

One Health in the Prevention and Control of Rabies

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Introduction

This is a viral zoonotic most deadly infectious disease, rabies are RNA viruses belongs to the genus lyssavirus within the family *rhabdoviridae*, order *mononegavirales*. Rabies virus is the type species and which is responsible for the most cases in human beings and animals, which causes the progressive and fatal inflammation of the brain and spinal cord. Dog-mediated human rabies can be eliminated by tackling the disease by infected dogs. It is estimated to cause approx. 59 000 human deaths annually in over 150 countries, due to underreporting and uncertain estimate, this number is likely a gross underestimate. The first World Rabies Day was held in 2007 and the premise of this day is the value of a One Health approach, which encompasses the connections among human health, animal health and the state of the environment for preventing the rabies current scenario in the world, the untreated disease causes progressive encephalomyelitis, that can be invariably fatal, and by neurotropic viruses of the genus lyssavirus.

This is a disease of warm-blooded animals, including humans; the high-risk animals for rabies are bats, raccoons, skunks, and foxes. These reservoirs are associated with species-specific rabies virus variants; rabies infection in a species other than the reservoir species for the variant is considered "spillover." Transmission occurs when saliva containing the rabies virus is introduced into the skin, by the bite of a rabid animal, though rare, transmission can also occur by infected saliva contacting mucous membranes (eyes, nose, and mouth) or a scratch or other break in the skin. The virus multiplies in the muscle for a varying amount of time before migrating into the nervous system. The virus acts with cunning stealth, using the central nervous system for viral replication and causing acute, progressive encephalitis, once the virus enters the nervous system, rabies post exposure prophylaxis (PEP) is no longer effective and death is almost inevitable. Since clinical signs (and symptoms in humans) do not appear until after the virus enters the nervous system, it is futile to wait for the appearance

clinical signs and symptoms to start PEP. There are some signs that serve as a clue that an animal is rabid include unexplained paralysis or paresis, a change in behavior, pica, chewing at the site of the bite, pawing at the mouth, difficulty swallowing, altered phonation, hyper salivation, lack of coordination and a hypersensitive reaction to stimuli. These are similar in nature to rabies clinical signs in humans: pain or tingling at the bite site, difficulty swallowing, hydrophobia, altered phonation, autonomic instability, change in behavior, lack of coordination, involuntary movements of the face, hypersensitivity to light, sound and touch, aerophobia, involuntary muscle twitching, paralysis, paresis and a plethora of others.

It has two forms:

1. **Furious form** –hyperactivity and hallucinations.
2. **Paralytic form** –paralysis and coma occur.

Encephalitic rabies often presents with hyper salivation and periods of agitation alternating with lucidity and this feature is so-called “**furious**” type of rabies. Here hydrophobia is also observed which leads to infection invariably with coma and death.

Transmission:-

Lyssaviruses are enveloped with a host-derived membrane and a bullet-like or bacilliform shape that contains a non-segmented negative sense RNA genome, which encodes the genes for five proteins: N (nucleoprotein), P (phosphoprotein), M (matrix protein), G (glycoprotein), and L (RNA dependent RNA polymerase). The N, P, and L proteins, binding of lyssaviruses to host cells is dependent on the glycoprotein that binds to one of the several proposed receptors that facilitate virus entry. This virus is most commonly transmitted by the bite of a rabid animal. This mechanism enables the virus to transverse the dermal barrier and deposit virus into tissues where it can initiate infection; human beings are termed dead-end hosts for the rabies. The Replication of rabies virus occurs in neuronal cells the virus usurps host cell machinery to reach cell bodies in the spinal cord or brainstem or in sensory ganglia, in the CNS and this virus replicates extensively and clinical symptoms develop.

Diagnosis:-

1. Brain samples are most readily taken by breaching the skull and sampling and brain smears or touch impressions are used for the detection of virus antigen with the fluorescent antibody test (FAT) for both human and animal samples, the test must



include tissue from at least two locations in the brain, preferably the brain stem and cerebellum. (OIE Recommended)

2. Histochemical test direct rapid immuno histochemical test; dRIT that allows the use of low-cost light microscopy which can detect rabies antigen in fresh brain impressions within 1 h.
3. Antigen detection can be done by biopsies which are used as a means of detecting infection in nerve fibres surrounding hair follicles.
4. Rabies virus nucleic acid can be detected in various biological fluids and samples like saliva, cerebrospinal fluid and skin biopsies by RT-PCR.

Objectives of One Health in Rabies:-

- Elimination of rabies spread by dogs to reach zero human deaths by 2030.(One Health, Zero Deaths)
- Collaboration at all levels to eliminate rabies globally.
- Vaccination can be as a cornerstone of rabies prevention and control efforts.

Prevention& Control:-

"Rabies is 99.9% fatal but 100% preventable, it is estimated that worldwide a person dies every 9 minutes from this disease. Vaccinating domestic animals, such as certain pets and livestock, against rabies is a key element to preventing human cases, pre-exposure vaccination of dogs and cats is an extremely important element of rabies prevention. The value of rabies vaccinations is imperative for accomplishing this prevention step and pet owners can also help to prevent the spread of rabies by keeping their cats indoors and not allowing their dogs to roam.

The rabies pre-exposure vaccination regimen includes a primary course of 3 vaccinations given in the deltoid area over a period of 3-4 weeks. On the horizon, there is the possibility of a 2-dose pre-exposure vaccination schedule. (Advisory Committee on Immunization Practices (ACIP), although pre-exposure vaccinations do not eliminate the need for additional vaccinations after a rabies exposure, they also reduce the amount of PEP needed compared to that for a person who has not received pre-exposure vaccinations.

This is not typically recommended for the general population, but for those especially if they will be going to a location or participating in activities that might enhance exposure to animals or going to areas with limited access to medical care and PEP. These are also



warranted for those with employment that put them at risk for exposure and the course of vaccinations is followed by serologic testing every 6 months and a booster if their antibody titer falls below 0.5 IU/mL. The "frequent" risk category, where the recommendations are that the primary course of vaccinations is followed by serologic testing every 2 years and a booster vaccination administered if antibody titer falls below acceptable level. The rapid fluorescent focus inhibition test (RFFIT) is available at only a few laboratories for performing rabies titer checks.

A bite or scratch wound is involved, wash the wound immediately with soap and running water for at least 20 seconds and apply a virucidal agent. PEP is just started after a possible rabies exposure as soon as possible, but sometimes there may be a short delay while trying to locate the animal involved in the incident.

Testing in animals during post-mortem with the animal's head as the specimen; if only the brain is submitted, the specimen must include a complete transverse cross section of the brain stem and tissue, In general, the specimen is set up for a fluorescent antibody test (FAB) in which specific rabies antibodies will attach to rabies antigens in tissue. The FAB test is still the gold standard.

In safely working with the virus then make ensure for rabies pre-exposure vaccinations and the use of personal protective equipment for those working with rabies virus play a critical role in their protection. The person suspects with rabies virus exposure, it sets off anxiety in the central nervous system that spreads like wildfire to the brain, much like the actual viral infection. The controlling rabies in dogs, and especially free-roaming (stray) dogs, is the first priority for prevention of human rabies.

Preventive Vaccination:-

No Exposure

- Animal handlers, veterinarians, rabies laboratory workers, biologics production employees in the rabies, are frequently at high risk of rabies exposure.
- International travellers with animals from different parts of the world should also be vaccinated where rabies is common in that area.
- The rabies pre-exposure vaccination consists of three doses-
- Dose 1: As appropriate
- Dose 2: 7 days after Dose 1

- Dose 3: 21 days or 28 days after Dose 1
- Booster doses and periodic testing for immunity are highly recommended for laboratory workers and others regularly exposed to the rabies virus.

After Exposure

- If bitten by an animal or have been exposed to the rabies virus, you should clean the wound first.
- One dose immediately, followed by three more on the third, seventh, and fourteenth days.
- A vaccinated person exposed to the virus receives two doses of the rabies vaccine.

One Health Approach

- This approach recognize that the health of humans is connected to the health of animals and our shared environment and embracing a One Health approach focuses on outbreak management of rabies in both human and animals. This not only reduces the need of post exposure vaccine but also lowers budgetary load for rabies control in humans. This is known to be an economical method to control rabies for low income developing countries.
- This includes for the control of rabies, diagnostic center in each regional laboratory would reduce the burden at the Central Reference Laboratory which collaborate with Capable health professionals at the regional laboratories would ensure the quality and effectiveness of the monitoring program.
- Active surveillance of the rabies in action would be helpful in figuring out the disease situation, that an integrated approach along with coordination among each of these components are equally important to execute a successful plan.
- Management key for the controlling the rabies is the mass vaccination in animals, a “Multi-sectoral One Health Approach” could be a strong strategy to make justifiable progress towards rabies control and prevention.
- India has recently completed a trial of this management approach in five different cities for conclusion of consideration for both human and animal component is critically important. There should be a conceptual framework on how to control or manage rabies using a One Health approach

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