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From Awareness to Action: Strengthening The Global Fight Against Rabies

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Abstract:

The world's most diabolical virus; Rabies is one of the oldest recognized diseases affecting warm blooded animals and it remains to be one of the most important zoonotic diseases affecting the developed countries causing heavy losses in human and livestock population. Dogs play an important role in maintenance and spread of rabies across the world resulting in nearly 10,000 human death every year in the country. The widespread of this disease is due to poor implantation of intervention strategies that included dog bite wound management practices, unavailability, and unaffordability of post exposure prophylaxis (PEP), failure to control the disease in free roaming dogs, improper dog population management, weak surveillance and diagnostic facilities and a lack of 'One Health' approach to this disease. The Global Action Plan (GAP) constitutes rabies elimination centered platform supported by the World Health Organization (WHO), the Food and Agriculture Organization (FAO) and the World Organization of Animal Health (OIE). Aptly called 'United Against Rabies' (UAR), these three organizations are collaborating towards the fruition of common objectives to eliminate the disease from the world by 2030.

Keywords: Rabies, control, eradication

Introduction:

Rabies is an acute infectious disease of central nervous system having worldwide distribution affecting all warm-blooded animal including man. The disease is propagated by bite from animal to animal and animal to man. The disease is known as Lytta or Lyssa and also ascribed as "Jalatanka" in India most particularly. Disease is noted in most of the tropical countries of the world which is primarily maintained and transmitted through bites of free roaming dogs and is widespread in countries that either do not have proper legislation regulating movement and ownership of dog or do not implement them strictly. In this view, it is imperative to take into the account of the awareness to actions in eradicating dog mediated rabies through One Health Approach.

Know about the virus?

1. Rabies:

It is caused by RNA virus belong to the family *Rhabdoviridae* and genus Lyssa virus. This is a neurotropic virus and which occurs in most concentrated form in the CNS. The virus is bullet shaped and measures about 180-250nm length by 75 nm in diameter. Five additional viruses identified in Africa are classified as rabies related virus (Mokolo, Logos bat, Duvenhage, Kotonkan, Obodhioang virus). The virion of rhabdovirus consist of lipid containing bilayer with glycoprotein peplomers surrounding a helical wound nucleocapsid. This gives the virus a distinct bullet shaped morphology. Until 1970, virus was considered to be a single antigenic group but serologically group of viruses could be demonstrated from rabies (Sikes,1980). Virus is grouped into street virus and fixed virus. The street virus is derived from one that exist in nature in naturally occurring cases and the fixed virus denotes to strain of virus that has been adapted by serial intracranial passage in some animals in the laboratory. Rabies virus haemagglutinates goose R.B.C, which is important from diagnostic point of view. It can affect wide range of host; all warm-blooded animals are susceptible. Animal like, fox, wolf, jackal, skunk, bandicoots, mongoose, cat, rat, squirrel, vampire, bat, are extremely susceptible in the tropical world, but dogs are the greatest source of rabies in the infection for human. Cattle and horses may also be considered as dead-end host. Rabies in human involves either the urban cycle with dog population maintains the infection or the sylvatic form which involves the wildlife (WHO,1966).

2. Epidemiology:

The disease was first recognized in dogs in Hong Kong in the year 1857 and later reported in India in Vedic period (5000 years ago). In 500 BC, Democritus, the Greek Philosopher ascribed the disease in animals and Aristotle (300 BC) drew attention to the danger of biting of rabid dogs. In the year 1967 & 1971, WHO listed rabies as the major zoonotic problem in India. An estimated population of 5000 die due to this disease in each year. Due to possible rigid quarantine measures many of the countries are presently free from rabies e.g. New Zealand, Papua, New Gunea, Bahamas, Turks, Hong Kong, Baharin, Cyprus, Britain, Howei. Rabies is endemic in dogs of Indonesia, Phillipines, Vietnam, Burma, Bangladesh, Pakistan and sporadic in Laos, Cambodia and Korea. Pacific island nations, and Australia have never witnessed Rabies. Japan is the first in Asia to eradicate it.

3. Mode of Transmission:

The natural transmission occurs through bite of reservoir animal. A bite on the face has contagious index of almost 100 % whereas, on the body or leg is about 2%. Other reported routes of infections include aerosol transmission (Tillosten *et al*., 1977), few precedents of infection through unboiled milk or meat of rabid animal of breast-fed children of rabid mother (Manual, N.I.C.D., 1985), or from caving in areas with a large population of bats (Dietzschold *et al*., 2008), direct contact transmission among dogs during breeding season, weaning (Narayan, 1985). Human to human transmission has also been reported in corneal transplant recipients (Crowcroft and Thampi 2015; Helmick *et al*.,1987). The ability of virus to reach the CNS depend on various factors such as age of the animal, distance of bite from CNS, virulence of virus, concentration of virus, presence of hyaluronidase at the time of attack.

4. Pathogenesis:

In man incubation period is exceptionally variable and imposes a problematic range which can vary from days to years approximately 30-90 days in humans. Incubation period in dog, sheep, horse, cattle and pig lie with the

average of 15-60 days. After introduction before entering the peripheral nervous system, it replicates in muscle fibre (amplification step to produce huge quantities of virus). On entering to unmyelinated axon terminals, transportation to nerve cell occurs in retrograde manner. On invading the brain, it damages the brain stem and medulla which leads to degeneration and paralysis of various muscles which leads to drooling of saliva, dropped jaw, inability to swallow, asphyxia and death. After reaching brain it invades ganglion cells and spread centrifugally to peripheral nerves. Mode of propagation (of virus) centripetal retrograde movement is faster than that of centrifugal (Hemachuda *et al*. 2013). Neuronal degeneration and perivascular infiltrations lead to formation of Negri bodies (Dierks,1981). Negri bodies is a acidophilic matrix containing a number of minute bluish granules. Fixed virus does not produce Negri bodies. Negri bodies is present in the hippocampus of carnivores and Purkinje cells of herbivores.

5. Clinical Overview:

The clinical development of the disease in dogs takes two general forms *a) Furious or mad dog form, b) Dumb or paralytic form.* In furious form infected dogs remain in unusual alert conditions, will show intense irritative sign, aggressiveness, will snap or bite imaginary objects, may hide in dark places due to photophobia, bite inanimate or animate objects, development of change in the bark, change of voice, drooling of saliva, will develop urge to bite and fly away. In dumb form, dog used to seek solitude and appear sluggish and morrosed, owner may suspect that any bone or hard object might have stuck in the throat and try to open mouth of dog for examination but it may lead them to possibility of contracting the infection (Open mouth condition). Ultimately death takes place in 1-7 days. Cat show nervousness, abnormal vocalization, irritability, seizure, paralysis and sudden death. In horses, weakness, period of sexual excitement, pawing and kicking viciously; are some of the clinical signs that are observed. In cattle, bellowing with low pitched voice, excessive salivation, sign of stimulating choke and difficulty in drinking water. Pig, Sheep and Goat shows sign of aggression, restlessness, attempt to bite hard objects and finally death. In man it is initiated with mild fever, sore throat, headache, hypersensitivity, muscular spasm, salivation, spasm may be seen with slight contact with food and fluid, progressively it follows paresis and paralysis and finally death.

Exposure Categories Categorized by WHO (April 2018):

Category 1: Slight or negligible exposure*, i.e.* minimum risk, All cases of licks (except those on fresh cuts).

Category 2: Nibbling of uncovered skin, minor scratches or abrasion without bleeding, *i.e.* definite but moderate risk.

Category 3: Single or multiple transdermal bites or scratches, contamination of mucous membrane or broken skin with saliva from animal licks, exposure due to direct contact with bats, *i.e.* severe exposure.

Seeking Medical Attention After a Potential Rabies Exposure:

The dog suspected to have rabies should be observed for 10 days. However, the treatment of bitten person should start immediately. The post exposure bite wound comprises washing and adequate flushing of bite wound with plenty of soap solution and water, followed by administration of series of post bite vaccine, and infiltration of rabies immunoglobulin to or around the site of bite, as soon as possible after the exposure. There have been significant advances in the development of rabies vaccine from 'Pasteur- treatment' to Cell Culture Vaccine. Different type of rabies vaccine which are in use are Sample Vaccine, Betapropionl Lactone Vaccine (BPL), Mouse Brain Vaccine, Purified Hamster Kidney Cell Vaccine, Rabies Vaccine Adsorbed, Purified chick embryo cell vaccine (Rabipur), Human Diploid Cell Culture Vaccine (Rabivax). To avoid side reaction of vaccine attempts have been made to protect

human by monoclonal antibodies (WHO, 1984). Oral vaccine against wild animals as vaccine baits is recommended (Artois *et al.*,1993).Vaccinia recombinant vaccine is also used to control wild life rabies (Pastoret and Brocher,1996). Some of the vaccines used in animals are Nobivac-R, Durarab, Rabdomun, Antirabies serum (ARs). Vaccination of people against rabies involves pre exposure and post exposure schedules. Pre exposure vaccines are recommended for individuals who are at higher risk of infections such as wildlife professionals, veterinarians, dog catchers. Post exposure vaccination is administered to individuals after they had potential exposure to rabid animal. Post exposure immunization for unprotected individuals are five doses on days 0,3,7,14 and 30 and booster on day 90. Person who has fully received full pre or post exposure treatment with a vaccine of proven potency but whose neutralizing antibody titre has not been determined, should receive 3 doses of a vaccine of proven potency on days 0, 3 and 7 after re-exposure. Systemic passive immunization (with immunoglobulin or antiserum) should not be given when the person has had pre or post exposure vaccination, and will receive booster dose of vaccine.

One Health Approach to Rabies Elimination:

It is rooted in the understanding that human health is closely linked to health of animals and environment. It is well established that rabies is not confined by national boundaries so; One Heath makes a cross disciplinary network that integrates the efforts of physicians, veterinarians, ecologists, public health workers, animal welfare workers, educational institutes, administrative authorities, social scientists to combat dog mediated Rabies. A network of laboratories catering to vulnerable areas, including rural and remote localities, has been suggested as a mandatory requirement for the elimination of rabies.

Global Efforts in Rabies Prevention and Control:

WHO has given statistics on rabies which is very much alarming. WHO says that 25 million of stray dogs in India contributes to 965 of countries and 80% of the world's incidence of rabies. As per WHO, rabies kills at least 30,000 Indians in a year out of which 70% victims are below 15 years of age. Each year, nearly 17.5 million people undergo post exposure rabies treatment.

- **Emphasis on awareness programmes** -It is one of the foundation pillars to eliminate rabies. The educational outreach drive should educate communities about the seriousness of this virus and the measures they can take to protect themselves. World Rabies Day, September 28 has become a essential platform for raising awareness. Trained field personnel of Vetico – Medico giving awareness to people through mass media, group discussion, seminar in both urban and rural areas.
- **Emphasis on Vaccination programmes for Dogs and Canine Rabies Prophylaxis-**To obtain herd immunity and sufficient vaccination coverage, it is suggested that 70% of canine population has to be covered with vaccine. The western country society, they have got a policy to take all the animal in shelter. While they are in shelter, dogs are neutered, vaccinated and then rehomed. A-B-C programme has been implanted in various parts of India which is meant for reducing dog's population and it also includes rabies vaccination. Jaipur in India is one of the cities where eradication of human rabies could be possible through A.B.C programme. In developing countries travelling dogs' control by mass vaccination with a certificate that there exists sufficient antibody titre in blood (Reg no. 998/2003). The person who are exposed to rabid animal require a timely post exposure prophylaxis to prevent the onset of symptoms. Many people in rural areas do not know how to wash the wound following bite, time of initiating treatment; they do not have idea about antiserum treatment. So, it is needed to provide antiserum facilities in all corners of the world.

- **Emphasis on Surveillance and Reporting Systems-** It give emphasis on establishing quality data on animal bite and disease burdens in humans. Recording and reporting of each and every case of animal bite is recorded by Anti -Rabies Clinics. These collected databases help in tracking the spread of disease, provide guidance in conducting campaigns, vaccination programmes, in specific regions, overall helps in managing the outbreak of rabies.
- **Emphasis on investing in Research and Innovation**- India has capability and infrastructure for producing modern rabies cell culture vaccine to meet its own requirement and more. Over 15 million doses of human rabies vaccine are being produced in the country annually. Other countries are importing human rabies vaccine from India. The country is also self-sufficient in production of purified ERIG which is very vital for the treatment of Category 3 bites.
- **Emphasis on intersectoral collaboration shaping One Health in the policy agenda-** There is a need that two or three Ministries should take ownership to deal with rabies viz Ministry of Health, Ministry of Agriculture and Local Civic Bodies. One Health Approach which focus on interconnection of human, animal and environment health has now become a central framework and it invites experts from different field to collaborate in fight against rabies.

Conclusion:

"Ending rabies is not only a public health issue, but a humanitarian imperative" as quoted. The successful elimination of human rabies needs prevention of animal rabies, public awareness and people's access to cost-effective and high-quality rabies vaccines in a coordinated fashion. The multifaceted One Health control model will also enhance the likelihood of achieving the goal of global rabies eradication by 2030.

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