

## Rabies Infection: An Overview

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### *Abstract:*

*Rabies is one of the serious disease, responsible for many human death. In Asia, rabies death occur approximately 45% globally and around 1.4 billion people are at risk of rabies infection. On the 10<sup>th</sup> annual of World Rabies Day, it was estimated that around 59000 people were still dying from the rabies infection annually. Therefore, the different health community must focus on this and develop more preventive methods to reduce the risk of rabies infection. According to the statistics, more than 95% human rabies cases are because of the dog bites specifically in the Asian and African countries. Rabies is fatal infection caused by the genus Lyssavirus affecting mainly warm-blooded animals. Raccoons, bats, skunks are responsible for rabies infection and for transmission infected host saliva are responsible even rabid animal bite are also responsible. Here in this paper a study on rabies virus has been done.*

**Keywords:** Rabies Infection, Rabies Vaccination, Prevention

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## Introduction

“Rabies” is the Latin word and it is derived from the Sanskrit word “rabhas” which means “to do violence.” Earlier the Roman writers described the infections caused by saliva of rabid dogs as a poison and denoted by the Latin word “virus” and these virus belong to the Lyssavirus. In Greek the word “lyssa” or “lytta” simply means “madness.” In 500 B.C., canine rabies was first time recorded by Democritus ca. and Aristotle described that dogs who is suffering from a madness causing irritability (Krebs, *et al.*, 1995).

Rabies virus belongs to the genus and family Lyssavirus and Rhabdoviridae respectively. Lyssavirus has a single stranded RNA genome encoding five proteins i.e. glycoprotein (G), RNA polymerase (L), phosphoprotein (P), nucleoprotein (N), and matrix protein (M) (Hicks, *et al.* 2012). Rabies is a zoonotic disease, affecting the warm-blooded species and generally transferred to human via contact and infected animals by bites, scratches etc. To infect the virus has to come in contact with the mucosal surfaces and the virus start replicating or directly enter to the peripheral nervous system. Rabies virus travels approximately 15-100 mm daily and when it reaches to the Central Nervous System it show major clinical symptoms. Development period of rabies virus is normally between two weeks and six month and the development will depend on two factors, first is the site of infection and another is the amount of virus transmitted. Around fourteen days before the symptoms are shown the salivary glands are affected and the virus is excreted in saliva (Jonasson, 2014).

The historical development of rabies has been discussed below as:

- Rabies was initially derived from animal nerve, therefore known as Nerve Tissue Vaccines (NTVs) whereas at the present time they are derived from the cell-culture and embryonated egg-based vaccines (CCEEVs).
- In 1885, rabies vaccination case was first reported, when Louis Pasteur treated a boy who had been bitten by a rabid dog.
- Later on virus was deactivated with phenol.
- Later on nerve tissue were used as these contain smaller amounts of myelin.
- NTVs can encourage severe adverse reactions and are less immunogenic in comparison with CCEEVs, therefore the World Health Organization does not recommend use of rabies NTVs.
- Later on rabies vaccine production started focus in on finding sources of virus propagation, which ultimately resulted in development of embryonated egg-based and cell-culture-based vaccines.
- Upon examination, it was found that the for immunization against rabies in human Flury virus vaccine could be used without ‘untoward effects.’
- Flury vaccine were still inferior to NTVs in spite of better immunogenicity.
- Inactivated duck embryo virus vaccine were more effective still its immunizing potency was not as high as that of NTVs
- Fetal fibroblasts developed in 1950s, found to be susceptible to human viruses and free of latent viruses.
- Human diploid cell line WI-38 was being used for rabies virus propagation during 1960s.
- Rabies vaccine produced using human diploid cells vaccine (HDCV) had a better immune response in animals and humans in comparison to other vaccine
- It was reported by different researcher that HDCV was related with less severe and persistent local irritation, headaches etc. in comparison to duck embryo virus vaccine.
- HDCV was approved first time for pre- and post-exposure immunization in Europe and USA in 1976 and 1980 respectively.
- In 1985, a purified Vero cell rabies vaccine (PVRV) was approved which has similar immunogenicity to HDCV with few modification.
- In late 1970s, examination of a purified chick embryo cell-culture vaccine for rabies was initiated in Marburg, Germany.
- Immunogenic PCECV containing inactivated rabies virus was developed in 1980s.

Rabies disease is matter of concern in respect of public health and economic status in Southeast Asia and the estimated expense is more than US\$ 563 million. According to the secondary data available

on internet, around 40% people are infected by dog bites, in which majority of cases are unreported. Around 21,000 – 24,000 individual die annually in the Southeast areas, in which the country Bangladesh 300,00 and 2000-2,500 number of dog bites and human rabies cases respectively were recorded by Ministry of Health and Family Welfare, Bangladesh. In Bhutan 5000 and <10 number of dog bites and human rabies cases respectively were recorded by the Ministry of Health, Bhutan. Assoc. for Prevention and Control of Rabies in India (APCRI) recorded 17,400,000 and 18,000-20,000 number of dog bites and human rabies cases respectively. Ministry of Health, Indonesia and Myanmar also recorded 1000 and 150-300 and 600,000 and 1000 number of dog bites and human rabies cases respectively. In Nepal around 100,000 and <100 number of dog bites and human rabies cases were recorded by the Ministry of Health and Population, Nepal. Public Veterinary Services, Sri Lanka noted that around 250,000 and <60 number of dog bite and human rabies cases respectively were record. In Thailand 400,000 and <25 number of dog bites and human rabies cases were recorded respectively by Ministry of Public Health, Thailand. At last but not the least Ministry of Health, Timor-Leste also recorded only number of dog bite i.e. 1,000 in Timor Leste (Gongal, and Wright, 2011)

World Health Organization suggested in response of contact with rabid animal and said that if an individual touch by any rabid animal then no is required treatment but is such contact leads to any kind of minor scratches or abrasions then immediately clean the wound with soap and water and get vaccination. And if these bites or scratches lead to skin damage, one must supposed to instantaneously clean the wound with soap and water get vaccination and anti-rabies immunoglobulin (Hicks, et al. 2012).

It is very necessary to diagnose the rabies virus in animal and human both. For diagnosing the rabies virus in animal, take the affected part from brain stem and cerebellum and apply either of the following methods i.e. Tissue Culture Infection Technique, Direct Florescent Antibody, Mouse Inoculation Technique, , or Polymerase Chain Reaction. But for diagnosing it in human, it is divided into three stages i.e. prodromal, excitement

(furious) and paralytic (dumb). Neuropathic pain is very first clinical symptom followed by the prodromal phase but ultimately the diagnosis is confirmed by the laboratory test only (Yousaf, et al., 2012).

Vaccination of human being is divided into two phase, first is pre-exposure prophylaxis vaccination and second is Post-exposure prophylaxis. Pre-exposure prophylaxis (PrEP) vaccination is recommended by the Advisory Committee on Immunization Practices and World Health Organization for an individual travelling to the endemic countries further pre-exposure booster vaccines doses is also recommended. The booster dose completely depend upon the individual capability of maintaining the neutralizing antibody titres. Three-doses of PrEP vaccination is schedule on days 0, 7, and 21/28. Post-exposure prophylaxis is an effective methods of prevention from rabies virus infection from centuries. It consist of depth wound cleansing and quick management of rabies immune globulin (RIG). For cleaning the wound always use virucidal antiseptics with copious irrigation and if not available immediately clean it with soap. Start the treatment immediately which includes series of injection, as soon as it's confirmed that its rabies infection. Rabies immune globin should be injected on the day of exposure after the initial dose of vaccine as RIG is also one of the important component to constrain spreading of viral (Fooks, et al., 2014).

World Rabies Day is celebrated on 28<sup>th</sup> September and on the 10<sup>th</sup> annual celebration day of world rabies day it was estimated that still 59000 people are dying due to infection. Louis Pasteur, who developed first human rabies vaccine is honored on 28<sup>th</sup> September. In 2016, “Educate. Vaccinate. Eliminate” was slogan that focuses on the preventive measures taken to end the human rabies death (Abela-Ridder, *et al.*, 2016).

## Review of Literature

**Teptomethanon, *et al.* (1991)**, studied on the Thai dog's immunity response towards vaccination and found that the data obtained clearly suggest that single dose of vaccination in dog with the help of subcutaneous route of injection is not the suitable

method to maintain the rabies neutralizing antibody in the serum for annually.

**Sage, et al. (1993)**, studied on the Alaskan dog's immunity response towards vaccination. The Tunisia and Thailand study proved that the single dose of vaccination is not everlasting antibody titre for a group of animal therefore, the study conducted the researchers used a tissue culture vaccine and given as one of the primary injection. Further, they determined the rapid fluorescent focus inhibition test and found that the titres were comparatively less after vaccination and conclusively said that single dose of vaccine injection often failed to outcome in satisfactory titres.

**Adeyemi, et al. (2006)**, discussed the current status of vaccination of dogs against rabies at the Ibadan University, Nigeria also suggested on the forthcoming of urban rabies control. According to the study, it was found that there is increase in registration of dogs and vaccination cost in different hospitals. Conclusively, declined vaccination and booster coverages were perceived and it was compared to the preceding 5 years observation, which was below the recommendation of World Health Organization.

**Gongal and Wright (2011)**, studied about the step taken for elimination of human rabies in the eleven member state of Southeast Asia Area i.e. India, Bangladesh, Indonesia, Bhutan, Sri Lanka, Democratic People's Republic of Korea, Nepal, Myanmar, Maldives, Thailand, Timor-Leste. In their study, they found that the different innovative methods has been taken for elimination of human rabies spread by dogs. For controlling rabies, the World Health Organization guide play an important role and control the human rabies in Southeast Asia.

**Davlin, et al. (2012)**, undertook a study which was based on the different factors related with dog rabies vaccination in Bohol, Philippines. In 2007, for controlling canine rabies a program i.e. the Bohol Rabies Prevention and Elimination Program was established with the aim to evaluate canine rabies vaccination in Bohol population. Further, in this paper factors related to the rabies vaccination after two years of the programme. For the study, 539 dogs living with 460 families were taken as sample and it

was observed that 76% of families owe at least one dog. 3,00,000 owned dogs population were found on calculation, in which around 71% of dogs were vaccinated for rabies at some time. In this study, the dogs were at the age of 24 months. With the increasing age the chance of vaccination increases in comparison to dogs aged 3-11 months. Conclusively they said that the Bohol Rabies Prevention and Elimination Program is on way to fulfill the objective of the program.

**Hidano, et al. (2012)**, conducted the study to estimate the prevalence of dog immunity from history of rabies vaccination and related family factors in Japan. This study actually provides us important and relevant information which will ultimately fill the gap and it will also allow us to establish a mathematical model which will simulate rabies transmission dynamics and provide the information regarding rabies risk in Japan. Further, their paper they discussed about the development of a plan that will help in improving the rabies vaccination.

**Yang, et al. (2013)**, discussed about the present-day and forthcoming scenarios of rabies vaccine in animals and said that the rabies vaccine has been the most effective weapon for handling the fatal viral zoonotic disease. Numerous rabies vaccines have been developed and used to control rabies infection. In current scenarios different rabies vaccine includes recombinant rabies virus-based vaccines, DNA-based vaccines, and plant vaccines, have been developed.

**Digafe, et al. (2015)**, described about the attitude, knowledge, practices of rural people toward rabies in Gondar Zuria District, Ethiopia. For the study, 400 respondents were selected for face to face interview and then further analyzed the data using SPSS statistical software version 20. After the study of the data it was found that around 99.3% of the people were aware about the rabies disease. Around 67.8% respondents believe that rabies is one of the serious and fatal disease whereas 27.8% respondent believe that it's a treatable disease. Conclusively, the researcher concluded that the respondent selected for the study are well aware about the rabies disease but limited.

**Birhane, et al. (2016)**, conducted a study in Ilocos Norte, Philippines for estimating the total sum of money that people of Philippines are ready to pay for dog vaccination and registration by their own wish and reason behind their wish for paying. For study purpose, the researchers conducted a survey in 17 cities out of total of 21. After implementation of different method for estimating the total sum, the researchers found that on an average of 69.65 and 29.13 Philippine Pesos which is equal to 1.67 and 0.70 USD in 2012 respectively is the average amount which the people of Philippines ready to pay by their own wish for dog vaccination and registration respectively. In this around 86% of an individual were ready to pay the specified amount just to vaccinate their dogs yearly and the reason behind their wish was effected by the demographic and knowledge factors.

**Wallace, et al. (2017)**, conducted a study on the impact of poverty on dog ownership and access to canine rabies vaccination in Uganda. For the study, the researcher conducted a study in 2013 on the basis of a knowledge, attitudes and practices toward dog, rabies vaccination and human rabies risk factors. For study purpose 24 villages were nominated and after studying the data obtained it was concluded that the poverty heavily influence the dog ownership and vaccination coverage and data can considered to improve models for rabies burden.

**Bender, et al. (2017)**, conducted a study in Navajo Nation with an objective of the evaluation of the bait handling and acceptance by dogs. After the study, it was concluded that the different type of bait used are accepted by the local dog population and the interaction between the bait and the blister effectively influenced bait handling resulting in vaccination. During this, it was observed that few animals problem in picking up these bait, so all it required was slight modification an can be used as very effectively used for oral rabies vaccination (ORV) for dogs in Navajo Nation, USA.

**Dodds (2017)**, presented a case study on adversarial reaction of rabies vaccination in a dog. A healthy

adult dog was given an authorized third rabies vaccine booster and the vaccine used at this period contaminated thimerosal which ultimately effected the health of the dog. The dog was feeling tired by a week later and even developed ulcerating wounds also. Doctors started the treatment for ischemic post-rabies panniculitis and the recovery will take around coming 2 months almost. Doctors even instructed that the dog should not receive any kind of rabies virus booster in forthcoming. Conclusively, it was said that the vaccination policies must be standardize to guarantee the safety and efficiency of human and veterinary vaccines.

**Cleveland and Hampson (2017)**, in their paper they summarized some of the practical vision made from rabies epidemiology and dog ecology research which can modify the dog vaccination plans. Further, the need for practicality in obtaining the feasible and difficult goal of canine rabies.

## Conclusion

Rabies virus are generally spread by the domestic and wild animals. Urban areas of many countries shows that number of rabies infected patient receiving postexposure prophylaxis (PEP) has increased just because of the public awareness, vaccine availability and affordability of vaccination but still there are different surveys which proves that rabies disease cannot be overlooked. Conclusively, after reviewing the research paper it can be said that still rabies is one of the most serious human disease as it kills around 50,000 people annually, even after the successes in treating rabies infected individual. Therefore, the government of different countries must think about more rabies prevention and controlling methods. According to the different studies, health education, awareness about rabies, dog vaccination plays an important role in preventing and controlling rabies infection. In all public awareness about the rabies plays a very significant role. Every state government must launch different awareness program to reduce the risk factor of rabies infection.



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