



Rabies

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In addition to rabies cases, this chapter includes the public health management of rabies exposures. Information for this chapter was adapted with permission from Alberta Health. For more information about Rabies see: [Alberta Public Health Disease Management Guidelines: Rabies](#)

1. CASE DEFINITION

Confirmed Case

- Clinical illness with laboratory confirmation * of infection by either:
 - Detection of viral antigen in an appropriate clinical specimen (preferably the brain or the nerves surrounding hair follicles in the nape of the neck) by immunofluorescence **OR**
 - Findings at autopsy including detection of rabies virus in central nervous system (CNS) tissue by immunofluorescence or RT-PCR and visualization of Negri bodies by histopathology **OR**
 - Isolation of rabies virus from saliva, cerebrospinal fluid (CSF), or central nervous system tissue using cell culture or laboratory animal **OR**
 - Detection of rabies virus RNA by RT-PCR in an appropriate clinical specimen

Probable Case

- Clinical illness** with laboratory evidence:
 - Detection of rabies-neutralizing antibody in the serum or CSF of an unimmunized person who did not receive rabies immunoglobulin

Suspect Case

- Clinical illness** without laboratory evidence



Confirmed Animal Case

- Confirmation of viral antigen or RNA in appropriate animal sample, reported by Canadian Food Inspection Agency (CFIA)

*Laboratory Confirmation:

- Negative serological results do not rule out a rabies infection because antibodies may not develop during infection and seroconversion usually occurs very late or not at all
- Serology cannot distinguish between antibodies resulting from vaccination, natural infection, or passive immunization
- Serology should be interpreted in conjunction with all other test results, the patient's clinical history, and epidemiological link
- Additional testing of appropriate samples should be performed in addition to the submission of serum or CSF samples

**Clinical Illness: Rabies is an acute encephalomyelitis dominated by forms of hyperactivity (encephalitic rabies) or paralytic syndromes (paralytic rabies) that almost always progresses to coma and death within 10 days after the first symptom.

2. DIAGNOSIS

Humans:

- The diagnosis of rabies in humans requires detection of viral antigen by direct immunofluorescence, rabies virus RNA, or rabies antibodies from clinical specimens
- Health care providers must consult with the Microbiologist/Virologist on call at ProvLab at University of Alberta Hospital (UAH) if they require stat testing for rabies. The virologist on call is available through UAH Switchboard (780) 407-8822
- The prospect for detecting viral RNA, antigen, and/or specific immune response increases as clinical symptoms progress
- Serology cannot distinguish between antibodies resulting from current infection or previous immunization
- Negative serological results do not rule out a rabies infection because antibodies may not develop during infection and seroconversion usually occurs very late or not at all



Animals:

- Since, in the early stages, rabies can easily be confused with other diseases or with normal aggressive tendencies, when rabies is suspected and definitive diagnosis is required, laboratory confirmation is indicated
 - Suspect animals should be humanely euthanized **without damaging the head**, and the head removed for laboratory shipment by a trained professional
 - Rabies virus in animals requires detecting viral antigens or RNA in a brain and/or spinal cord sample taken at necropsy. The main test used at the CFIA laboratories is the fluorescent antibody test
 - When uncertain about animal behaviour or an animal is behaving strangely it is recommended to report* to the following:
 - For wild life: Environment and Natural Resources (ENR) by email wildlifeobs@gov.nt.ca or [call](#)
 - For domestic animals: Local law enforcement (By-law or RCMP)
- *Unless there is a bite or exposure do not call public health.

3. REPORTING

All HCPs must follow the NWT [Public Health Act](#). Measures for contact tracing and legislative requirements are laid out within the [Reportable Disease Control Regulations](#) and reporting timelines are found in the [Disease Surveillance Regulations](#).

Note: the only acceptable methods of reporting to the OCPHO are outlined below. Information provided outside of these methods will not be considered reported unless otherwise stated by a CPHO delegate.

Health Care Professionals

For **Part 1** Call immediately and written report within 24 hours

- All suspect, confirmed, or probable rabies cases in animals or humans are to be reported immediately after diagnosis is made or opinion is formed to the Office of the Chief Public Health Officer (OCPHO) by telephone (867) 920-8646 **AND**
- **Immediately** report by phone (867) 920-8646 all animal bites to the head or neck, animal bites to children and/or severe/multiple bites or concerning animal exposures to the OCPHO **AND**
- All animal bites/exposures must be reported within 24 hours by completing and forwarding the [Animal Bite / Rabies Investigation Form](#) by fax: (867) 669-7517 **OR** secure file transfer e-mail: environmental_health@gov.nt.ca to the Environmental Health main office **immediately** after initial treatment.
- **Report out of province or out of country rabies exposures or animal bites to OCPHO by telephone (867) 920-8646 immediately. Information should include name, date of birth, and any positive laboratory reports or relevant information including details on any post exposure prophylaxis provided (name of vaccine, dose, administration route, and dates)**



Laboratories

- Report all positive results to the OCPHO by telephone (867) 920-8646 **AND** by fax (867) 873-0442 **immediately.**

4. OVERVIEW

Causative Agent

- Rabies infection is caused by different species of RNA virus in the *Rhabdoviridae* family

Animal Reservoirs of Rabies

- Any mammal can develop rabies
- In Canada from 2014-2016, raccoons, skunks and bats account for about 90% of rabies infections in animals
- In southern NWT, bats also represent a potential exposure risk
- In the NWT, rabies infections are known to occur most commonly in foxes (arctic and red) and domestic dogs
- Rabies is most commonly present above the treeline where Arctic Fox are abundant, specifically, in the Northern Sahtu and Beaufort-Delta Regions.
- The Beaufort Delta, and the Sahtu regions have the highest proportion of animals diagnosed with rabies but this DOES NOT rule out rabies in animals elsewhere in the NWT

Clinical Presentation and Major Complications - Humans:

- Initial symptoms include headache, fever, malaise, flu-like illness, pruritus on the site of the animal exposure and a sense of apprehension

Two forms of the disease are possible:

- Encephalitic rabies (“furious” rabies) occurs in approximately 80% of human cases
 - Characterized by signs and symptoms of hyperactivity, apprehension, excited behaviour, photophobia, hydrophobia, and sometimes aerophobia (fear of drafts)
 - The individual may be confused and aggressive
 - They may experience hyper-salivation, resulting in frothing at the mouth
 - After a few days, coma may develop, and death occurs by cardio-respiratory arrest
- Paralytic rabies (“dumb” rabies) occurs in approximately 20% of human cases
 - Typically runs a less dramatic and longer course than the Encephalitic form
 - The muscles gradually become paralyzed, starting at the site of the exposure
 - The symptoms progress to the central nervous system, and can include paresis or paralysis, dysphagia, and convulsions
 - A coma develops, and death occurs from cardio-respiratory arrest, usually within 7-10 days
- Rabies is presumed invariably fatal



Clinical Presentation - Animals:

- Recognizing rabies presentation in animals can help identify exposures to humans, The signs of rabies in different animal species, however, can vary and is difficult to interpret in wild animals
- Establishing signs of rabies in animals is essential for risk assessments of exposures, but **public health decisions should not depend solely on the presence or absence of symptoms of rabies in an animal**
- In general, rabies should be suspected in terrestrial mammals appearing ill or acting abnormally. Animals may display the “furious form” in which they are extremely aggressive, or the paralytic or “dumb form” in which the animal is lethargic, immobile and becomes comatose. Signs of rabies in an animal include:
 - An animal that is normally timid or shy becoming less restrained and unnaturally approachable or aggressive
 - Clinical signs of rabies in animals can be very subtle and nonspecific at first, and can include lethargy, fever, vomiting, anorexia, colic, and lameness
 - Bats flying in the daytime, resting on the ground, aggressive towards people or animals, or fighting
 - Self mutilation, excessive salivation, abnormal vocalization, aggression, paralysis or seizures, lethargic, immobile or comatose

Transmission

- Rabies is transmitted from infected animals to humans via a bite, scratch, or lick that introduces saliva of an infected and communicable animal into a break in the skin, or contact with intact mucous membranes including the eyes, nose, and mouth
- Most cases of human rabies involve a bite from an animal with communicable rabies
- Aerosol transmission, although rare, has been reported in caves and laboratory settings
- Although the virus has been isolated from the saliva of infected people, making person-to-person transmission from a human bite is theoretically possible, such transmission has not been confirmed
- Activities that could potentially pose a risk to others include bites, kisses, direct contact between saliva and mucous membranes or broken skin, sexual activity, sharing utensils or cigarettes
- Transmission has been reported following corneal and other organ transplants, where the donors have died of undiagnosed rabies
- Mother-to-child transmission is possible, although rare
- Ingestion of raw meats or other tissues from animals infected with rabies is not likely a source of human infection but is not advised



- There have been documented cases in which people have contracted rabies from cuts or sprays while handling rabid animal carcasses and hides
- The virus is inactivated rapidly in sunlight (1.5h at 30°C) and does not survive for long periods outside of the host (minutes to hours depending on environmental conditions)
- Ultraviolet light, detergent, ethyl alcohol, or a 1:10 dilution of bleach can destroy the virus

Incubation Period

- The incubation period in humans is usually 3-8 weeks but varies from a few days to several years
- Without Post Exposure Prophylaxis (PEP), the majority of cases (approximately 75%) develop symptoms less than 90 days after exposure
- The incubation period is dependent on the severity of the wound, site of the wound in relation to the richness of the nerve supply, distance from the brain, the amount and strain of virus introduced, and if protective clothing was worn

Communicability

- **Humans:** A person is considered infectious 14 days prior to the onset of symptoms
- **Animals:** The period of communicability varies depending on the species of the animal
 - On average, dogs and cats could be communicable as long as 10 days prior to clinical illness, but are likely most infectious 3 – 4 days before the onset of clinical disease, and throughout the course of the disease
 - period of communicability is not well documented in most animals and may vary across species

Clinical Guidance

For patient-specific clinical management, consult your local healthcare professional, paediatrician, infectious disease specialist, and/or the [NWT Clinical Practice Guidelines](#).

5. PUBLIC HEALTH MEASURES

Management of Cases in Animals or People

- **Public Health management of rabies in the NWT must be grounded in careful and thorough exposure and risk assessment**
- All cases of rabies or rabies exposure (confirmed, probable, or suspect) must be managed as an **urgent issue, requiring immediate public health action**
 - Confirm that the client meets the case definition (confirmed, probable or suspect) or represents a reasonable risk of exposure
 - Obtain a history of illness including the date of onset, signs, and symptoms



- Determine the possible source of infection for all confirmed, probable, and suspect cases, taking into consideration the incubation period, reservoir, and mode of transmission.
- Assessment may include determining, obtaining, or identifying:
 - Travel/immigration history
 - Animal involved
 - Type of exposure (bite, scratch, other)
 - Details and nature of exposure
 - Geographic location of exposure
 - Immunization status of the animal (if possible, or applicable)
- Determine the immunization status of the patient
 - Unless patient has a high-risk occupation or travel history, most of the population is not vaccinated against Rabies (see [Prevention-Pre-exposure immunization](#))
- Individuals should avoid contact with the saliva and tears of a rabies case
- Healthcare providers should consult Infection Prevention and Control professionals and should maintain routine precautions) all times during patient care
- Anyone working with potentially rabid animals should use appropriate PPE (e.g. protective clothing, gloves, and eye protection) when working with potentially rabid animals
- Health care providers should use airborne precautions during aerosol generating procedures such as intubation, suctioning, and autopsy because of potential aerosolization of the virus
- Concurrent disinfection of articles soiled with saliva or tears should be done as soon as possible and must be discarded as biohazard waste

Management of Contacts of an Animal with Confirmed Rabies

- Because of the near 100% case fatality rate of rabies disease, public health investigation of source identification and prophylactic treatment of all contacts is critical and should begin **immediately**
- Determine contacts. A contact is a person who:
 - Was bitten or scratched by a probable or confirmed animal case during its communicable period. Had an open wound/skin break/mucous membrane exposure to the bodily fluids of a confirmed animal case during its communicable period, or to a probable animal case (source of a known human infection)
 - Had any direct contact to a confirmed or probable case in a bat
 - Those close to the same source as the case (e.g., animal)
- **Contacts should receive rabies post exposure prophylaxis (PEP) urgently. Post-exposure rabies prophylaxis of previously unimmunized individuals consists of both rabies immunoglobulin and rabies vaccine**



- For PEP guidance and standards, NWT adopts the Canadian Immunization section on Rabies PEP, under Part 4—Active Vaccines, Rabies available at: <https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-18-rabies-vaccine.html>

Management of Animal Exposures Where Rabies Status of Animal is NOT Known

Risk Assessment

- The risk of exposure to rabies increases when:
 - The exposure occurred in a geographical area where rabies is present
 - In the NWT rabies is most commonly present above the treeline where Arctic Fox are abundant, specifically, in the Northern Sahtu and Beaufort-Delta Regions
 - The animal looks ill or displays abnormal behaviour
 - The exposure was unprovoked
 - The animal was not up to date with their rabies vaccinations
 - The type of exposure is important to the risk assessment. In general, rabies transmission requires a bite, direct contact with a bat, or a non-bite exposure where rabies virus in saliva contacts open skin or mucous membrane
 - Type of exposure:
 - Bite Exposures: are the most common form of transmission. Multiple bites with prominent salivary contamination in highly innervated areas and near the brain, pose the highest exposure risk
 - Direct contact with a bat can transmit rabies because small sharp teeth may transmit virus without an obvious wound
 - Non-Bite Exposures: can include aerosolization in laboratory settings or in enclosed spaces with bats, scratch from a rabid animal where the animal may have saliva and virus to their limb, or contamination of scratches, abrasions, open wounds, or mucous membranes by infectious material (saliva or brain tissue)
 - Circumstances of exposure:
 - Unprovoked attacks from animals are signs of abnormal behaviour and could indicate an animal has rabies
 - Provoked attacks are when the human did something (intentionally or unintentionally) to trigger an attack, and the attack was a normal response to such an action. Examples include startling, antagonizing, threatening an animal, or entering its territory

Management of Animal Bite, Rabies Status Unknown

- Clinicians should follow established clinical practice guidance for wound management and consideration of prophylactic antibiotics



- All bite wounds should be thoroughly flushed and washed for a minimum of 15 minutes with soap and water, povidone iodine, or other accepted cleansing agents as soon as possible after the bite
- If there is an exposure to saliva, body fluid, or CNS tissue of a known or suspected rabid animal, the individual or health care provider should thoroughly flush and wash area exposed area for a minimum of 15 minutes with soap and water, povidone iodine, or other accepted cleansing agents as soon as possible after the exposure
- **Whenever possible, keep the animal alive and observable for 10 days following the exposure while consulting with the Environmental Health Officer (867) 767-9066 ext. 49262**
- **Notify OCPHO immediately by phone (867) 920-8646 if the exposure:**
 - Is to the head, neck; **OR**
 - Involves multiple or severe bites; **OR**
 - Is a wild animal bite; **OR**
 - Occurs to a child

Post Exposure Prophylaxis (PEP)

- Rabies prophylaxis must be considered in every incident in which human exposure to potentially rabid animals has occurred
- Provision of rabies PEP after an exposure is contingent on the risk assessment. In any exposure situation where the healthcare practitioner is considering administration of RabIg or Rabies Vaccine, **they must call** the OCPHO (867) 920-8646 for authorization
- PEP started in another country requires individual assessment and consultation with the OCPHO (or designate) as necessary
- The consent for immunization and the importance of the timing of vaccine administration should be discussed with the client, as well as the required schedule for doses
- Determine the client's willingness and commitment to accept and complete rabies post exposure prophylaxis. In situations where PEP is indicated, ensuring that risk of rabies, it's severity, and preventability is clearly communicated so the patient can make an informed decision
- If an individual fails to follow up for PEP, health centres and local public health should make every effort to facilitate further doses and follow up. Most responsible physician should be informed of potential loss to follow up
- Plan the immunization schedule with the client and confirm the location where the remaining doses will be given
- Pregnancy and breastfeeding are not contraindications to PEP



- Persons who present for evaluation and rabies PEP even months after having been exposed should be assessed in the same manner as if the exposure occurred recently
 - The variation in incubation periods for rabies requires investigation of all self reported exposure regardless of length of time from incident.
- **Rabies Immunoglobulin (RabIg)**
 - RabIg provides immediate passive protection that persists for a short period of time (half-life of about 21 days) until the exposed person mounts a long-lasting immune response to the rabies vaccine
 - Recommended dose is 20IU/kg given so as to fully infiltrate the wound(s) and surrounding area(s)
 - After infiltration, any additional volume should be delivered intramuscularly with a different needle and at a site distant from the site of vaccine administration
- **Rabies Vaccine**
 - Rabies Vaccine Preparations used in Canada include IMOVAX® Rabies (HDCV) and RabAvert® (PCECV)

Patient Information	Number of doses	Dose schedule
Immunocompetent person previously unimmunized	Four doses	Day 0, 3, 7, and 14
Immunocompromised person previously unimmunized	Fives doses	Day 0, 3, 7, 14, 28
Immunocompetent person previously appropriately immunized*	2 doses	Day 0 and day 3
Immunocompetent person previously inappropriately immunized*	Serum antibody concentration sample followed by 2 doses If serum antibodies are ≥ 0.5 IU/mL 2 doses are sufficient If serum sample antibodies are ≤ 0.5 IU/mL complete as if previously unimmunized	Day 0 and Day 3 Followed by Day 7 and 14 if serum antibodies ≤ 0.5 IU/mL

*Appropriately immunized consist of:

- Documentation of a complete course of pre-exposure or post-exposure prophylaxis with HDCV or PCECV **OR**
- Documentation of complete immunization with other types of rabies vaccine, or with HDCV or PCECV according to unapproved schedules, with the demonstration of an acceptable concentration of neutralizing rabies antibody in serum after completion of the series
- Post Exposure Prophylaxis procedures are highly dependent on the individual exposure’s risk assessment, as **such the CPHO or designate must be consulted for all rabies post exposure prophylaxis.**



Recommendations for PEP in Rabies Exposure

Animal Species	Condition of animal at time of exposure	Management of exposed person NOT previously immunized against Rabies	Management of exposed person previously immunized against rabies
Large domesticate mammals (example: Dog, Cat, or Ferret)	Healthy and available for a 10-day observation period	<ul style="list-style-type: none"> Local treatment of wound At first indication of rabies in the animal, give RabIg and begin four or five doses of HDCV or PCECV At first indication of rabies in the animal, arrange to have the animal tested for rabies 	<ul style="list-style-type: none"> Local treatment of wound At first indication of rabies in the animal, begin two doses of HDCV or PCECV At first indication of rabies in the animal, arrange to have the animal tested for rabies
	Unknown or escaped	<ul style="list-style-type: none"> Local treatment of wound Consult OCPHO for risk assessment 	<ul style="list-style-type: none"> Local treatment of wound Consult OCPHO for risk assessment
	Rabid or suspected to be rabid	<ul style="list-style-type: none"> Local treatment of wound RabIg and begin four or five doses of HDCV or PCECV Arrange to have animal tested for rabies if available 	<ul style="list-style-type: none"> Local treatment of wound Begin two doses of HDCV or PCECV Arrange to have animal tested for rabies if available
Wild or undomesticated mammals (example: Skunk, bat, fox, coyote, racoon and other carnivores)	Regard as rabid unless geographic area is known to be rabies-free	<ul style="list-style-type: none"> Local treatment of wound Post-exposure prophylaxis with RabIg and four or five doses of Rabies Vaccine should begin immediately. If the animal is available for rabies testing, in some instances post-exposure prophylaxis may be delayed for no more than 48 hours while awaiting results 	<ul style="list-style-type: none"> Local treatment of wound Post-exposure prophylaxis with two doses Rabies should begin immediately. If animal is available for rabies testing, in some instances post-exposure prophylaxis may be delayed for no



		<ul style="list-style-type: none"> • Arrange to have animal tested for rabies if available 	<p>more than 48 hours while awaiting results</p> <ul style="list-style-type: none"> • Arrange to have animal tested for rabies if available
Livestock, rodents or lagomorphs (hares and rabbits)	Consult appropriate public health and environmental health officials. Bites of squirrels, chipmunks, rats, mice, hamsters, gerbils, guinea pigs, other small rodents, rabbits and hares would only warrant post-exposure rabies prophylaxis if the behaviour of the biting animal was highly unusual. Bites from larger rodents (e.g., ground hogs (woodchucks), beavers) require a risk assessment.		

Note: For all exposures where rabies PEP was administered, PEP may be discontinued if CFIA lab testing of the animal brain does not indicate the presence of rabies virus, unless the individual is at continued risk of rabies exposure.

Prevention

Healthcare providers:

- Routine precautions are recommended at all times during patient care, and the number of healthcare staff involved in care should be limited

General public:

- Education the public:
 - Avoid close contact with unfamiliar animals, including handling, feeding, or unintentionally attracting wild animals
 - Ensure children know to avoid unfamiliar wild or domestic animals, even if they appear friendly
 - Cover up potential entrances, such as uncapped chimneys and openings in attics, roofs, and decks to discourage wild animals, such as bats, from taking up residence in or around homes
 - Report* any animal(s) behaving strangely to the following:
 - For wild life: Environment and Natural Resources (ENR) by email wildlifeobs@gov.nt.ca or [call](#)
 - For domestic animals: Local law enforcement (By-law or RCMP)
- *Unless there is a bite or exposure do not call public health
- When an exposure occurs, report to the nearest hospital, health centre, or clinic for assessment
- Do not attempt to nurse a wild animal back to health. Seek assistance from a veterinary clinic or city by-law



- Do not keep wild animals as pets
- Do not handle dead carcasses without the proper PPE including gloves, masks, and eye protection when dealing with suspect animal cases
- Have all domestic pets vaccinated by a licensed veterinarian or with lay vaccinator program
- When travelling with pets:
 - Ensure rabies immunizations are up to date
 - Keep pets under control to avoid contact with other animals (wild and domestic)
- Publicly funded pre-exposure rabies immunization may be considered for the following risk groups:
 - Hunters and trappers
 - Veterinarians, veterinary staff, animal control, and wildlife workers
 - Those travelling to rabies-endemic regions, where exposure to infected animals is likely
 - Spelunkers (cavers)
 - Laboratory workers who handle the rabies virus

6. PUBLIC & HEALTH PROFESSIONAL EDUCATION

For more information about Rabies:

- [Canadian Immunization Guide](#)
- The Government of Canada: [Canada/ Rabies](#)
- Centers for Disease Control and Prevention: [CDC/ Rabies](#)
- World Health Organization: [WHO/ Rabies](#)
- GNWT Environment and Natural Resources: [Wildlife diseases-rabies](#)
- GNWT Environmental Health: [Rabies Prevention](#)

7. EPIDEMIOLOGY

There have been no human cases of rabies reported in the NWT since rabies has been reportable in Canada. For more information on the epidemiology of Rabies in the Northwest Territories (NWT) see: [Epidemiological Summary of Communicable Diseases: Rabies Exposure](#).

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