

Canine Rabies: Significance and Threats

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Abstract

Rabies is an acute viral disease that infects domestic and wild animals and is transmissible to humans. Worldwide, rabies kills over 55,000 people every year. If there is any one species that can be pin pointed as the key species responsible for rabies perpetuation particularly in the developing world, it is canine particularly dog. The presence and involvement of dogs in man's life has become so interwoven and mutually dependent that has lead to increased possibilities of contact and exposure to rabies from dogs to man irrespective of the fact whether the dog is domesticated or stray. Dog has to be identified as the key species for focus of all control measures especially in the developing world. If rabies is eliminated from domestic animals and wildlife, the incidence of rabies in mankind will also be controlled.

INTRODUCTION

Rabies is a viral zoonosis and dog is the major vector [1,2]. Rabies virus is a bullet-shaped, 180 by 70 nm size. It belongs to *Lyssavirus* genus within the family *Rhabdoviridae*. The nucleocapsid (N) of the virus is composed of single-strand of negative-sense RNA genome and an RNA-dependent RNA polymerase enclosed in a matrix (M) protein covered by a lipid bilayer envelope containing pin heads like glycoprotein (G) [2]. Transmission of rabies virus usually begins when infected saliva of a host (i.e., a rabid dog) is passed to an uninfected organism (animal or human being) [3]. Although the most common mode of rabies virus transmission is through the bite and virus-containing saliva of an infected host [4], other most significant transmission route is licking by dogs on the mucous membranes. However, there is dearth of reporting of such transmission routes [5-8]. Another fact that lends further complexity to the concern of canine rabies is that rabies virus starts getting secreted and excreted in all the secretions (saliva being the most impactful in spread of rabies) and excretions of the body even before first discernible clinical sign appears in a rabid dog.

One natural protection to unaware and ignorant victims is that dogs secrete rabies virus intermittently in saliva [1,3]. Therefore, even by bite from a rabid dog, about half of the victims do not actually get infected because if absence of virus in the saliva in about half of the total victims bitten by rabid dog. The carrier state of rabies is another point of debate. Although there have been very rare reports of dogs being in carrier state [6], yet, it is quite an exception rather than rule in rabies. We need to refrain from using 'dog is carrier of rabies'. However, it is almost right to state that 'dog is not a carrier of rabies' while exceptions would exist as rare as they are.

In dogs, the initial symptoms comprise of anorexia, fever and sudden change in behavior with latter being most characteristic clinical development. In humans, symptoms of cerebral dysfunction, agitation, anxiety, and confusion

develop. Later, the person experiences abnormal behavior, delirium, hallucinations, insomnia, and respiratory failure. Once symptoms develop, the disease is often fatal. [2,5,8]. Recovery from rabies in humans has been a rare report like the one in 2004, however, antiviral treatment in cases of rabies infection continues to remain a major challenge [9]. Post-exposure prophylaxis consists of prompt and thorough wound cleansing and immunization with modern cell culture vaccines, together with administration of rabies immunoglobulin as required [7,10] after the rabies treatment that has evolved with significant developments [11,12].

Emergence and re-emergence of Canine Rabies

The neglect of rabies [13-15] that with heightened worldwide public awareness [16,17] food habits, religious practices [18-20] has ensured the emergence and reemergence of this zoonotic disease [21-24].

Public Awareness

A significant variable (read hindrance) in rabies control had been; continues to be and shall always be; is public awareness [25]. Therefore, a proactive efforts for stronger animal control laws, better reporting of dog bites, and public education are required [26-28].

Dog-Man Relationship

'Modern globalization' is affecting the way human beings conceptualize, deal, and interact with diseases [29,30]. One of these associated processes is urbanization, leading to increased pets in households [31,32] almost substituting for childbearing [33]. The estimated pet dog population in the People's Republic of China is up to 200 million [34], in France is 8 million [32], in Taiwan is 2.5 million [35], in the Netherlands is 2 million [32], in the United Kingdom is 7 to 8 million [36], and in the United States is 60 million [32]. The current world population of domestic dogs may be as high as 500 million, of which a substantial proportion is poorly supervised or free-roaming [37]. Dog rabies remains a looming threat to

public health especially in developing countries, while developed countries have shifted their concern to continuance of rabies because of wildlife reservoirs^[38]. Most countries do not have the capacity for laboratory confirmation of rabies cases, and most suspected rabies victims do not die in hospital, so rabies is underreported^[39,40]. In addition, there are numerous other linkages between diseases, health, socioeconomics, and international affairs that are often not considered^[41,42].

Geographic spread of Canine Rabies

In order to disaggregate the data and information into recognizable categories, let's focus on canine rabies in specific continents or regions;

Africa: More than 95% of human deaths occur in Africa and Asia^[39]. Rabies has been, and continues to be, a public health threat in Angola^[43,44], Southern Africa^[44], Tanzania^[45], and Zambia^[46], Nkomazi^[47], Limpopo Province^[48]. Africa somehow continues to harbor rabies in animals and humans on endemic proportions throughout continent^[49]. In Kenya, enzootic pattern has been posing threats even to neighbors^[50,51].

Australia: Australia is unique in way that it is free of rabies as a continent. This is partly explained because all imported animals are subject to strict quarantine requirements. Three decades ago, in a survey of animal bites in Canberra, out of a total of 800 mammalian bites, 81 percent were due to dogs and cats^[52]. The chances of re-occurrence of rabies by way of tourists in Australia do occur^[53,54].

Europe: Rabies is rare in Western Europe^[55] while some reemergence of rabies has been reported in Central and Eastern Europe^[56,57], Lithuania^[58,59], Southeastern countries^[60], especially in Romania, Bulgaria, and Turkey^[61,62].

Eurasia: Rabies in Eurasia is quite a public health issue. Human rabies of primarily dog origin^[63,64] and lack of awareness^[65,66].

South America: Rabies outbreak was reported in Colombia^[67] due to lack of a cold chain for vaccines, and the absence of trained human resources^[68] as in Brazil^[69] and Bolivia^[70].

South Asia: Assessments of the burden of rabies in South Asia have been reported^[71-74]. In India, dogs are the source of exposure in more than 95 percent of cases. The dog bites inflicted on humans are often second or third degree bites^[75]. Dog as a key animal inflicting bite wounds and transmitting rabies has been reported from various parts of India^[76]. The higher exposure field work is also an important risk factor in rural India^[73].

Southeast Asia: Rabies is a reoccurring public health concern in Southeast Asia [77] especially Thailand^[78] where rabies is spread by dogs^[79] among even foreigners^[80,81]. In Vietnam^[82,83] and Cambodia^[84], rabies deaths have

reportedly increased.

East Asia: Rabies largely caused by dogs is a serious public health issue^[85,86].

Dog Rabies Public Health Impact

Rabies exerts a considerable public health impact^[87]. This may be justified by exposures and interactions between humans and animals in urban, peri-urban as well as rural settings^[88]. And dogs that are less restricted in their interactions with humans are at elevated risk for biting^[89] with children and elders being the usual victims of unsuspecting rabid dogs.

Way Ahead

Dog has to be identified as the key species for focus of all control measures in the developing world [90, 91]. One of the key concern has to be on decreasing unwanted interactions of animals-humans. If rabies is eliminated from domestic animals and wildlife, the incidence of rabies in mankind will be controlled.

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