

Rabies

Summary

Rabies is a preventable viral disease of mammals most often transmitted to humans through the bite of a rabid 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, foaming at the mouth, 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, and 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 distinct 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 also reservoirs for distinct rabies variants.

Transmission

Reservoir:

Rabies can occur in any mammal. In New Mexico, skunks, bats, and more recently foxes in southwestern New Mexico are the reservoirs for the specific rabies variants that occur in the state 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 of these variants 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 only one or two human cases per year. But the most common source of human rabies in the United States is from bats. For example, among the 19 naturally acquired cases of rabies in humans in the United States from 1997-2006, 17 were associated with bats. Among these, 14 patients had known encounters with bats. Four people awoke because a bat landed on them and one person awoke because a bat bit him. In these cases, the bat was inside the home.

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, foaming at the mouth, hydrophobia, delirium, hallucinations, insomnia, and paralysis. The acute neurologic manifestation of disease typically ends after 10 days. Once clinical signs of rabies appear, the disease is nearly always fatal.

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, 505-383-9124. 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 Epidemiology and Response Division (ERD) at 505-827-0006 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 ERD for assistance in having samples sent to the Centers for Disease Control and Prevention (CDC) for testing.
- Animal Quarantine. Definitive diagnosis for dogs, cats, and ferrets can also be made through quarantine for 10 days after the bite. Definitive diagnosis for wild animals cannot be made through quarantine, and thus quarantine is not recommended for wild animals. Bites from horses and other livestock are evaluated on a case-by-case basis. If the livestock is acting normal and has no history of exposure to a rabid animal, it is usually recommended that the animal be quarantined and watched for 30 days. If it shows signs of rabies during the 30-day quarantine period, it is euthanized immediately, and the brain sent to SLD for testing. Quarantines 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. ERD should be consulted in all of these situations. 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 ERD. 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

1. How to Manage Persons Exposed to Potentially Rabid Animals

1.1. Bite exposure: State law requires anyone aware of an animal bite, including physicians, health offices, veterinarians, and the general public, to report them immediately to their local 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 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. 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 in order for definitive determination of rabies status to be made by quarantine 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. ERD should be consulted to assist in determination of level of risk.

1.1.c The decision regarding prophylaxis of a bite victim in order to prevent development of rabies is made by the patient and personal physician, after consultation with the ERD. Recommendations for or against prophylaxis will be made based on the likelihood of rabies virus transmission. Rabies vaccine and immune globulin are available in New Mexico from the NMDOH Pharmacy through an order placed by ERD. A bill will be sent to the patient with the biologicals. Insurance information is also collected for the patient. Some hospitals carry their own supply of rabies vaccine and immune globulin in their pharmacy. The vaccine and immune globulin must be administered under the supervision of a physician (see prophylaxis regimen below).

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 skunk, bat or fox which is tested as rabies positive or cannot be tested. People usually know when they are bitten by a bat. However, 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 or mentally impaired or intoxicated individual.

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 may be indicated and ERD should be consulted.

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) 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. The dose of HRIG is calculated as 0.0606 mL/lb. body weight (which converts to 20 IU per kilogram). 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).
- 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. If post-exposure prophylaxis is indicated for a bite victim who has received the recommended pre-exposure regimen of human rabies vaccine, 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.

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 Epidemiology and Response Division (ERD) at 505-827-0006. 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: Contact isolation for oral secretions for the duration of illness. Immediate caregivers should be warned of the potential hazard of infection from saliva and should wear appropriate protection to avoid exposure from a patient's saliva.

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 consists of three 1.0-mL injections of human rabies vaccine administered intramuscularly in the deltoid on days 0, 7, and either 21 or 28.

- 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), <http://www.vet.k-state.edu/depts/dmp/service/rabies/rffit.htm>
- A one mL booster dose should be administered only if the serum titer fails to maintain a value of at least complete neutralization at a 1:5 serum dilution by the rapid fluorescent focus inhibition test, because immune complex-like allergic reactions (such as rashes, urticaria, and arthus) can occur.

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 ERD at 505-827-0006).

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

References

Compendium of Animal Rabies Prevention and Control, JAVMA • Vol 248 • No. 5 • March 1, 2016; 505-17.

Prophylaxis against rabies. N Engl J Med. 2004 Dec 16; 351(25):2626-35

CDC. Human rabies prevention—United States, 2008. Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Early release 2008; 57 [May 7, 2008]:1-28.

CDC. Use of a Reduced (4-Dose) Vaccine Schedule for Postexposure Prophylaxis to Prevent Human Rabies, Recommendations of the Advisory Committee on Immunization Practices. MMWR 2010; 59(No. RR-2).

New Mexico Administrative Code: Title 7, Health; Chapter 4, Disease Control Requirements (Epidemiology); Part 2 Animal Control Requirements. Available at: <http://www.nmcpr.state.nm.us/nmac/parts/title07/07.004.0002.htm>

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

1. Testing is done by the Virology 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 can remove the head.
3. The heads should not be removed from bats; bats should be shipped whole. Bats must definitely be dead before shipping--hoping that they will smother in the shipping container is not sufficient.
4. Special metal containers supplied by SLD should be used. They are available at many animal control offices, local health offices, or from SLD. A sturdy Styrofoam container inside a cardboard box may be substituted if the metal container is not available. 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 ERD 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 ERD 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 quarantining biting dogs, cats, ferrets and livestock

1. Quarantine is preferable to testing heads as it eliminates the chance of shipping errors and laboratory errors. Local animal control has jurisdiction over where and how the quarantine 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. If the livestock is acting normally and has no history of exposure to a rabid animal, it is usually recommended that the animal be quarantined and watched for 30 days.
3. If the pet or livestock becomes ill with signs of rabies during the quarantine, it must be euthanized and tested for rabies.
4. If it remains well, it is assumed to be rabies free.
5. Ideally, quarantine 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 quarantine for pets is not available, quarantine can take place elsewhere, such as at a veterinarian's clinic, kennel, or someone's home or fenced yard. However, these types of quarantine 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 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 Epidemiology and Response Division, 505-827-0006).

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 cause concern the pet may have been rabid.

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

1. Healthy appearance.
2. Male or unneutered animal.
3. Chronically vicious animal, repeat biter.
4. Vaccinated.
5. Owned.
6. 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.
7. 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 approached 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, 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 or bats) in the area. One example is Mexico and Texas border counties. 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 bats, skunks, raccoons, and foxes, treatment is usually recommended for bites from these species when they cannot be laboratory tested. Pet raccoons and skunks which have escaped from their homes and thus could have been exposed to rabies are included in this classification. Bites from other species that rarely are rabid in New Mexico are evaluated on a case-by-case basis (e.g., bears, cattle, horses).

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

1. The biting wild animal is immediately destroyed, 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 ERD.
 - 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 adequate lifetime vaccination history (demonstrated immunity)—recommend booster dose of vaccine and discuss 45-day observation period.
 - 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 ERD zoonoses team) recommend euthanizing the pet or recommend rabies vaccination (within 96 hours of exposure) and strongly recommend four-month quarantine.
 - 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 and be observed for 45 days. Head of wild animal is positive for rabies, and pet has never been vaccinated against rabies – strongly recommend euthanizing the pet or require a four-month strict isolation. 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 suggest that a quarantine may be advisable (45-days if up-to-date or vaccinated previously, four months if not.)

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