

RABIES ACTIVE SURVEILLANCE PROTOCOL

Public Health Action

1. Ensure that personnel who will perform brain stem extractions are educated about rabies, rabies transmission and exposure, pre-exposure vaccination and post-exposure vaccination (PEP). (Appendix 1: Information for Workers Performing Brainstem Extraction for Active Surveillance-Rabies in Wildlife), (Appendix 2: Rabies Vaccine: What You Need to Know). [State Public Health Veterinarian or designee].
2. Ensure that staff are appropriately trained in performance of brain stem extraction procedure, including appropriate safety precautions. [State Public Health Veterinarian or designee].
3. Ensure personnel receiving pre-exposure rabies vaccination are appropriately screened for contraindications prior to vaccination and are educated about possible vaccine reactions. [LHD Public Health Nurse].
4. Ensure personnel who are performing brain stem extractions receive pre-exposure rabies vaccination, according to Advisory Committee on Immunization Practices (ACIP) recommendations (Appendix 3. MMWR: Human Rabies Prevention-United States 1999, Jan 8, 1999, vol. 48, No. RR-1). [LHD Public Health Nurse].
5. Ensure signed documentation of education, training, pre-screening and vaccination is placed in each employees file who receives rabies vaccine and participates in brainstem removal activities (Appendix 4: Rabies Vaccination Checklist).
6. Submit a maximum of 8 brain stem samples per month from each of the active surveillance counties to the Office of Laboratory Services (OLS) for rabies testing.
7. On an annual basis educate the public about rabies, the Oral Rabies Vaccination (ORV) program and active surveillance , especially recognition of target species that are potentially infected with the rabies virus.
8. On an annual basis educate local government officials, physicians, veterinarians and the general public about the ORV program with regard to aerial distribution and vaccine safety.
9. Ensure that all persons who receive pre-exposure vaccination have their immune titers checked every 2 years and receive booster vaccination if titers fall below recommended levels.

Prevention Objectives

1. Reduce risk of rabies exposure and disease.

Disease Control Objectives

1. Prevent the westward spread of raccoon strain rabies in WV by appropriate placement, determined through active surveillance, of an ORV barrier.

Surveillance Objectives

1. To identify geographic location of each case of raccoon strain rabies (RSR).
2. To determine where RSR is occurring in WV and identify the western edge of the epizootic throughout the length of WV.
3. Evaluate surveillance data to identify appropriate placement for the ORV barrier.

Public Health Significance

The original focus of RSR was identified in Florida in the 1940's and spread gradually to other nearby southern states during the next three decades. In the late 1970's, a focus of rabies involving raccoons was discovered on the West Virginia - Virginia border. Epidemiologic and virologic investigations suggested that this new focus was established due to the translocation of raccoons from the southeast that were incubating rabies virus.

West Virginia has a population of 1.8 million people, and is one of the two most rural states in the nation. Since raccoon rabies was first identified within our borders in 1977, the epizootic has extended throughout the eastern panhandle, and across the continental divide. This epizootic now threatens the Ohio River valley leading to the Midwestern United States; and the New River Gorge, leading to Charleston.

During the years prior to Year 2001, West Virginia had about 100 cases of raccoon rabies per year using passive surveillance (submission of specimens when there has been a human or domestic animal exposure). Therefore the location of the true 'leading edge' of the epizootic was unknown. During the year 2001, active surveillance was initiated in 20 West Virginia counties as part of the USDA funded Oral Rabies Vaccination Program. These counties were chosen because they were adjacent to counties where raccoon rabies had been identified previously. In 2002 and 2003 surveillance was extended to include 29 counties, the original 20 counties plus 9 additional counties that were within the oral vaccine distribution area. Active surveillance will continue in these 29 counties until surveillance indicates otherwise. The 29 counties are:

Boone	Kanawha	Raleigh
Braxton	Lewis	Ritchie
Brooke	Logan	Roane
Calhoun	Marshall	Tyler
Clay	McDowell	Webster
Doddridge	Mercer	Wetzel
Fayette	Mingo	Wirt
Gilmer	Nicholas	Wood
Hancock	Ohio	Wyoming
Harrison	Pleasants	

Active surveillance during the year 2001 revealed 7 rabies positive raccoons in 4 counties where rabies had not been known previously (3 Raleigh, 2 Webster, 1 each in Fayette and Nicholas). In 2002, a positive raccoon was found in Braxton County (on the border with Lewis County, a county where rabies had been identified previously) through passive surveillance. Since 2002 no new counties have been found positive for RSR.

Clinical Description

Rabies is an acute viral infection of the central nervous system that affects mammals. It is an almost invariably fatal encephalomyelitis. In humans the encephalomyelitis is often heralded by a sense of apprehension, headache, fever, malaise and indefinite sensory changes often referred to the site of a preceding animal bite. Excitability and aerophobia are frequent symptoms. The disease progresses to paresis or paralysis; spasm of swallowing muscles leads to fear of water (hydrophobia); delirium and convulsions follow. Without medical intervention, the usual duration is 2 - 6 days, sometimes longer; death is often due to respiratory paralysis.

In animals there are no known definitive or species-specific clinical signs of rabies beyond acute behavioral alterations; "the abnormal becomes typical". Severity and variation of signs may be related to the specific site(s) of the primary CNS lesion. At the end of the incubation period, the disease progresses through a short prodromal state to encephalopathy and death, usually within days.

Initial signs of rabies are nonspecific and may include anorexia, lethargy, fever, dysphagia, vomiting, diarrhea, straining to urinate and defecate. Alteration in behavior, such as increasing aggressiveness and vocalization are common. In addition to behavioral abnormalities, cranial and peripheral nerve deficits may occur. Most animals die within one week to 10 days of symptom onset.

Etiologic Agent

Rabies virus, a rhabdovirus of the genus *Lyssavirus*. All members of the genus are antigenically related, but use of monoclonal antibodies and nucleotide sequencing of the virus demonstrates differences according to the animal species or the geographic location from which they originate.

Reservoir

The two principal rabies reservoirs found, at present, in WV are raccoons and bats.

Mode of Transmission

Rabies is transmitted by introduction of the virus into cuts or wounds in the skin or via the mucous membranes. Bites from infected mammals is the usual path of transmission to humans and animals. Transmission may also occur through scratches, abrasions, open wounds or mucus membrane that come into contact with saliva of other potentially infectious material, such as brain tissue, from a rabid animal. Casual contact, such as petting or touching a rabid animal, does not constitute an exposure and is not an indication for prophylaxis.

Organ transplants taken from persons dying of undiagnosed CNS disease have resulted in rabies in the recipients. Airborne spread has been demonstrated in a cave where myriad of bats were roosting and in laboratory settings, but this occurs very rarely. In the USA, rabid insectivorous bats rarely transmit rabies to terrestrial animals, wild or domestic.

Incubation Period

Incubation period in humans is usually 3 - 12 weeks, rarely as short as 9 days or as long as 7 years. Depends on the severity of the wound, site of the wound in relation to the richness of the nerve supply and its distance from the brain, amount and strain of virus introduced, protection by clothing and other factors. Prolonged incubations have occurred in prepubertal individuals.

Incubation period in most animal species is unknown. However, periods of less than 10 days to several months are well documented. As with humans, severe and multiple bites to the head and neck and bites to highly innervated areas may result in shorter incubation periods.

Infectious Period

Transmission from person to person is theoretically possible since the saliva of the infected person may contain virus, but this has never been documented.

Domestic dogs, cats and ferrets are the only animals with scientifically documented viral shedding periods in saliva. Virus may be shed for up to 10 days prior to onset of clinical signs in these animal. There are no available data for other animal species.

Brainstem Specimen Collection

Persons collecting brainstem specimens are required to obtain pre-exposure rabies vaccination and training prior to collecting samples. Signed documentation of vaccination and training should be placed in the employees file (refer to Public Health Actions section)

1. Equipment

- face shield or surgical mask and eye goggles
- surgical gloves (non-sterile)
- surgical gown (if desired)
- disposable scalpels
- Kelly forceps
- tweezers
- plastic zip-lock bags
- large trash bags
- sharps container
- specimen collection tins
- Rabies specimen submission form (Appendix 5)
- permanent marker

- disinfectant (10% bleach solution or other commercial disinfectant diluted according to label directions)
- leakproof container for disinfection of instruments
- hand sanitizer
- GPS unit

2. Target Species

- a. Raccoons, foxes, skunks and coyotes that are exhibiting signs consistent with rabies, found dead or as roadkill. Signs consistent with rabies include:
 - loss of apparent wariness of humans and domestic animals
 - unprovoked agitation and extreme aggression toward animate or inanimate objects
 - head tilt, head pressing or butting and “star gazing”
 - signs of self-mutilation
 - no apparent response to pain
 - paralysis of limbs and facial muscles
 - change in normal behavior patterns (i.e., out during daylight hours)
- b. Handling target species
 - i. If euthanasia is necessary, it should be performed by a professional with experience in handling or dispatching wild animals.
 - ii. Complete a Rabies Submission Form (Appendix 5) for each specimen.
 - Take a GPS coordinate reading to identify the place where the animal was found and record on the Rabies Submission Form.
 - Allocate a unique county specific identification number for each animal and write it on the top right corner of the corresponding rabies submission form (there is no official space provided on form).
 - Fill in all other information for the specimen, human and animal exposure as appropriate.
 - iii. Wearing gloves to prevent direct contact with infectious materials (saliva/nervous tissue) place carcass in a thick ply garbage bag (> 1 mil, 13 gallon garbage bags work well) and secure shut. Double bagging may be used to transport carcass to sample collection site. Place contaminated gloves inside the second bag before securing shut.
 - iv. Decontaminate all working surfaces and equipment with disinfectant.
 - v. Practice proper hygiene following work with carcasses (use alcohol based hand sanitizer or washing with soap and water).
 - vi. Place the Rabies Test Submission form inside a plastic zip-lock and attach it to the bagged carcass.

3. Collection Procedure

**If there has been a human or animal exposure the entire head must be submitted for testing.*

- a. Put on personal protective equipment:
 - face shield or surgical mask and goggles
 - double glove
 - surgical gown if desired
- b. Using a permanent marker pen label the specimen collection tin with:
 - initials of person collecting brainstem
 - animal's county specific identification number

Open the tin and place it within easy access to the specimen collection area.

- c. With animal on its back, use a disposable scalpel to make an incision from the tip of the lower jaw extending approximately 2 inches below the point where head and neck join.
- d. Sever the muscular attachments of the tongue along both sides, using the lower jawbone as a guide, and continue cutting caudally to free the larynx, trachea and esophagus as a single unit.
- e. Retract this unit to expose the ventral surface of the spinal column and associated musculature.
- f. With one hand flex the head while using a finger from the other hand to feel the place where the head and neck join (atlantoccipital joint).
- g. Dissect tissue in order to further expose the surface of the joint.
- h. Access to brainstem appears as a "small window" covered by a thin layer of connective tissue.
- i. To increase access to the brainstem enclosed in the bony canal joint, cut through the connective tissue on either side of the joint while flexing the head to permit better access.
- j. The exposed brainstem/spinal cord tissue should be cut as close to the large opening into the skull (foramen magnum) as possible. Place the final cut to make a section of brainstem approximately 1/4 inch.
- k. Place the brainstem specimen into the open collection tin and secure the lid. Wipe the outside of the specimen tin with disinfectant and place it inside a plastic zip-lock. Attach the corresponding Rabies Submission Form securely to the specimen (either on the outside of the zip-lock or double bag the container and place the form inside the second zip-lock).

- l. The carcass and disposable personal protection equipment (e.g., gloves and surgical gown) should be placed into a thick ply trash bag (not a red bio-hazard bag) and discarded in a dumpster or landfill.
- m. Decontaminate all working surfaces and equipment with disinfectant.
- n. Wash hands with hand sanitizer or soap and water.
- o. Specimens should be submitted to the Office of Laboratory Services (OLS) according to current shipping regulations (see OLS manual). If specimens are not sent immediately to OLS they may be stored in a regular freezer (**not** frost free, as they have freeze and thaw cycles to remain frost free) for less than a week prior to shipping.

Laboratory Diagnosis

Laboratory Criteria for Diagnosis

Brain tissue samples that are positive by immunofluorescent antibody testing are considered diagnostic.

The standard test for detecting rabies is an immunofluorescent antibody (IFA) test on brain tissue. Any brain tissue sample that tests positive by IFA is considered positive for rabies and will be further tested with monoclonal antibodies to determine which strain of rabies is involved.

Brainstem samples should be sent to the West Virginia Office of Laboratory Services (OLS), 167 11th Ave, South Charleston, WV 25303 for testing. Sharon Hill (304-558-3530) should be contacted in regard to questions about active surveillance testing. The specimen should be accompanied by a completed Rabies Submission Form (Appendix 5) when sent to the OLS.

Preventive Interventions

All personnel performing brainstem extractions as a part of active surveillance are required to receive pre-exposure vaccination for rabies according to ACIP recommendations (Appendix 3. MMWR Human Rabies Prevention - United States, 1999). Although pre-exposure prophylaxis does not eliminate the need for additional therapy after a rabies exposure, it simplifies therapy by eliminating the need for RIG and decreasing the number of doses of vaccine needed. It may also protect persons whose post-exposure therapy is delayed and provide protection to persons at risk for inapparent exposures to rabies.

Prior to vaccination personnel should be screened for potential contraindication, advised of potential adverse reactions and informed of how to deal with reactions if they occur. Signed documentation of the following should be placed in each participating employees file:

- education on rabies pre and post-exposure vaccination, including screening and information on adverse reactions

- vaccine administration according to ACIP recommendations

1. Pre-exposure vaccination (ACIP recommendations)

Three 1.0-mL injections of rabies vaccine should be administered intramuscularly (deltoid area) — one injection per day on days 0*, 7, and 21 or 28 (*day 0 is the day of the first dose of vaccine administered).

a. Precautions and Contraindications

i. Immunosuppression

Corticosteroids, other immunosuppressive agents, antimalarials, and immunosuppressive illnesses can interfere with the development of active immunity after vaccination. For persons with immunosuppression, pre-exposure prophylaxis should be administered with the awareness that the immune response might be inadequate (see Primary or Pre-exposure Vaccination). Patients who are immunosuppressed by disease or medications should postpone pre-exposure vaccinations and consider avoiding activities for which rabies pre-exposure prophylaxis is indicated. When this course is not possible, immunosuppressed persons who are at risk for rabies should be vaccinated by the IM route and their antibody titers checked. Failure to seroconvert after the third dose should be managed in consultation with appropriate public health officials (see Pre-exposure Vaccination and Serologic Testing). Immunosuppressive agents should not be administered during post-exposure therapy unless essential for the treatment of other conditions. When post-exposure prophylaxis is administered to an immunosuppressed person, it is especially important that a serum sample be tested for rabies antibody to ensure that an acceptable antibody response has developed.

ii. Pregnancy

Because of the potential consequences of inadequately treated rabies exposure, and because there is no indication that fetal abnormalities have been associated with rabies vaccination, pregnancy is not considered a contraindication to post-exposure prophylaxis (117,118). If the risk of exposure to rabies is substantial, pre-exposure prophylaxis might also be indicated during pregnancy.

iii. Allergies

Persons who have a history of serious hypersensitivity to rabies vaccine should be revaccinated with caution (see Management of Adverse Reactions).

b. Management of Adverse Reactions

Once initiated, rabies prophylaxis should not be interrupted or discontinued because of local or mild systemic adverse reactions to rabies vaccine. Usually, such reactions can be successfully managed with antiinflammatory and antipyretic agents, such as ibuprofen or acetaminophen. When a person with a history of serious hypersensitivity to rabies vaccine must be revaccinated, antihistamines can be administered.

Epinephrine should be readily available to counteract anaphylactic reactions, and the person should be observed carefully immediately after vaccination. Although serious systemic, anaphylactic, or neuromuscular reactions are rare during and after the administration of rabies vaccines, such reactions pose a serious dilemma for the patient and the attending physician. A patient's risk of acquiring rabies must be carefully considered before deciding to discontinue vaccination.

Advice and assistance on the management of serious adverse reactions for persons receiving rabies vaccines may be sought from the state health department or CDC. All serious systemic, neuromuscular, or anaphylactic reactions should be reported to the Vaccine Adverse Event Reporting System (VAERS) via a 24-hour toll-free telephone number ([800] 822-7967).

2. Pre-exposure Vaccination and Serologic Testing

Because the antibody response has been satisfactory after these recommended pre-exposure prophylaxis vaccine regimens, routine serologic testing to confirm seroconversion is not necessary except for persons suspected of being immunosuppressed. Patients who are immunosuppressed by disease or medications should postpone pre-exposure vaccinations and consider avoiding activities for which rabies pre-exposure prophylaxis is indicated. When that is not possible, immunosuppressed persons who are at risk for exposure to rabies should be vaccinated and their antibody titers checked. In these cases, failures to seroconvert after the third dose should be managed in consultation with appropriate public health officials.

3. Serologic Response and Pre-exposure Booster Doses of Vaccine

Although antibody levels do not define a person's immune status, they are a marker of continuing immune response. Persons who receive pre-exposure vaccination should have their immune titers checked every 2 years and receive booster vaccination if titers fall below the minimum cut off for the laboratory where testing occurred. Rabies titer testing should be coordinated through the Local Health Department (Appendix 6a: Atlanta Health Associates Testing Information and Submission Form), (Appendix 6b: Kansas State University Testing Information).

4. Post-exposure Therapy for Previously Vaccinated Persons

If exposed to rabies, previously vaccinated persons should receive two IM doses (1.0 mL each) of vaccine, one immediately and one 3 days later. Previously vaccinated persons are those who have received one of the ACIP recommended pre-exposure or post-exposure regimens. RIG is unnecessary and should not be administered to these persons.

Surveillance Indicators

- Number of active surveillance specimens per month sent to OLS for testing (goal is 8 brainstem submissions per month) from each participating county
- Proportion of submissions with GIS locating information
- Proportion of submissions with complete rabies submission form