

Rabies

Summary

Rabies is a preventable viral disease of mammals most often transmitted to humans through the bite of an infected animal. Rabies virus infects the central nervous system, causing encephalopathy and ultimately death. Signs and symptoms include aggressiveness, apprehension, headache, fever, malaise, sensory changes, paralysis, hydrophobia, delirium, and convulsions. The incubation period is usually one to three months but can range from less than one week to more than a year. Death occurs in nearly 100% of infected persons within days to months after symptom onset.

Agent

The rabies virus is a bullet-shaped, enveloped ribonucleic acid (RNA) virus in the genus *Lyssavirus*. In the United States (US), several rabies virus variants have been identified in terrestrial mammals, including raccoons, skunks, foxes, and coyotes. In addition to these terrestrial reservoirs, several species of insectivorous bats are reservoirs for rabies variants.

Transmission

Reservoir:

Rabies can occur in any mammal. While aggression is typically associated with rabies, it can cause a wide variety of neurologic symptoms and rabies should not be discounted based solely on animal behavior. In New Mexico, skunks, bats, and foxes are common reservoirs and bites from these species are considered high risk. Raccoons are also a major reservoir for rabies in the eastern US. Occasionally there is spillover into other species such as unvaccinated dogs or cats. Rabies in small mammals (such as mice and squirrels) is rare and transmission from these species to humans has not been documented. Rabies in larger rodents, such as woodchucks, has been reported more frequently, primarily from the eastern US where raccoon rabies is epizootic.

Rabies in humans is rare in the United States. There are usually fewer than ten human cases per year. The most common source of human rabies in the United States is wildlife, particularly bats: approximately 70% of all US human rabies cases are attributed to bat exposures.

Mode of transmission:

- The virus is transmitted by the bite of an infected animal or infected saliva in contact with an open wound or mucous membrane. Rarely, organ transplantation cases have occurred from an infected donor.

Period of communicability:

- In dogs, cats, and ferrets, rabies virus is not present in the saliva more than a few days before clinical signs occur. If signs consistent with rabies do not occur in the biting dog, cat, or ferret within 10 days after a bite, it can be safely assumed that virus was not in the saliva at the time of the bite. No such determination has been made for other animals.

Clinical Disease

Incubation period:

In humans, the average incubation is one to three months but ranges from less than one week to more than one year.

Illness:

The first signs of rabies in humans may be nonspecific flu-like signs: malaise, fever, or headache, which may last for days. There may be discomfort or paresthesia at the site of exposure (bite), progressing within days to signs and symptoms of cerebral dysfunction, apprehension, aggressiveness, confusion, agitation, hydrophobia, delirium, hallucinations, insomnia, and paralysis. Once clinical signs of rabies appear, the disease is nearly always fatal.

Laboratory Diagnosis

- Definitive diagnosis of rabies for animal species can be made through a test of brain tissue by fluorescent antibody (FA) available at the New Mexico Department of Health Scientific Laboratory Division (SLD) in Albuquerque. See Appendix A for guidelines for head submission. According to state law, any biting wild animal other than a dog, cat, or ferret must be euthanized and submitted for laboratory testing if it cannot be proven that it was born and raised in captivity and never had a chance to come in contact with another wild animal. Local animal control should consult with the New Mexico Department Of Health's (NMDOH) Infectious Disease Bureau (1-833-796-8773) to determine if an animal needs to be euthanized and tested.
- Antemortem testing in humans requires several tests for confirmation. Tests are performed on samples of saliva, serum, spinal fluid, and skin biopsies of hair follicles at the nape of the neck. For suspected human cases, the physician should contact the NMDOH's Infectious Disease Bureau (1-833-796-8773) for assistance.
- A healthy dog, cat, or ferret that bites a person should be observed for 10 days. If they are healthy after 10 days, they would not have been shedding virus and would not have been infectious at the time of the bite. Observation is not appropriate for wild animals; prompt euthanasia and testing is required in most circumstances. Bites from horses and other livestock are evaluated on a case-by-case basis. Observation periods are instituted using the procedures given in Appendix B.
- The risk of rabies can be estimated based on the health and behavior of the biting animal, vaccination status of the animal if appropriate, the amount of rabies in the species and geographic area, and on the circumstances of the bite situation. See Appendix C for guidelines used in estimating the chances of an animal being rabid.
- SLD immediately reports animals that test positive for rabies to the submitter and to the Infectious Disease Bureau. For negative rabies results, SLD phones the results within 24 hours to the submitter. The submitter, in turn, needs to notify other interested parties such as the bite victim, animal control officer, physician, veterinarian, or local health office.

Prophylaxis

- How to Manage Persons Exposed to Potentially Rabid Animals.
 - Bite exposure: State law requires anyone aware of an animal bite, including physicians, health offices, veterinarians, and the general public, to report the bite immediately to the appropriate animal control office with a complete description of the biting animal and

circumstances of bite. Bites from rodents or rabbits are extremely low risk for rabies and typically no investigation is conducted unless unusual circumstances exist (the animal was in contact with a known rabid animal and/or is exhibiting signs of rabies). Rodents and rabbits have not been documented to transmit rabies to humans.

1.1.a Wounds should be washed thoroughly to reduce potential rabies virus presence. Antibiotics may be considered for prevention or treatment of bacterial infection. The need for tetanus vaccine update or prophylaxis should be evaluated. A tetanus booster is recommended if it has been greater than 5 years since their last tetanus vaccine. Vaccination history of biting pets should be verified with veterinarians.

1.1.b If the biting animal has escaped, animal control should search for it for definitive determination of rabies status to be made by either observation or laboratory testing. Due to the low risk of rabies in cats and dogs in New Mexico, animal control should be given 72 hours to search for a cat or dog. However, the search for an escaped biting animal should not continue for more than seven days after the date of the bite, at which time a decision whether to prophylax or not should be made. Rabies prophylaxis should be initiated within 24-48 hours of a high-risk bite situation (skunk, bat or other rabid acting animal) but can wait a few days for a low-risk bite situation. A high-risk bite situation involving a head wound should have rabies prophylaxis initiated as soon as possible. Infectious Disease Epidemiology Bureau may be consulted to assist in determination of level of risk.

1.1.c The decision regarding prophylaxis of a bite victim to prevent development of rabies is made by the patient and personal physician, after consultation with the Infectious Disease Epidemiology Bureau. Recommendations for or against prophylaxis will be made based on the likelihood of rabies virus transmission. Patients can receive rabies immune globulin and vaccines through their local emergency department or urgent care. NM DOH may be able to provide assistance if the patient is unable to access PEP.

1.2. Non-bite exposures: Rabies prophylaxis should be given to a person whose open wounds or mucous membranes come in contact with the saliva or neural tissue of a laboratory confirmed or suspected rabid dog or cat (see Appendix C). Prophylaxis should also be given for such contact with a wild animal (other than rodents and rabbits) which is tested as rabies positive or cannot be tested. People do not always know when they are bitten by a bat. Because bats have small teeth which may leave marks that are not easily seen, there are situations involving bats which may be considered non-bite exposures, such as:

1.2.a A person awakens to find a bat in the room.

1.2.b A bat is in a room near an unattended young child, a person with intellectual disability, an intoxicated individual, or anyone else who is unable to provide an accurate history of interaction with the bat.

1.2.c A person has any skin contact with a bat; this includes contact through clothing that would not prevent a bite from reaching skin

In these situations, the bat should be caught by an animal control officer and sent in for testing. If the bat escapes or cannot be tested, then post-exposure prophylaxis is indicated.

2. Prophylactic regimen:

- 2.1. No previous rabies vaccinations: For those without pre-exposure prophylaxis, post-exposure rabies prophylaxis (PEP) consists of 1) human rabies immune globulin (HRIG) 20 IU per kilogram administered intramuscularly on day 0; and 2) four 1-mL doses of human rabies vaccine administered intramuscularly in the deltoid muscle on days 0 (same day as HRIG), 3, 7, and 14. For younger children, the outer aspect of the thigh may be used for rabies vaccine. Infiltrate as much of the dose of HRIG as anatomically possible into and around the site of the bite and inject the remainder intramuscularly in the deltoid or quadriceps (at a location other than that used for vaccine inoculation to minimize potential interference). HRIG may be given up to 7 days after the first dose of rabies vaccine if it is not possible to give it on day 0.
- 2.2. Because corticosteroids, other immunosuppressive agents, antimalarials, and immunosuppressive illnesses might reduce immune responses to rabies vaccines substantially, for persons with immunosuppression, rabies PEP should be administered using a 5-dose vaccine regimen (i.e., one dose of vaccine on days 0, 3, 7, 14, and 28). The patient should be managed in consultation with their physician and ERD as rabies virus-neutralizing antibody values may need to be checked to ensure that an acceptable antibody response has developed.
- 2.3. Previously rabies immunized:
 - 2.3.a. If post-exposure prophylaxis is indicated for a bite victim who has received the three-dose pre-exposure regimen of human rabies vaccine recommended prior to 2022, or has previously demonstrated rabies antibody, HRIG should not be given. Two one mL doses of rabies vaccine should be given intramuscularly on days 0 and 3.
 - 2.3.b. If post-exposure prophylaxis is indicated for a bite victim who has received the new two-dose pre-exposure regimen of human rabies vaccine recommended beginning in 2022, AND they were adherent to the ACIP guidelines of a one-time booster dose given between day 21 and year three or a titer check any time between year 1 and 3 confirming a titer of $\geq 0.5\text{IU/mL}$, they can receive two one mL doses of rabies vaccine given intramuscularly on days 0 and 3.
 - 2.3.c. If post-exposure prophylaxis is indicated for a bite victim who has received the new two-dose pre-exposure regimen of human rabies vaccine recommended beginning in 2022, and they were not adherent to the ACIP guidelines (no titer or booster as detailed in 2.3.b), they should receive the same PEP as an individual with no history of PrEP: 1) human rabies immune globulin (HRIG) administered intramuscularly on day 0; and 2) four 1-mL doses of human rabies vaccine administered intramuscularly in the deltoid muscle on days 0 (same day as HRIG), 3, 7, and 14.

Surveillance

Case Definition:

Laboratory criteria - Detection by direct fluorescent antibody of viral antigens in a clinical specimen; or isolation of rabies virus from saliva, cerebrospinal fluid (CSF); or central nervous system tissue; or identification of a rabies-neutralizing antibody titer in the serum or CSF of an unvaccinated person.

Confirmed – a clinically compatible case that is laboratory confirmed.

Reporting:

Report all suspected or confirmed cases of rabies in humans or animals immediately to the NMDOH Infectious Disease Epidemiology Bureau (1-833-796-8773). Information needed includes: patient's name, age, sex, race, ethnicity, home address, home phone number, occupation, and health care provider.

Case Investigation:

Use the CDC Possible Human Rabies Case Report Form to complete the investigation. Information should also be entered into NM-EDSS per established procedures.

Control Measures

1. Case management

1.1. Isolation: Standard precautions. Immediate caregivers should be warned of the potential hazard of infection from saliva and should wear appropriate protection (e.g. gloves and eye protection) during care activities that increase exposure.

1.2. Prophylaxis: Not applicable.

2. Contact management

2.1. Isolation: None required.

2.2. Prophylaxis: Refer to "Prophylaxis" section for instruction on post-exposure prophylaxis.

3. Prevention

3.1. Immunization

3.1.a Dogs and cats. To reduce the risk of rabies infection and transmission in dogs and cats, the New Mexico Statutes and Regulations on Animal Control and Rabies requires rabies vaccination of all cats and dogs. Either the one-year or three-year vaccination protocol may be used based on the type of licensed vaccine administered. Documentation of vaccination by a veterinarian with a separate serially numbered certificate for each animal vaccinated is required. Information on each certificate should include: name of veterinarian, vaccine type, vaccine producer initials, name and address of owner, description of dog or cat vaccinated (i.e. gender, neuter status, color, breed, age); date of vaccination, and the expiration date for the period of immunity.

3.1.b Human Pre-exposure. Pre-exposure rabies prophylaxis (PRE-RP) is recommended for persons with increased risk of exposure to rabies virus. This includes veterinarians, animal control officers, professional trappers/hunters, and laboratory workers performing rabies testing. PRE-RP generally consists of two 1.0-mL injections of human rabies vaccine administered intramuscularly in the deltoid on days 0 and 7, followed by either a 1 dose booster between 3 weeks and 3 years following the initial series or serological monitoring, dependent upon risk category. Information on risk category and recommendations can be found here: <https://www.cdc.gov/rabies/hcp/clinical-care/pre-exposure-prophylaxis.html>.

- For those concerned about waning immunity, serum titers can be checked through: Department of Veterinary Diagnosis, Veterinary Medical Center, College of Veterinary Medicine, Kansas State University, Manhattan, Kansas 66502 (785-532-4483), <https://ksvdl.org/laboratories/rabies-laboratory/diagnostic-test/>

3.2. Other Preventive Activities

3.2.a Appendix D offers guidelines for pets that have contact with wild animals which could possibly be rabid, either by bringing home a dead carcass, or biting or being bitten by a wild animal, or fighting with a wild animal.

3.2.b New Mexico Game and Fish Department has regulations that forbid any importation of skunks or raccoons into the state, by anyone, including private citizens, pet shops, breeders, and hunters without a permit. Upon routine inspection of pet shops, animal control officers should request the purchasing records for skunks or raccoons. If they were purchased outside of New Mexico, the New Mexico Game and Fish Department should be notified.

Appendices

Appendix A. Guidelines for submitting animal heads for rabies testing to Scientific Laboratory Division (SLD).

Appendix B. Guidelines for quarantining biting dogs, cats, ferrets and livestock.

Appendix C. Guidelines for estimating likelihood of a biting animal being rabid, for purposes of deciding on rabies treatment (Also consult NMDOH's Infectious Disease Epidemiology Bureau (1-833-796-8773)).

Appendix D. Guidelines for handling pets bitten by or interacting with wild animals.

References

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See Rabies Fact Sheets ([English](#)) ([Spanish](#)).

Appendix A: Guidelines for submitting animal heads for rabies testing to Scientific Laboratory Division (SLD)

1. Testing is done by the Virology/Serology Section of the New Mexico Department of Health Scientific Laboratory Division (SLD), New Mexico Department of Health, 1101 Camino de Salud NE, Albuquerque, NM 87102, 505-383-9125.
2. The local animal control office or veterinarian should remove the head except for bats and very young/small animals where removing the head might cause damage to the brain's anatomical structures. Smaller wild animals such as skunks, raccoons, ringtails, and bobcats are not required to be decapitated prior to testing.
3. The heads should not be removed from bats or very young/small animals; bats should be shipped whole. Bats must be euthanized prior shipping--hoping that they will smother in the shipping container is not acceptable.
4. A rabies submission form and specific step-by-step instructions for packaging rabies specimens can be found on the SLD website:
<https://nmhealth.org/publication/view/help/1503/>
5. The body and head should be refrigerated to prevent decomposition before shipping if shipping can be done within 72 hours of collection. If shipment will not occur until >72 hours, consult with the IDEB regarding whether the specimen should be frozen prior to shipment.
6. The head should be shipped in the container along with a sufficient supply of ice packs.
7. Containers should be shipped as quickly as possible. The courier service should be used to ship containers from Monday – Thursday. Shipment of containers on Fridays or weekends should be done only after consultation with the IDEB to determine the risk of rabies exposure. In low-risk situations, the head should be kept refrigerated over the weekend and shipped on Monday.
8. Sometimes heads can be analyzed even if the animal has been dead for several days, particularly if the temperatures have been cold outside. If there is any chance brain tissue remains, find and/or dig up the biting animal and send the head to SLD.

Appendix B: Guidelines for observing biting dogs, cats, ferrets and livestock

1. Observation is preferable to testing heads as it eliminates the chance of shipping delays and/or unsatisfactory specimens. Local animal control has jurisdiction over where and how the observation is to be done.
2. The dog, cat, or ferret must be observed to remain healthy for 10 days after the bite. Livestock are evaluated on a case-by-case basis.
3. If the pet or livestock becomes ill with signs of rabies during the observation period, it must be euthanized and tested for rabies.
4. If dogs, cats, and ferrets remain healthy at 10 days, they could not have transmitted rabies at the time of the bite.
5. Ideally, observation should take place at an animal control shelter, where chance of escape and contact with other animals or humans is eliminated. Livestock should be removed from open fields and penned up close to home where they can be observed daily.
6. If shelter observation for pets is not available, observation can take place elsewhere, such as at a veterinarian's clinic, kennel, or someone's home or fenced yard. However, these are less satisfactory, and must be approved by the local animal control officer.
7. Some jurisdictions may allow home quarantine of biting pets that are up to date on their rabies vaccinations. (Up to date means having a current rabies certificate from a licensed veterinarian).

Appendix C: Guidelines for estimating likelihood of a biting animal being rabid, for purposes of deciding on rabies treatment (Consult NMDOH Infectious Disease Bureau (1-833-796-8773)).

If definitive assessment of rabies status cannot be made for a dog or cat because it has escaped, rabies treatment is usually not recommended in New Mexico because of the low incidence of dog and cat rabies, unless there are factors to increase suspicion the pet may have been rabid.

Information supportive of a biting dog or cat **not** being rabid include:

1. Healthy appearance.
2. Chronically aggressive animal, repeat biter.
3. Vaccinated.
4. Owned.
5. Provoked bite, such as: riding bikes; surprising animal; touching animal; running; entering animal's yard, vehicle, or house; handling animal's food; breaking up animal fight; helping injured animal.
6. Rabies in dogs, cats, and other species is rare in this geographical area.

Information supportive of an animal being rabid include:

1. Animal appearing ill.
2. Dog or cat which bites without any provocation (see above.)
3. Dog or cat approaching the person rather than the person approaching the pet.
4. Frenzied biting behavior, jumping from one person/animal to another to bite.
5. Dog or cat has spent much time in wild or roaming, possibly interacting with wild animals.
6. Dog or cat has never been vaccinated.
7. Presence of rabies in dogs and cats, or other species (specifically skunks, foxes or bats) in the area. Higher numbers of wild animals positive for rabies have been identified in eastern and southwestern areas of the state. Dog and cat bites from these areas should be considered to have a higher risk of rabies exposure unless the animal is tested by a US laboratory or quarantined by a US animal control agency.

Similar information regarding the circumstance of the bite, species of biting animal, and rates of rabies in the area can be used in estimating the chances of a biting wild animal being rabid. However, because of the higher rate of rabies in wild animals other than rodents and rabbits treatment is always recommended for bites from these species when they cannot be laboratory tested. Pet raccoons and skunks which have escaped from their homes or spent time outdoors, even if confined, and thus could have been exposed to rabies are included in this classification. Bites from other domestic species that rarely are rabid in New Mexico are evaluated on a case-by-case basis (e.g., cattle, horses).

Appendix D: Guidelines for handling pets bitten by or interacting with wild animals

1. The biting wild animal should be euthanized immediately, and the head shipped to SLD for testing.
2. Pending test results at SLD, the owner may be advised or required to have the pet vaccinated for rabies, regardless of previous vaccination history. This may not prevent an unvaccinated pet from getting rabies.
3. A quarantine at home or elsewhere, where human contact and chance of escape is minimized or eliminated, may be required or recommended (see below.)
 - 3.1. The lifetime vaccination history is reviewed by the local veterinarian, since this will partially determine the type of quarantine.
 - 3.2. The type of quarantine is directed by the local animal control officer (local ordinances vary but cannot be less restrictive than state regulations) and approved by IDEB.
 - 3.3. Compliance with the quarantine will be enforced by the local animal control officer, who will also release the pet from quarantine when it is completed.
4. The enforcement of the quarantine is as follows:
 - 4.1. Head of wild animal negative for rabies--no quarantine necessary.
 - 4.2. Head of wild animal not available for testing, and pet has received at least one previous rabies vaccine or has demonstrated immunity—recommend booster dose of vaccine within 96 hours and animal should be observed under owner's care and control for 45days.
 - 4.3. Head of wild animal not available for testing, or testing comes back as unsatisfactory, and pet does not have adequate lifetime vaccination history or immunity (as determined by consultation with the IDEB zoonoses team) recommend euthanizing the pet or recommend rabies vaccination (within 96 hours of exposure) and strongly recommend four-month isolation for cats and dogs and six-month isolation for ferrets.
 - 4.4. Head of wild animal is positive for rabies, and pet has adequate lifetime vaccination history or demonstrated immunity—pet must receive booster dose of vaccine within 96 hours and be observed under owner's care and control for 45 days. Head of wild animal is positive for rabies, and pet has never been vaccinated against rabies – requires euthanizing the pet or require a four-month strict isolation for cats and dogs and six-month isolation for ferrets. Isolation in this context refers to confinement in an enclosure that precludes direct contact with people and other animals. Rabies vaccine should be administered upon entry into isolation to comply with pre-exposure vaccination requirements. Pets overdue for a booster vaccination will be evaluated on a case-by-case basis based upon severity of exposure, time elapsed since last vaccination, number of previous vaccinations, current health status, and local rabies epidemiology to determine the need for euthanasia or immediate revaccination and observation/isolation.
5. If it is uncertain whether a pet was bitten by a wild animal, test the wild animal if possible, vaccinate the pet, and consult with IDEB Zoonotic Disease Team.