



Rabies

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BACKGROUND

Luckily, rabies is a disease that most people have no experience with, other than the vaccination of their pets. It is important to realize that rabies is fatal over 99% of the time and that more than 59,000 people worldwide still die of rabies every single year. This makes it one of the deadliest and most important diseases on the planet. The following is an overview of the disease as well as a reminder that current vaccination is strongly recommended and may be required by some veterinarians.

EPIDEMIOLOGY

Rabies is present worldwide and reported in over 150 countries. The only place that it has not been reported is Antarctica. All mammals can potentially carry and/or become infected with rabies. Wildlife such as bats, skunks, raccoons, and foxes are the most common hosts. Rabies is exceptionally rare in opossums due to their lower-than-normal body temperature (~94-97 degrees Fahrenheit). Birds have only been experimentally infected and are not considered a natural threat.

Rabies virus is specifically adapted to its reservoir host species with several different variants existing in the United States. These include raccoon variant, bat variant, fox variant, and skunk variant. The canine variant was eliminated in the US in 2004 thanks to leash laws and a rigorous (and effective) vaccination program. Although cross-species transmission of rabies variants does occur (for example, dogs becoming infected with bat or raccoon variant), rabies virus variants are primarily transmitted within the species to which they are adapted. In other words, the raccoon variant is primarily transmitted between raccoons. With that said, it is still entirely possible for dogs to become infected and then transmit the disease to a human.

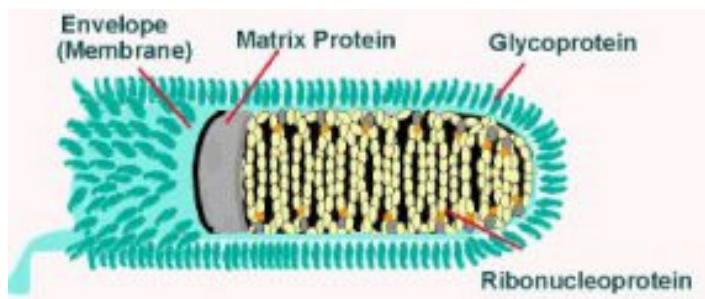
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STRUCTURE

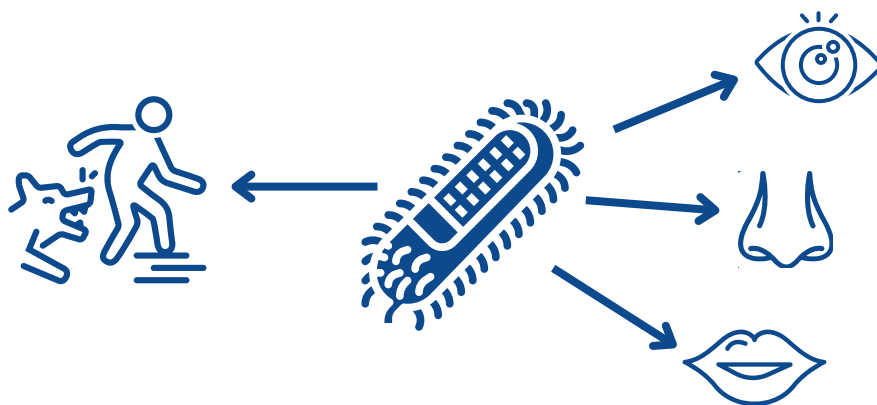
The rabies virus is within the family Rhabdoviridae. Each viral particle is surrounded by a thick lipid (fatty) envelope which helps protect it from attack while within an animal. This is part of what makes rabies infection so difficult to treat or cure once an animal is infected. Once outside of the animal, the envelope makes them very sensitive to drying out in the environment, and relatively easy to kill with various chemicals (ie. formalin, alcohol, phenols), soaps, and detergents. So, rabies actually has limited survival when not inside of its host animal.



RABIES VIRUS IS A ROD- OR BULLET-SHAPED, SINGLE-STRANDED, NEGATIVE-SENSE, UNSEGMENTED, ENVELOPED RNA VIRUS.

INFECTION

Rabies virus is transmitted through direct contact (ie. through broken skin or mucous membranes in the eyes, nose, or mouth) with saliva or nervous system tissue from an infected animal.



While this occurs most readily through a bite wound from a clinically rabid animal, infected saliva can get into the body through any of the above-mentioned methods. Inhalation has been reported but is extremely rare. Blood, urine, and feces are not considered with risk of infection.

INFECTION

Once an animal becomes infected with the rabies virus, there is an incubation period before the virus actually ascends through the nerves to the central nervous system. This is influenced by many things including the age of the animal, the proximity of the bite to the spinal cord, and the degree of innervation of the inoculation site. The virus particles enter the peripheral nerves near the inoculation site and travel in a retrograde fashion toward the spinal cord. This travel can be as slow as 1 cm/day or as fast as 40 cm/day. Once in the spinal cord, the virus ascends towards the brain rapidly and bilaterally resulting in damage to the spinal cord's lower motor neurons. This can result in flaccid weakness or paralysis. Once in the brain, necrotizing encephalitis ensues resulting in marked injury and death of neurons. After this damage occurs, the virus then travels through cranial nerves and peripheral spinal cord nerves to other tissues. This includes the acinar cells of the salivary glands. Presence of virus in saliva indicates brain involvement has already occurred.



CLINICAL SIGNS

The clinical course associated with rabies infection is invariably progressive and has classically been divided into a furious (or "psychotic") form and a paralytic (or "dumb") form. It should be noted that clinical signs in rabid animals can be highly variable and that not all cases adhere to these specific signs.

The furious type of disease can last from 1-7 days and is marked by increasing levels of anxiety, restlessness, hyperesthesia, and photophobia. As they progress through this form of the disease, they become increasingly aggressive to people, objects, or their enclosure (cage). Ataxia and seizures can also occur. Cats typically show wild and erratic behavior, muscle tremors, and continuous running.

The paralytic form of the disease is characterized by ascending paralysis until the entire central nervous system is affected. This form is most commonly seen in dogs; however, when seen in cats, it typically follows the furious form. Dogs will often show the characteristic change in bark, dropped jaw, difficulty swallowing, and hypersalivation ("foaming at the mouth") due to the brainstem and cranial nerves being affected. Since it was often mistaken for choking, people may be exposed when exploring or trying to clear the mouth.



DIAGNOSIS & PATHOLOGIC FINDINGS

Rabies is most often strongly suspected based on clinical signs and history; however, due to the large variation in presentation, it should be suspected in any animal displaying a profound change in attitude or behavior. Definitive diagnosis is only made postmortem by finding rabies virus antigen in suitable brain tissue samples. Similar testing on skin samples, saliva, and blood have been described, but lack the sensitivity and specificity required for such an important disease.

POST-EXPOSURE MANAGEMENT

Whenever there is concern that an animal may have been exposed to the rabies virus, care needs to be taken to minimize the possibility of exposure to humans until the vaccination status of the animals involved is known. We recommend checking with your state's public health department for specific policies. For example, our BVNS locations in Virginia adhere to the Virginia Department of Health Guidelines for Rabies Prevention and Control. This can be found at <https://www.vdh.virginia.gov/animal-contact-human-health/rabies-control/virginia-guidelines-for-rabies-prevention-and-control/>

PREVENTION

Vaccination of dog and cat pets is the best and most effective strategy for preventing rabies. Elimination of stray or feral unvaccinated dog and cat populations is expensive, controversial, and ineffective. Control of wildlife populations is also not effective or practical.

While modified live vaccines generally provide better immunity to disease, rarely reported vaccine-induced rabies has prevented their use. Currently, rabies vaccines utilize inactivated (killed) virus and provide good immunity. Recombinant or DNA vaccines have been developed and may prove to be a better alternative in the future.

In Virginia, the law (*see reference above) requires every dog and cat receive a rabies vaccination before 4 months of age (whenever possible). The second vaccination (ie. booster) should be administered within 12 months of the first. Subsequent vaccinations should be administered based on the formulation of the previous vaccine given (ie. 1-year vs 3-year).

Proper vaccination is essential for the protection of your pet and for the protection of veterinarians and their staff. If your pet has clinical signs compatible with rabies and no history of rabies vaccination, your pet will not be seen or examined by our staff. Examination of pets with outdated vaccine status depends on several factors but is typically handled on a case-by-case basis.

SUMMARY

Rabies is a very rare disease in our domesticated pets; however, the risk of contracting the disease is very real. Because rabies can present with subtle or variable clinical signs, care should be taken with any animal displaying abrupt neurologic dysfunction. Knowing that it is invariably fatal once neurologic signs develop, we feel strongly that every animal needs to be properly vaccinated.

