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Revisiting the Basics of Rabies

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What is rabies?

Rabies is a zoonotic viral disease that affects humans and animals. It is transmitted through bite of an infected animal and is considered as a fatal disease. The causative agent of this disease is Rabies virus of the genus Lyssavirus belonging to the family Rhabdoviridae. This disease was first described way back in 2300 B.C. and ever since then Rabies has been a dreadful disease.

How did “rabies” get its name?

Although the exact details of coining the term “Rabies” is unknown, retrospectively, the etymology of the word “Rabies” has been found to have roots in Sanskrit and Latin (rabere) where it means “to rage” and “to do violence” respectively. Later, the virus that caused Rabies was named as Lyssa, which is a Greek word meaning frenzy or madness.

How can a rabies virus be described?

Rabies virus belongs to the genus Lyssavirus of the family Rhabdoviridae. Rabies virus (RABV) is a bullet shaped, enveloped virus with helical symmetry and a single stranded negative sense RNA genome belonging to Class V of Baltimore virus classification. It has tropism towards neuronal tissues.

What are the various species affected by rabies?

RABV affects terrestrial and airborne mammals including dogs, wolves, foxes, coyotes, jackals, cats, bobcats, lions, mongooses, skunks, badgers, bats, monkeys, livestock, and humans.

What is the reservoir host of RABV?

In general, bats are the true reservoir host of RABV. However, RABV has established independent transmission cycles in numerous carnivorous animals thereby rendering jackals, mongoose, red fox, ferret badger, golden jackal, racoon, racoon dog, grey fox, coyote, striped skunk, crab eating fox, marmoset, small Indian mongoose and domestic dogs as reservoir hosts. In India, dogs are the major reservoir host of RABV.

Does rabies occur in birds?

Earlier, it was reported that birds and reptiles are not affected by rabies, however, natural infection of rabies in domestic chicken has been reported recently.

What is the dead-end host of rabies?

Humans, livestock (Cattle, Sheep and Goat) and horses are considered dead end host for rabies, as direct transmission of disease to other species from such hosts has not been reported.

What are the different modes of transmission of rabies?

Rabies spreads primarily through bite of an infected animal, wherein their salivary gland is laden with RABV. Occasionally, RABV has also been reported to spread through open wounds or mucous membranes. However, RABV does not penetrate intact skin.

What is the incubation period of rabies in animals?

On an average, the incubation period of rabies in animals is 2 weeks to 4 months.

What are the host cell receptors to which RABV binds?

Upon inoculation into the muscle or subcutaneous tissue, the glycoprotein present in the envelope of RABV binds with host cell receptor, nicotinic acetylcholine, and enters the host cell cytoplasm either through endocytosis or viropexis or pinocytosis to initiate infection.

Why it is necessary to wash the dog bitten area with soap?

RABV is an enveloped virus. The envelope is made up of two layers of phospholipid, and glycoprotein. When washing the dog bitten area with soap, the lipid bilayer is dissolved, without which RABV cannot bind with host cell receptors to cause disease. Further, the movement of RABV from the muscle or subcutaneous tissue to neurons is slow, hence washing the dog bite area with soap has been reported to reduce the RABV viral load in the host.

Why is it necessary to observe the dog for 10 days after biting?

Rabid dogs have the tendency to bite without provocation. It has been reported that, after biting, 50% of dogs have died within 3 days, 95% of dogs within 5 days and 100% of dogs within 7 days. However, these dogs are observed for another 3 days counting to 10 days. This is because the presence of RABV in salivary secretions was not identified prior to 3 days of onset of rabies.

What are the major clinical symptoms of rabies in animals?

In dogs, clinical symptoms can be observed in three forms namely prodromal, furious and paralytic stage. In prodromal stage, fever, hypersensitivity to light, change in barking tone and behavioral changes like withdrawal from people and anxiety can be observed. In furious stage, aimless wandering, biting of animals, objects and humans without provocation, and irritability to light and sound can be observed. In paralytic stage, jaw and throat muscles get paralyzed impinging on the drinking and eating ability and causes excessive salivation and labored breathing. In cattle, dumb form is more common with clinical signs like ataxia, salivation and paralysis, however furious form is also observed occasionally showing aggression and bellowing. In Sheep, clinical signs are more like that of cattle including muscle tremors and salivation. In goats, excessive bleating and aggression can be observed, whereas in sheep bleating is uncommon. In pigs, either excitement with a tendency to attack or being quiet with incoordination can be observed. Further, twitching of the snout, excessive grunting, change in vocalization, profuse salivation, rapid chewing, clonic convulsions and lateral recumbency can be observed. In horses, hypersalivation, ascending paralysis, agitation, aggression, ataxia, loss of anal sphincter tone, biting, pharyngeal paresis and abnormal postures followed by death within 1 week can be observed.

How can rabies be diagnosed?

Diagnosis of rabies primarily involves obtaining thorough history of dog bite and observation of clinical signs. Demonstration of antigen by direct fluorescent antibody test from brain samples and demonstration of Negri bodies by histopathology of brain can be done as confirmatory tests for rabies.

What are Negri bodies?

Negri bodies are viral factories or cytoplasmic inclusion bodies possessing a concentrated form of RABV proteins, cellular factors and RNA that facilitates RABV replication. They are present in the cytoplasm of neuronal cells and are most observed in pyramidal cells of Ammon's horn, Purkinje cells of the cerebellum, and are also found in the cells of the medulla, ganglia, and neurons of salivary glands and tongue. They can be round or oval or can display variety of sizes and shapes. Staining includes

Mann's, Giemsa, or Sellers stains, wherein Negri bodies appear magenta in color and have dark-blue interior basophilic granules.

What are the different vaccine strains of rabies?

Rabies vaccine strains include Pasteur's and its derivatives namely Pitman-Moore, Pasteur virus, Challenge Virus Standard, and other strains like Flury, Street-Alabama-Dufferin, Vnukovo, Kelev.

What are the different anti-rabies vaccines available for veterinary use in India?

Commercial name	Strain	Species	Manufacturer
Rabigen Mono	Inactivated VP12 Rabies virus strain	Dog and Cat	Virbac
Nobivac Rabies	Inactivated Rabies strain Pasteur RIVM	Dog, Cats, Cattle, Sheep, Goat and Horse	MSD Animal Health
Defensor	Cell culture adapted, chemically inactivated Pasteur's strain	Dog and Cat	Zoetis India
Rasksharab	Cell culture adapted (BHK Cell line) inactivated Rabies Challenge Virus Strain	Cattle, Buffalo, Dog and Cat	Indian Immunologicals
Starvac-R*		Buffalo, Dog and Cat	
Rabivac Vet	Cell culture adapted (BHK Cell line) inactivated PV11 strain	Dog and other domestic animals	Brilliant Biopharma

***Prophylactic use only**

What is the importance of post-exposure anti-rabies vaccination?

Anti-rabies vaccination induces both humoral and cell-mediated immune response, wherein antibodies produced against RABV Glycoprotein (G) is the neutralizing antibody that neutralizes RABV. Hence, the 5-day post-exposure vaccination is primarily targeted towards production of more neutralizing antibody that would aid in the prevention of disease manifestation.

How can rabies be prevented?

Rabies is a vaccine-preventable disease; hence vaccinations are highly important. In dogs and cats, anti-rabies vaccine can be administered at 90 days of age; in cattle, sheep and goat, and horses, the age of administration is after 6 months of age.

References

WHO Immunological Basis for Immunization Series: Module 17: Rabies

Katz, I.S.S., Guedes, F., Fernandes, E.R. and dos Ramos Silva, S., 2017. Immunological aspects of rabies: a literature review. Archives of virology, 162(11): 3251 – 3268.

Beyene K, Derese A, Teshome G and Teshome D., 2018. Review on Rabies Vaccine: As Prevention and Control Option of Rabies. Austin Journal of Veterinary Science & Animal Husbandry, 5(3): 1049.

Agarwal, A.K., Mahore, R.N., Bhatia, M., Yuwane, P. and Jain, S., 2014. Why a dog needs to be observed for 10 days after biting a human being?. Survival, 5339, p.5339.