signs are often nonspecific and may include fearfulness, restlessness, anorexia, vomiting, diarrhea, dilation of the pupils, hyperactivity to stimuli and excessive salivation. Vaccination of domestic animals, removal of stray animals, quarantine and movement control, isolation of animals exposed to rabies and euthanizing and biosecurity are the major measurement must be taken to prevent and control rabies in the animal. In Ethiopia, it is an important disease that has been recognized as disease of dogs for many centuries. There is a scarcity of information on rabies prevention and control practice and associated factors among dog owners in Ethiopia. Knowledge of the responsible dog ownership and dog population management among the public is low. Thus; interventions should be implemented both to urban and rural residents based on the identified findings so as to promote effective rabies prevention and control activities.

Key words: Control • Epidemiology • Ethiopia • Rabies

INTRODUCTION

Rabies is a major public health problem in most of the parts of the developing world, where dog plays a principal role as a reservoir and transmitter of the disease to humans. Rabies remains an important public health issue in the developing countries which is evident from the fact that globally this devastating disease is responsible for more than 60, 000 human deaths, while approximately 15 million people receive rabies post-exposure prophylaxis annually. Despite of global vast attempt and implementation of extensive control schemes, currently more than 95% of the mortality happens in Asia and Africa, where canine rabies is enzootic [1].

In Ethiopia, it is an important disease that has been recognized for many centuries. Rabies in Ethiopia is primarily a disease of dogs. Many people are at increased risk of being exposed to rabies since; man-dog contact is

very common. The total fatal human cases between 2001 and 2009 were 386 humans with annual range of 35 to 58 people [2]. The viruses shade in the saliva of clinically ill animals and are transmitted through a bite. The virus affects virtually all mammals and infected species invariably die from the disease once clinical signs are manifested. Once clinical symptoms appear, it is almost 100% fatal. More than 95% of human rabies cases are due to dog bites and the rest associated with cat, fox and other carnivores [3].

Surveillance of animal-related injuries could provide useful information for planning and evaluating public health interventions. It is important to know the epidemiology of animal bites and factors influencing post-exposure treatment for preventing human deaths due to rabies and formulate rabies control strategies [4]. Therefore; the objective of this paper is to review rabies epidemiology and important control measures.

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Etiology: The causative agent of rabies is a member of the Lyssavirus genus of the Rhabdoviridae family. The virus is bullet shaped having a single-stranded RNA genome. The genus Lyssa virus comprises rabies virus and closely related viruses, including Mokola virus, Lagos bat virus and Duvenhage virus from Africa, European bat virus 1 and 2 and Australian bat Lyssa virus. Each of these viruses is considered capable of causing rabies like disease in animals and humans. All the Lyssa viruses have many biological and physicochemical features as well as amino acid sequence characteristics that classify them with other rhabdoviruses. These include the bullet shaped morphology helical nucleocapsid or ribonucleoprotein core. The five structural proteins of the virion include nucleocapsid protein, phosphoprotein (P), matrix protein (M), glycoprotein (G) and RNA – dependent RNA polymerase or large protein (L) [5].

Epidemiology

Distribution: Rabies is widely distributed throughout the world with the exception of Australia, New Zealand, Japan, a number of European countries and some Caribbean Islands. Wild animals serve as a large and mainly uncontrollable reservoir of sylvatic rabies, which is an increasing threat to the human population and to domestic animals in many countries. Globally, It causes around 60, 000 human deaths per year despite more than 15 million people receive post exposure prophylaxis. Above 95% of deaths occur in Asia and Africa. Africa accounts for 44% of deaths. More than 40% of deaths occur in children under 15 years old. It was assumed that more than 2, 700 human lives lose estimated annually in Ethiopia in 2015 [6].

Reservoirs of rabies vary throughout the world. Canine rabies is dominant in Africa, Asia, Latin America and the Middle East. In North America and Europe, canine rabies has been practically eliminated; rabies is maintained in wild life. Some countries such as the United Kingdom, Ireland, Sweden, Norway, Iceland, Japan, Australia, New Zealand, Singapore, Malaysia, Papua New Guinea, the Pacific Islands and some Indonesian islands have been free of this virus for many years. It has been reported that 98% of human rabies cases occurred in the developing countries of Asia, Africa and Latin America [7].

The annual reports of the Ethiopian Health and Nutrition Research Institute indicated that a total of 488 human deaths had occurred from 1964 to 1975 in Addis Ababa. During the period between 1996 and 2000, a total of 9593 post exposure and a total of 153 fatal human rabies cases were recorded. The cases were originated from

Addis Ababa and its surroundings and other regions in the country [8, 9]. Studies showed that fatal human rabies cases in Ethiopia reached up to 322 from period 1990 to 2000. Reports show that there is considerable higher dog to human ratio, approximately 1:6 and 1:8 in urban and rural areas, respectively. Such a large number of dogs in both urban and rural settings along with low vaccination imply the risk of rabies circulation and spread to human and other domestic animal populations [10].

Host Range and Species Variations: All mammals are susceptible to rabies, but only a limited number of species also act as reservoir hosts. Cattle with furious rabies can be dangerous, attacking and pursuing humans and other animals. Horses and mules frequently show evidence of distress and extreme agitation. Rabid foxes and coyotes often invade yards or even houses, attacking dogs and people. Many animal species can be regarded as accidental hosts or ‘dead end’ hosts and these species have no epidemiological significance in sustaining rabies epidemics. These include humans and other primates, horses, cattle, sheep and pigs. The most common hosts are domestic dogs, cattle and man in Ethiopia [11].

Transmission: From CNS rabies virus reaches the salivary glands via cranial nerves and then it is excreted in saliva and transmitted to a new host. Most common way of transmission for rabies is bite of infected animals like dogs and cats, because of their intimate association with human being [12].

Rabies virus is usually transmitted from animal to animal through bites. A rabies exposure is any bite, scratch, or other situation in which saliva, cerebral spinal fluid, tears, or nervous tissue from a rabid animal or person enters an open wound, is transplanted into, or comes in contact with mucous membranes of another animal or person. The common mode of transmission of rabies in man is by bite of a rabid animal or the contamination of scratch wounds by virus infected saliva and of both wild and urban rabies occurs mainly when an animal that is shedding virus in its saliva bites another susceptible animal or humans. Spread of the disease is often seasonal, with high incidence in late summer and autumn because of large scale movement of wild animals at the mating time and in pursuit of food [13].

Pathogenesis: The rabies virus enters the body through wounds or by direct contact with mucosal surfaces, but cannot cross intact skin. After inoculation of infectious saliva by bite and virus enters the body, the virus may either persist and replicate in the striated muscles of the

inoculation site for two weeks or follow a relatively rapid centripetal to the central nervous system, with replication and dissemination prior to the development of a significant immune response. It travels along the nerve to the center of multiplication. The virus may then spread to the salivary glands or other parts of the body. This incubation period lasts a varying amount of time; it can range from days to years, but the average length is 3-8 weeks. Once virus reaches the brain, it spread centrifugally to a variety of organs, the spread into the salivary gland, which represents the final phase of infection, is important from animal to animal and from animal to human transmission. Destruction of spinal neurons results in paralysis, but when the virus invades the brain, irritation of higher centers produces manias, excitement and convulsions and death is usually due to respiratory paralysis. The clinical signs of salivation, indigestion and pica, paralysis of bladder and anus and increased libido all suggest involvement of the autonomic nervous system, including endocrine glands [14].

Clinical Presentation: The incubation period has been said to depend on the size of the viral inoculum, the proximity of the wound to large nerves and the length of neural path from the wound to the brain. Thus, it may be shorter following bites on the face and head and longer when the bites occur in the legs or the extremities. It may also be shorter in small breeds of dogs as compared with large breeds. The incubation period in animals can vary considerably. In dogs and cats, the incubation period ranges from 2 to 12 weeks [15].

The initial clinical signs are often nonspecific and include fearfulness, restlessness, anorexia or an increased appetite, vomiting, diarrhea, a slight fever, dilation of the pupils, hyperreactivity to stimuli and excessive salivation. The course may be divided into three phases' namely prodromal, excitement and paralytic or end stage. During the prodromal period which lasts approximately 1-3 days, animals show only vague central nervous system signs, which intensify rapidly [16].

Diagnosis: The clinical signs of rabies are confused with other neurological signs caused by other neurotropic etiological agents. Rabies infection has variable and lengthy incubation period in humans and animals generally last up to 20 to 90 days. Infection with rabies virus can be difficult to diagnose at ante-mortem. Although hydrophobia is highly suggestive, no clinical signs of disease are pathognomonic for rabies [17].

The detection of Negri bodies is a traditional method for diagnosis of rabies. The direct fluorescent antibody

technique is a gold standard test for diagnosis of rabies and approved by WHO, because of short duration, low cost and high sensitivity. Detection of rabies virus nucleic acid in the clinical samples such as CSF, saliva, skin biopsy and corneal impression smear by polymerase chain reaction (PCR) seems to be reliable diagnostic tool for the ante mortem diagnosis of rabies [18].

Control and Prevention: In humans: hound management, reporting of bites, making public awareness, pre-exposure prophylaxis and post-exposure prophylaxis are the major measurement must be taken to prevent and control rabies in human. The rabies virus is easily killed by sunlight, soap and drying. Wound care is central to the prevention of rabies infection. Post-exposure prophylaxis involved one dose of rabies immune globulin and five doses of rabies vaccine within the 28 days period. Rabies immunoglobulin contains antibodies from blood donors who were given rabies vaccine. The rabies vaccine works by stimulating a person's immune system to produce antibodies that neutralize the virus [19].

In animals; vaccination of domestic animals, removal of stray animals, controlling rabies in wild life, quarantine and movement control, isolation of animals exposed to rabies and euthanizing them and biosecurity are the major measurement must be taken to prevent and control rabies in animal. Rabies can be prevented in domesticated animals by vaccination and by avoidance of contact with rabid wild animals. Vaccinating domestic dogs can substantially reduce the numbers of canine rabies and, most importantly, human most of rabies cases [20].

CONCLUSION

Rabies is one of the oldest recognized fatal diseases affecting all warm-blooded animals and remains to be the most important zoonotic disease mainly affecting the developing countries. Poor rabies prevention and control practice are common among rural dog owners. Rabies poses the great risk to areas where dog and human populations reach their highest population densities. In Ethiopia, knowledge of the responsible dog ownership and dog population management among the public is low and there is little understanding among the public of dog vaccination and the value of timely post exposure treatment following animal bite. Therefore, interventions should be implemented both to urban and rural residents based on the identified findings so as to promote effective rabies prevention and control activities. The stray dogs and cats need to be controlled as they might be reservoirs of the virus.

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