



Rabies

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Rabies is an acute, progressive viral encephalomyelitis that principally affects carnivores and bats, although it can affect any mammal. The disease is fatal, once clinical signs appear. Rabies is present in many countries worldwide, although a number of countries are free of the disease due either to successful elimination programs or to their island status and enforcement of rigorous quarantine regulations.

Etiology and Pathogenesis

Rabies is caused by lyssaviruses in the Rhabdovirus family. Lyssaviruses are usually confined to one major reservoir species in a given geographic area, although spillover to other species is common.

Reservoirs of rabies vary throughout the world. Canine rabies predominates in Africa, Asia, Latin America, and the Middle East. In North America and Europe, where canine rabies has been eliminated, rabies is maintained in wildlife.

For many years, skunks were the most commonly reported rabid animal in the USA, but since 1990, rabid raccoons have been the most numerous. Canine rabies became established in dogs and coyotes (*Canis latrans*) in southern Texas, but was eliminated. Canine rabies persists in Mexico, with the potential to spread throughout the USA if reintroduced. Skunk, raccoon, and fox rabies are each found in fairly distinct geographic regions of North America, although some overlap occurs. Bat rabies is distributed throughout the Americas. The vampire bat is an important reservoir in Latin America, and is the source of multiple outbreaks in cattle, as well as in humans, particularly in parts of Amazonia.

In Europe, red fox rabies predominated before its elimination by oral vaccination. In parts of eastern Europe, rabies in raccoon dogs is of increasing concern. Rabies in insectivorous bats may be widely distributed in Europe.

Other wild species play an important role in the transmission of rabies in certain areas, including mongooses in the Caribbean, southern Africa, and parts of Asia; jackals in parts of Africa; and wolves in parts of northern Europe.

Transmission almost always occurs via introduction of virus-laden saliva into tissues, usually by the bite of a rabid animal. Although much less likely, it is possible for virus from saliva, salivary glands, or brain to cause infection by entering the body through fresh wounds or intact mucous membranes. Usually, saliva is infectious at the time that clinical signs occur, but it is possible for domestic dogs, cats, and ferrets to shed virus for several days before onset of clinical signs. Viral shedding in skunks has been reported for up to 8 days prior to onset of signs.

The incubation period is both prolonged and variable. Typically, the virus remains at the inoculation site for a considerable time. The unusual length of the incubation period helps to explain the effective action of local infiltration of rabies immune globulin during human postexposure prophylaxis, even days after exposure. Most rabies cases in dogs develop within 21–80 days after exposure, but the incubation period may be shorter or considerably longer.

The virus travels via the peripheral nerves to the spinal cord and ascends to the brain. After reaching the brain, the virus travels via peripheral nerves to the salivary glands. If an animal is capable of transmitting rabies via its saliva, virus will be detectable in the brain. Virus is shed intermittently in the saliva.

Clinical and Pathological Findings

Clinical signs of rabies are rarely definitive. Rabid animals of all species usually exhibit typical signs of CNS disturbance, with minor variations among species. The most reliable signs, regardless of species, are acute behavioral changes and unexplained progressive paralysis. Behavioral changes may include sudden anorexia, signs of apprehension or nervousness, irritability, and hyperexcitability (including priapism). The animal may seek solitude. Ataxia, altered phonation, and changes in temperament are apparent. Uncharacteristic aggressiveness may develop—a normally docile animal may suddenly become vicious. Commonly, rabid wild animals may lose their fear of humans, and species that are normally nocturnal may be seen wandering about during the daytime.

The clinical course may be divided into 3 general phases—prodromal, acute excitative, and paralytic/endstage. However, this division is of limited practical value because of the variability of signs and the irregular lengths of the phases. During the prodromal period, which lasts ~1–3 days, animals show only vague nonspecific signs, which intensify rapidly. The disease progresses rapidly after the onset of paralysis, and death is virtually certain a few days thereafter. Some animals die rapidly without marked clinical signs.

The term “furious rabies” refers to animals in which aggression (the acute neural excitative phase) is pronounced. “Dumb or paralytic rabies” refers to animals in which the behavioral changes are minimal, and the disease is manifest principally by paralysis.

Furious Form

This is the classic “mad-dog syndrome,” although it may be seen in all species. There is rarely evidence of paralysis during this stage. The animal becomes irritable and, with the slightest provocation, may viciously and aggressively use its teeth, claws, horns, or hooves. The posture and expression is one of alertness and anxiety, with pupils dilated. Noise may invite attack. Such animals lose caution and fear of humans and other animals. Carnivores with this form of rabies frequently roam extensively, attacking other animals, including people, and any moving object. They commonly swallow foreign objects, eg, feces, straw, sticks, and stones. Rabid dogs may chew the wire and frame of their cages, breaking their teeth, and will follow a hand moved in front of the cage, attempting to bite. Young pups can seek human companionship and are overly playful, but bite even when petted, usually becoming vicious in a few hours. Rabid skunks may seek out and attack litters of puppies or kittens. Rabid domestic cats and bobcats can attack suddenly, biting and scratching viciously. As the disease progresses, muscular incoordination and seizures are common. Death results from progressive paralysis.

Paralytic Form

This is manifest by ataxia and paralysis of the throat and masseter muscles, often with profuse salivation and the inability to swallow. Dropping of the lower jaw is common in dogs. Owners frequently examine the mouth of dogs and livestock searching for a foreign body or administer medication with their bare hands, thereby exposing themselves to rabies. These animals may not be vicious and rarely attempt to bite. The paralysis progresses rapidly to all parts of the body, and coma and death follow in a few hours.

In general, rabies should be suspected in terrestrial wildlife acting abnormally. The same is true of bats that can be seen flying in the daytime, resting on the ground, paralyzed and unable to fly, attacking people or other animals, or fighting.

Diagnosis

Clinical diagnosis is difficult, especially in areas where rabies is uncommon and should not be relied on when making public health decisions. In the early stages, rabies can easily be confused with other diseases or with normal aggressive tendencies. Therefore, when rabies is suspected and definitive diagnosis is required, laboratory confirmation is indicated. Suspect animals should be euthanized and the head removed for laboratory shipment.

Rabies diagnosis should be done by a qualified laboratory, designated by the local or state health department in accordance with established standardized national protocols for rabies testing. Immunofluorescence microscopy on fresh brain tissue, which allows direct visual observation of a specific antigen-antibody reaction, is the current test of choice. When properly used, it can establish a highly specific diagnosis within a few hours. Brain tissues examined must include medulla oblongata and cerebellum (and should be preserved by refrigeration with wet ice or cold packs).

Source: Merck Vet Manual